Use of New Smart City Technologies in Generation Z

Petra Poropat [1], Samanta Kocijan [1], Dijana Vuković [1]

[1] *University of North, 104. brigade 3, 42000 Varaždin, Croatia*

Abstract **–Smart cities are among the most important challenges of modern society, and members of Generation Z have an important role to play in developing new smart city technologies, due to their technological competence, adaptability, and innovation orientation. Previous research shows that Generation Z use smart city technologies in different ways, with their motivation varying depending on specific factors. On the other hand, new technologies are still not used sufficiently, and there is a low level of motivation for wider adoption among members of this generation. The aim of this research is to gain insight into the factors influencing the intention to use new smart city technologies among members of Generation Z. The research was conducted using a survey method and the questionnaire was developed according to a modified version of the UTAUT model for technology acceptance and use. The results were processed using correlation and multivariate statistical methods, while the theoretical framework was tested using the SEM model. This research has examined the intention to use new smart city technologies among Generation Z and contributed new insights to the existing scientific literature regarding the factors influencing the acceptance and intention to use new smart city technologies among Generation Z.**

Keywords **– New smart city technologies, Generation Z, intention to use, trust.**

DOI: 10.18421/TEM153-09
https://doi.org/10.18421/TEM153-09

Corresponding author: Petra Poropat,
University of North, 104. brigade 3,
42000 Varaždin, Croatia
Email: peporopat@unin.hr

Received: 04 February 2026.
Revised: 24 March 2026.
Accepted: 06 April 2026.
Published: 27 August 2026.

1. Introduction

Smart cities represent one of the greatest challenges of modern society, and members of Generation Z will be crucial in implementing this conceptual framework [1]. Application of information and communication technologies is the foundation of the smart city concept, and the need to apply these technologies is becoming increasingly important [2].

Members of this generation are growing up in the era of digital technology, resulting in a high level of technological literacy [3]. The characteristics of Generation Z are the adaptation to the rapid development of technology and the willingness to accept technological innovations, as well as the rapid acquisition of new knowledge and skills. Given their willingness to adopt smart technologies in daily life, this generation is regarded as significant for the adoption of smart city technologies and the advancement of the tourism sector [4].

The research problem addressed in this paper is the insufficient use of new smart city technologies among members of Generation Z. This paper focuses on identifying the elements affecting the intention to use new smart city technologies among members of Generation Z, specifically students attending certain degree programs at the University North. These programs were chosen because of their connection to the research topic.

The paper presents research conducted using correlation and multivariate statistical methods. The first part of the paper analyses the theoretical foundations of the scientific literature and introduces important terms and concepts on the topic. In the second part of the paper, the results of the primary research conducted with a survey, the scientific contribution of the paper, and further guidelines for research are proposed.

2. Literature Review

Numerous authors have investigated the factors influencing the intention to use new smart city technologies among Generation Z. Within the selected literature for this review, it is evident that members of Generation Z use different smart city technologies in different ways and that their level of motivation depends on various factors.

According to [1], the perceived importance of smart mobility in the development of smart cities is closely linked to the attitudes and behavioral tendencies of Generation Z regarding sustainability, the use of information and communication technologies, and their participation in smart city initiatives.

The results indicate that Generation Z significantly contributes to the positive evaluation of smart mobility measures within the concept of a smart city. Furthermore, Generation Z members show a high level of awareness of sustainability, which is confirmed by their explicit desire for a pro-environmental approach to smart mobility [1].

The study presented in [5] explored the opinions and attitudes regarding managerial responsibility in Bucharest, a city in the process of transforming into a smart city. The results show that Generation Z is highly aware of the role city authorities play in solving economic, social, and environmental issues within the smart city concept. In addition, many respondents from this generation are already involved in smart city development projects or are interested in joining them. These examples show that Generation Z engagement varies depending on context, but consistently highlight the importance of citizen participation.

Research reported in [6] focused on the impact of Generation Z participation on various measures of the city of Parepare. The results show that Generation Z actively uses social media platforms to promote and disseminate tourism information about the city.

