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SMART CITIES DEVELOPMENT IN UKRAINE: WOMEN, DIGITAL GAP AND INCLUSION

The article is devoted to an interdisciplinary study of the potential of smart cities to implement the principles of inclusivity, equality and accessibility in the context of overcoming the consequences of the digital gap and supporting women. The article defines the relationship between the quality of life and the development of digital skills, and the factors of effective development of digital skills in women are given. The given data from gender statistics and the results of sociological research on the assessment of the level of digital skills among civil servants and officials of local self-government bodies in the city of Kyiv allows to determine the gap between the digital skills of women and men and to identify areas of potential managerial influence to overcome it in the conditions of a smart city. The importance of taking into account gender issues during the development of smart cities in Ukraine and the potential of ICT for empowering women and giving them access to information are substantiated. It identifies the need to develop initiatives to close the gender gap in digital skills and areas related to educational technology, such as mentoring programs, scholarships and networking opportunities. In addition, the paper explores the potential of digital skills to bridge the digital divide and promote inclusiveness and citizen engagement in smart city initiatives. A series of management mechanisms is defined improving legislation and developing local policies based on the principles of gender equality; development and implementation of a system for monitoring and assessing the situation and the basis of indicators; dissemination of data on achievements determined through this monitoring in open sources, as well as the use of this information in the process of making management decisions; support for policies aimed at increasing the presence of women in socially significant positions, developing civic competences and digital skills.

Key words: *smart cities, gender mainstreaming, good governance, digital skills, public servants, digital gap.*

General statement of the problem and its connection with important scientific or practical tasks. The concept of smart cities has gained significant attention in recent years due to the increasing urbanization and the need for sustainable development. However, despite the potential benefits of smart cities, gender issues

have been overlooked in the development of smart cities. Therefore, this article aims to explore the perspectives for smart city development in Ukraine, taking into account gender equality. Most scientists who conduct their research in the field of smart city development emphasize the importance of taking into account the social perspectives that open up in this light. In the end, the development of modern technologies and scientific and technological progress in itself is seen as a source and a way to improve the quality of life of the planet's population. In this light, we will consider the future of smart cities in Ukraine – to what extent they will be able to harmonize those social disproportions that are already inherent in Ukrainian society and avoid aggravating what is not yet considered critical.

Analysis of the latest research and publications, in which the solution of this problem was initiated. Thus, some modern scholars have highlighted the importance of conceptualizing gender inclusion in smart cities that means addressing the specific needs, priorities, and experiences of women and other marginalized groups in urban planning and design. This includes ensuring that smart city initiatives are accessible, inclusive, and responsive to the needs of diverse communities.

For instance, Warschauer, M., & Matuchniak, T. examined the evidence of equity in access, use, and outcomes of new technologies, including digital skills, and how these factors are related to social inequality [9]. The authors explore the role of gender in digital skills and find that women are less likely than men to have high levels of digital skills, which can contribute to the digital divide. Van Deursen discusses the shift in the digital divide from access to usage and explores the factors that contribute to differences in online usage, including digital skills [8]. The author finds that gender is one of the factors that contribute to differences in online usage, with women being less likely to engage in activities such as online shopping, social networking, and online gaming, which can contribute to differences in digital skills. Livingstone, S., & Helsper, E. also emphasizes that gender is one of key factors of digital inclusion, with girls being less likely

than boys to engage in online activities that can contribute to the development of digital skills [6]. Eynon, R., & Helsper, E. explore the relationship between digital inequalities, including digital skills, and learning outcomes among adults learning online [2]. The authors find correlation between gender and digital inequalities, and highlight that women are less likely than men to have high levels of digital skills and achieve positive learning outcomes in online learning environments.

Focusing on issues of inclusivity in smart cities, it is worth mentioning studies that, based on in-depth interviews, define four pillars of Barrier-free digital urban logic: digital inclusion and equity leadership, standardization of digital access, culture of universal accessibility, shared commitmen [5; 3]. Considering the level of development of different countries of the world in terms of creating conditions for gender equality, it is important to find a suitable metric that will allow for proper comparative analysis. Among such assessment systems are various indices and indicators, in the assessment system of which there is a gender parameter. These measuring systems include: Gender Development Index, Gender Inequality Index, Global Gender Gap Index, Gender Parity Index, Gender Equality Index, Gender Sensitivity Index, Gender Vulnerability Index, Women, Peace and Security Index etc. Indicator systems that take into account the inequalities emerging in today's digital economy also have a gender dimension. Among these: The Gender Digital Divide Index, Digital Opportunities Index, Digital Skills Gap Index.

It is worth noting that different indexes and tools may use different criteria and indicators to assess gender inclusiveness, and there is no one-size-fits-all approach to ranking cities. Nonetheless, these tools and indexes can provide valuable insights into the gender inclusiveness of cities and help identify areas where improvements are needed.