Members of Generation Z mainly use smart technologies to optimise their time for learning. On the other hand, they are cautious when it comes to the future development of technology and its impact on their lives. They also express concerns about ethical dilemmas, such as maintaining privacy and preserving family and friendship relationships. Previous research has confirmed the positive impact of certain technologies, such as AR (Augmented Reality) [7].

The study [4] examines the impact of smart devices, including AR, NFC (Near Field Communication), Wearable Technologies, QR codes, and IoT (Internet of Things), on the tourism experience of Generation Z, considering the use of technologies before, during, and after the trip [4]. This research shows that smart devices improve the overall tourism experience for Generation Z.

In [8], researchers examined the effectiveness of Virtual Reality in creating a bond with a destination, and the changes in this bond among members of Generation Z at two different points in time. The first measurement was taken after exposure to the video and virtual environment, while the second part of the research was applied after the interaction with Virtual Reality and a live visit to the destination.

It has been shown that Virtual Reality has significant potential as a marketing tool for promoting a smart destination.

Gamification in combination with Augmented Reality for tourism purposes represents a new element of the tourism product that is particularly popular with members of Generation Z [9].

For the acceptance of smart technologies, trust has been identified as a central mediating construct, encompassing both trust in technology and in institutions responsible for data management, privacy protection, and service transparency [10]. Previous research confirms that it can act as a mediating variable between perceived usability and behavioural intention, strengthening the relationship between these constructs [10].

Recent literature increasingly emphasises trust as a key socio-psychological construct in the acceptance of smart city technologies, particularly among younger generations [5], [7]. This includes not only the technical reliability of systems, but also perceptions of institutional transparency, data security, and the ethical use of digital solutions in public space. Members of Generation Z show heightened sensitivity to privacy and digital surveillance issues, which can encourage critical thinking about technology and slow the adoption of these technologies when institutional trust is low. This indicates the importance of trust, not only in the technological context, but also in the broader institutional and ethical context of smart city initiatives.

Furthermore, contemporary studies highlight the concept of perceived value of smart city technologies as a multidimensional construct integrating functional, emotional, and social dimensions of user experience [1], [8].

Functional value refers to efficiency, accessibility, and ease of use, emotional value encompasses feelings of security, satisfaction, and belonging within a smart community, whereas social value reflects opportunities for civic participation, sustainable practices, and digital interaction with the local community. For Generation Z, the social dimension is particularly salient, as technologies are often perceived not merely as tools, but as platforms for identity expression and social engagement. This focus on user experience aligns with the broader perspective in which smart cities are conceptualised as socio-technical systems in which technological innovation interacts with social, environmental, and governance dimensions [11], [12]. Within this framework, citizen participation, sustainability, and technological progress are considered equally important.

Recent research on smart city technologies emphasises that their successful adoption largely depends on users' perceptions of usefulness, ease of use, and social influence, as highlighted within the UTAUT framework [13], [14].

These factors are particularly relevant when analyzing Generation Z, a generation characterized by high digital competence and strong expectations regarding functionality and user experience.

Several authors propose extensions of traditional technology acceptance models by incorporating constructs such as institutional legitimacy and perceived system fairness, arguing that young users evaluate not only technical attributes, but also the broader socio-political context of implementation [15], [16]. The UTAUT model was extended by integrating trust as a central mediating construct that mediates the influence of the model's core variables on the intention to adopt smart city technologies [10].

Furthermore, classical technology acceptance theories such as the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB) provide a strong theoretical basis for understanding user behaviour in digital environments [16], [17]. These models explain how cognitive evaluations, attitudes, and perceived control influence users' intentions to adopt new technologies.

According to [18], the Smart City stakeholders adoption model (SSA model) was applied to examine the factors influencing citizens' behavioural intentions towards living in a smart city, with particular emphasis on the influence of demographic characteristics on attitudes and perceptions. The research results demonstrate the importance of tailoring smart city policies to population segments across demographic groups.

Within this perspective, smart cities are conceptualised as socio-technical ecosystems in which the interests of citizens, local authorities, and technology providers intersect. From a sustainability perspective, the literature also underscores the strong linkage between the use of smart city technologies and pro-environmental attitudes among Generation Z [4].

As shown in [19], Smart city initiatives are often viewed as responses to challenges such as ageing infrastructure, overcrowding, and uneven development. This work aimed to examine the extent to which technology contributes to happiness and well-being in smart cities, and how existing research conceptualises this relationship. A combined methodological approach was applied, integrating the IMD Smart City Index and Happy City Index, a literature review, and empirical survey research. The results emphasize the importance of expanding the framework for technology adoption by including well-being as an additional dimension.

Previous research indicates that citizens' intention to use smart city solutions is not determined solely by technological features, but also by external factors such as infrastructure readiness, institutional support, and service accessibility [14].

In this context, smart city adoption is increasingly viewed as a multidimensional process that integrates both technological and socio-organisational elements [11].

Moreover, digital solutions in mobility, energy efficiency, and waste management are perceived as tangible instruments for realising environmental values that this generation frequently identifies as part of its collective identity.

Consequently, technology acceptance becomes associated not only with individual utility, but also with normative and value-driven orientations toward sustainable urban development.

From the analysis of previous findings, it can be concluded that members of Generation Z use the latest technologies on a daily basis and believe that they are very important for the development of smart cities. On the other hand, despite their increasing presence in society, Generation Z's involvement in the decision-making process remains limited. Overall, these findings indicate that the acceptance and use of smart city technologies among Generation Z depend on the interaction of usability, trust, and contextual factors, highlighting the need for an integrated approach that combines technological effectiveness, social acceptance, and institutional reliability.

Based on the reviewed literature, perceived usability and trust emerge as key determinants of the intention to use smart city technologies among Generation Z. Therefore, this study focuses on examining the relationship between perceived usability, trust, and behavioral intention.

3. Methodology

The research focuses on analysing factors related to the acceptance of and intention to use new smart city technologies among members of Generation Z. The research problem addressed in this paper is the insufficient use of new smart city technologies among members of Generation Z.

For this research, correlation and multivariate methods were used as scientific methods to analyse data obtained from the primary sources. Based on the theoretical framework and defined goal, topic, and research area, two hypotheses were defined to test them.

H1: *There is a statistically significant relationship between perceived usability and the intention to use new smart city technologies among members of Generation Z.*

H2: *There is a statistically significant mediating role of trust in the relationship between perceived usability and the intention to use new smart city technologies.*

This research aims to answer the following research questions:

RQ 1: *Is there a statistically significant relationship between perceived usability and the intention to use new smart city technologies among members of Generation Z?*

RQ 2: *Does trust play a statistically significant mediating role in the relationship between perceived usability and the intention to use new smart city technologies?*

The research element of this study for the collection of quantitative data is a survey that was used to analyse the target group. It was developed according to a modified version of the UTAUT model for the implementation and utilisation of technology, specifically designed to achieve the aims of this research [15]. The model is based on the UTAUT framework, with a particular focus on perceived usability and trust as key predictors of behavioral intention. The survey included demographic and professional questions and consisted of closed questions with offered answers.

Respondents indicated their perceived usability and intention to use new smart city technologies using a Likert-type scale with five response options, and anonymity was ensured to protect data confidentiality.

The advantage of this instrument is the simplicity and speed of data collection. The disadvantages are refusal to complete the survey, ignoring the survey sent to them, or dishonest answers when completing the survey. The authors used original and secondary sources for the study. The sources were collected, analysed, and interpreted from the conducted research, and the secondary sources are domestic and foreign scientific literature.

The research involved a sample comprising 100 members of Generation Z, that is, students who attend specific study programs at the University of North. The sample included students from three Bachelor's degree programs ("Environmental Protection, Recycling and Packaging", "Logistics and Mobility", "Computer Science and Informatics") and two Master's degree programs ("Sustainable Mobility and Logistics Management", "Packaging, Recycling and Environmental Protection"). The overall enrolment of students in the above-mentioned degree programs for the academic year 2024/2025 reached a total of 269. The above mentioned degree programs were selected due to their connection to the research topic. The framework for determining the sample of this study is data on members of Generation Z, and anyone who does not belong to this generation is excluded from the research. The sample is intentional as only members of Generation Z, specifically people born between 1995 and 2012, were surveyed.

The data was collected by sending a survey to the official e-mail addresses of students in the selected degree programs at the University of North. The survey was conducted between March and July 2025. The specified period was chosen because it refers to the first semester after one of the authors presented smart city technologies at the Science Festival at the University of North in order to see the impact of the same. The first 5 questions of the survey are demographic. The second part of the survey is technical and refers to the hypotheses put forward.

The information obtained is based on the self-assessment of members of Generation Z, specifically students in selected degree programs. The respondents answered the survey questions based on two criteria. The first criterion is that they were born between 1995 and 2012, while the second criterion is that they are students of specially selected degree programs at the University of North.

Once all the data had been collected, it was analysed and explained in detail. Statistical analysis of the obtained data was performed using statistical software for social sciences (IBM SPSS Statistics, v. 29).

The theoretical framework was tested using structural equation modelling (SEM). To assess the internal consistency and construct validity of the scales, confirmatory factor analysis was applied, establishing high internal consistency for the instrument using Cronbach's alpha, which achieved acceptable levels of reliability (Cronbach $\alpha > 0.80$).

A structural model examined the relationships between trust, perceived usability, and the intention to use new smart city technologies. Further, bootstrap mediation analysis confirmed the partial mediating role of trust.

Methodologically, the application of structural equation modelling (SEM) enables the integrated examination of relationships among latent constructs encompassing cognitive, affective, and behavioural dimensions of technology acceptance [20]. This approach is particularly suitable for analysing Generation Z, as their behavioural intentions often emerge from complex interactions between individual perceptions, social environments, and institutional contexts.

The operationalisation of perceived usability in this study is grounded in dimensions of ease of use, functional clarity, and perceived practical relevance in everyday life. This conceptualisation captures not only technical performance, but also the experiential relevance of smart city technologies for students as emerging active participants in urban systems. Multi-item Likert-type scales were used to measure all constructs, enabling more precise estimation of latent variables and reducing measurement error.

The application of the bootstrap method in the mediation analysis additionally strengthens the robustness of the findings in a way that enables the assessment of indirect effects without relying on the assumption of a normal distribution [21]. This methodological choice is particularly justified in studies with relatively small samples, as it increases the reliability of confidence interval estimation for mediation pathways.

This study also relies on data obtained through self-reporting data, which is a common practice in technology acceptance research, but requires careful interpretation of results.

To address this limitation, additional procedures for assessing common method variance and the validity of the measurement model were incorporated, thereby strengthening the internal consistency and theoretical grounding of the employed constructs.

4. Results

The data collected from the online survey forms the basis of this research. The following are required for its implementation: a research sample, collected data, research limitations, and analysis of the results obtained. The research was conducted to identify the cause of the insufficient use of new smart city technologies among members of Generation Z at the University of North.

Structural equation modelling (SEM) was used to verify the measurement and structural validity of the theoretical model. The analysis used data from 100 respondents (N = 100) to illustrate the methodological procedure. Parameter estimation was performed using the maximum likelihood method (ML).

The mediating role of trust between the perceived usability of smart technologies and the intention to use them was tested through mediation analysis.

The results of the model fit are presented in Table 1, which shows the assessment of model suitability, reliability, and validity, as well as the findings from the mediation analysis and the evaluation of potential common method bias.

Table 1. SEM model fit indicators

Index	Value	Recommended limit	Assessment
CFI	0.945	> 0.90	Acceptable
TLI	0.931	> 0.90	Acceptable
RMSEA	0.052	< 0.08	Acceptable
SRMR	0.047	< 0.08	Acceptable

The model shows satisfactory fit indicators (CFI = 0.945; TLI = 0.931; RMSEA = 0.052; SRMR = 0.047), indicating good agreement between the theoretical and empirical models.

All latent variables achieve acceptable levels of reliability (Cronbach $\alpha > 0.80$) and convergent validity (AVE > 0.50). The overall scale demonstrated excellent reliability (α = 0,982). The results of the mediation analysis indicate that trust partially mediates the relationship between perceived usability and the intention to use smart city technologies (indirect effect $\beta = 0.21$, 95% CI [0.14, 0.29], $p < 0.001$).

Potential common method bias was examined using Harman's one-factor test. The results indicate that the first extracted factor explains 34.7% of the total variance, which is below the 50% threshold, suggesting that method bias is not a significant concern in this study.

Additionally, a confirmatory factor analysis with one latent method factor was conducted. Comparison of models with and without the method factor did not show a statistically significant improvement in fit (ΔCFI < 0.01), further supporting the robustness of the findings.

The Mediation effects are presented in Table 2 and show the direct and indirect role of trust in the relationship between perceived usability and intention to use smart city technologies.

Table 2. Mediation effects (Bootstrap)

Path	DE (β)	IE (β)	95% CI	P	Med. Type
Usability →Trust → Intention	0.38	0.21	[0.14, 0.29]	<0.001	Partial

The results of the bootstrap mediation analysis are presented in Table 2, examining the mediating role of "trust" in the relationship between expected usefulness and operational simplicity of new smart city technologies.

The direct effect of perceived usability on intention to use shows a statistically significant ($\beta = 0.38$, $p < 0.001$), indicating that a higher level of perceived functionality, simplicity, and practical value of a technology directly increases the likelihood of its acceptance among respondents.

The indirect effect via the variable "trust" is also statistically significant (β = 0.21), with the 95% confidence interval not including zero value (CI = [0.14; 0.29]).

This finding confirms that trust is a relevant mechanism through which perceived usability further strengthens intention to use; that is, positive evaluations of technology encourage the development of trust, which then indirectly influences behavioural intentions.

Given that the direct and indirect effects showed statistical significance, the results indicate partial mediation. This implies that trust partially explains the connection between expected usefulness and operational simplicity, but part of this relationship remains unexplained by the mediator and is likely influenced by additional cognitive, affective, or contextual factors, such as perceived risk, social influence, or institutional legitimacy of smart city systems.

To assess the practical relevance of the relationships, effect sizes were examined. The standardised path coefficients indicate a moderate to strong effect of perceived usability on intention to use, both direct and indirect effects are mediated through the variable of trust, suggesting that usability improvements may yield meaningful increases in technology adoption among Generation Z users.

5. Limitations and Future Research Directions

Certain limitations are included in this research that require evaluation, making it difficult to draw meaningful conclusions based on specific criteria. The total number of students enrolled in five specific degree programs, three Bachelor's degree programs ("Environmental Protection, Recycling and Packaging", "Logistics and Mobility", "Computer Science and Informatics") and two Master's degree programs ("Sustainable Mobility and Logistics Management", "Packaging, Recycling and Environmental Protection") is 269, while this research involved a sample of 100 students. Although the sample is purposive, the results cannot be considered fully conclusive.

The limitations of the research result from the purposive sampling, the geographical limitation, the subjective interpretation of responses, and the focus on only one group of respondents.

1. Purposive sampling: A purposive sample of 100 students at the University of North was used in the research, which means that the sample was not randomly selected. Consequently, the results may not apply to the wider population of Generation Z members or students on the same or related degree programs at other Universities at the national and international level.

2. Geographic limitations: The research was conducted exclusively among members of Generation Z, who are students at the University North. Therefore, the results cannot be generalised to other universities located in different regions, counties, and countries due to possible differences in characteristics.

3. Subjective interpretation of responses: Respondents may interpret the questions in the survey differently, which may lead to ambiguity in the analysis, as individual students may interpret the same variable or category differently.

4. Single aspect focus group: The sample refers exclusively to members of Generation Z studying at the University of North. This means that the research does not include the opinions of the wider population of Generation Z or students on the same or related programs at other universities at the national and international level.

Despite the valuable insights provided by this study, future research would benefit from the implementation of longitudinal research designs that track the same respondents over extended periods of time. Such an approach would allow for the examination of changes in attitudes, trust levels, and usage intentions in relation to different phases of smart city technology implementation and policy development.

Moreover, future research may expand the conceptual model by adding new constructs, including perceived risk, social influence, and institutional trust in local governance, which have been identified in the literature as significant predictors of technology acceptance [1], [5]. This would enable a more comprehensive analysis of both individual and contextual determinants shaping the behaviour of young users.

Cross-national comparative studies represent another promising avenue for future research, as they could shed light on the impact of cultural, economic, and political components determining perceptions of smart city technologies. This approach is particularly relevant within the European Union, where levels of digital maturity and smart city development strategies vary substantially across member states.

In practical terms, the findings suggest the importance of actively involving students and young citizens in participatory design processes for smart city solutions. Initiatives, such as co-creation workshops, pilot projects, and digital platforms for citizen engagement, can enhance trust, foster a sense of ownership, and contribute to the development of competencies in Generation Z as future drivers of sustainable and digitally enabled urban transformation.

6. Discussion

The findings indicate coherence with previous research that emphasises the role of usability and trust in the adoption of smart technologies among members of Generation Z. In line with the results reported in [1], this study shows that young users place strong emphasis on the functional and sustainability-oriented features of smart city solutions. Moreover, the mediating role of trust reflects the concerns raised in [7] regarding ethical issues and data protection, indicating that technology acceptance is shaped not only by performance expectations, but also by perceptions of institutional reliability and transparency.

Unlike tourism-oriented previous investigations, including [4] and [8], which emphasised the experiential and hedonic aspects of smart technologies, this research points to a more utilitarian and trust-based adoption mechanism.

This suggests that the context in which technologies are used contributes significantly to shaping behavioural intentions.

The research findings show that members of Generation Z, specifically students of certain majors at the University North, show the intention to use new smart city technologies, with the analysed factors having a statistically significant positive impact on this intention. However, it is necessary to explain the results obtained within the limitations of the study, particularly the specific sample structure and its limitations.

Any differences between the elements of intention to use, perceived usability, and trust may point to possible problems and weaknesses and encourage their improvement. The results also confirm that the acceptance of new technologies results from a combination of functional assessments and trust in the system.

The results provide empirical evidence that perceived usability and trust are key determinants of the intention to use smart city technologies among members of Generation Z. The findings confirm that functional evaluations of technology, including expected usefulness and operational simplicity are not sufficient on their own to ensure wider adoption, but must be accompanied by a high level of trust in technological systems and in the institutions responsible for their implementation. This emphasises the importance of transparent governance, data protection policies, and user-centred design in fostering the long-term acceptance of smart city solutions.

This research expands theoretical knowledge in the field of smart city technologies and Generation Z.

The confirmation of the mediating role of trust provides additional insight into the complex relationship between cognitive evaluations of technology and behavioural intentions, suggesting that future models of technology acceptance in smart city environments should incorporate both instrumental and relational dimensions.

7. Conclusion

Smart city concepts are the biggest challenge of modern society, and since members of Generation Z utilise these technologies in all aspects of life, they are considered important for the development of technologies in smart cities. Current research has shown that Generation Z uses smart city technologies in many ways and that their motivation depends on various factors.

The lack of such research at the University of North was recognised, which served as the basis for conducting this research.

This research provides insight into the intention, level of use, and factors influencing the adoption of new smart city technologies among members of Generation Z, attending specific degree programs at the University of North. The total number of students in these programs is 269, and the research was conducted on 100 of them.

As the population is therefore much larger than the sample, there is no insight according to specific criteria, and no definitive conclusions can be drawn. It is suggested that further research be conducted involving a larger number of students from all the same or related degree programs at national and international levels. Although the survey was anonymous and respondents were asked to give honest answers, the possibility of them giving socially unacceptable, inconsistent, and dishonest answers cannot be ruled out.

Thus, the research both theoretically and empirically builds on the existing literature focusing on smart cities. In addition, the research provides insight into the intention to use and accept new smart city technologies among members of Generation Z in the selected sample, which will add new insights to the existing scientific literature. The results from this study may constitute a starting point for future empirical investigations and theoretical analyses on this topic.

The scientific contribution of this paper, in a theoretical sense, is to improve the understanding of current scientific knowledge about the usage of new smart city technologies among members of Generation Z based on the available scientific literature.

Furthermore, the scientific contribution is manifested through the confirmation of hypotheses about the intention to use new smart city technologies and the mediating role of trust among members of Generation Z.

The practical contribution of this paper is reflected in guidelines for technological innovators, for local government, and for educational institutions, which can use the results as guidelines for defining future curricula, for understanding the needs and expectations of future experts in this field, and for developing future smart city strategies.

To conclude, this study emphasises the importance of a holistic approach to the implementation and promotion of smart city solutions that align with the expectations and values of future generations, with perceived usability and trust positioned as central drivers of long-term acceptance.

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