Selection of previously unresolved parts of the general problem, to which the specified article is dedicate. This article, among other things, contains the original results of a study of digital skills of civil servants and officials of local self-government bodies of the city of Kyiv in a

gender perspective, as well as based on the analysis of statistics on the digital gender gap in European countries, the most effective management strategies for improving inclusion processes in smart cities.

This article is devoted to the study and justification of the relationship that exists between the quality of life, the level of digital skills and how this relationship is embodied in the concept of smart cities. The focus of the study is the gender aspects of smart city development in Ukraine, which involve studying the basic conditions for the implementation of these models of urban development in practice. This implies the study of gender-related differences in the quality of human capital, in particular, the level of education of men and women, and their level of involvement in public life.

Presentation of the main material of the research with a full justification of the obtained scientific results. In general, ICTs have great potential in redressing gender imbalances. ICT can provide women with access to information that is relevant to their lives and their communities. This can include access to government services, job opportunities, health information, and educational resources. By having access to this information, women can make informed decisions and participate more fully in their communities. These possibilities can be realized using mobile technologies, online services (e.g.petitions and surveys). Overall, ICT has the potential to empower women to participate more actively in social life by providing access to digital platforms, information, and training women can be more informed, engaged, and empowered to advocate for their needs and interests.

But such opportunities can be realized only if the human capital itself is ready. In this case, we are talking about the level of formation of digital skills, which can become both a stimulus for the development of smart cities, and a significant obstacle (if a particular society is characterized by a pronounced digital stratification).

We can define different ways how digital skills can make smart cities more inclusive. Firstly, they can bridge the digital divide by ensuring that all citizens have access to technology and digital services. This can pro-mote inclusivity by providing equal opportunities for all citizens to participate in smart city initiatives. Secondly, smart cities may enhance citizen engagement, as they can help citizens to engage with local authorities more effectively. Citizens can participate in online discussions, provide feedback, and suggest new ideas, making smart city initiatives more inclusive and citizen-driven. Also digital skills can foster innovation and creativity, leading to new solutions and approaches that can make smart cities more inclusive. Citizens with digital skills can use technology to develop new ideas, products, and services that meet the needs of diverse communities, leading to a more inclusive and sustainable smart city.

The demand for digital skills in the labor market has been steadily increasing in recent years, driven by the increasing digitization of the economy and the growing importance of technology in a wide range of industries. Here are some statistics that illustrate the current demand for digital skills in the labor market. According to Microsoft Data Science, by 2025 the number of jobs requiring digital skills will increase by 149 million globally [11]. This includes jobs in areas such as data analysis, artificial intelligence, and digital marketing. Also the COVID-19 pandemic has accelerated the demand for digital skills, as many businesses have had to shift to remote work and online operations.

According to Eurostat data (table 1), digital skills are among the most demanded in the labor markets of the EU countries. At the same time, in countries such as Poland and Slovenia, this trend is most pronounced. Among the most requested digital skills are the ability to create digital content and cybersecurity knowledge.

We are convinced that there is an unquenchable trend for high demand for digital skills. At the same time, these skills are needed both as an incentive for the development of the digital technology market and the digital economy as a whole, and as a factor in the introduction of these technologies into mass consumption. After all, the level of consumer ability to correctly and appropriately use digital technologies ultimately determines the prospects for the digital economy.

Table 1

Most Demanded Digital Skills On Labor Markets Of EU Countries
(based on Eurostat.com data)

MOST DEMANDED DIGITAL SKILLS ON LABOR MARKETS OF EU COUNTRIES in 2022	
Estonia	digital content creation, office tools and collaboration software
Germany	digital content creation, ICT safety, networks and servers
Austria	digital content creation, office tools and collaboration software, web development and cloud technologies
Hungary	computer programming, digital content creation, digital data processing
Czech Republic	computer programming, ICT safety, networks and servers, web development and cloud technologies
European Union	digital content creation, digital data processing, office tools and collaboration software
Slovak Republic	digital content creation, digital data processing, office tools and collaboration software
Slovenia	ICT safety, networks and servers, office tools and collaboration software, web development and cloud technologies
Lithuania	computer programming, ICT safety, networks and servers, digital content creation
United Kingdom	computer programming, digital content creation, web development and cloud technologies
Poland	computer programming, digital content creation, ICT safety, networks and servers
Italy	computer programming, digital content creation, digital data processing
France	computer programming, digital data processing, web development and cloud technologies
Latvia	computer programming, digital content creation, ICT safety, networks and servers
Spain	computer programming, digital content creation, ICT safety, networks and servers
Netherlands	digital content creation, ICT safety, networks and servers, web development and cloud technologies

Table 2

Assessment of the level of digital skills of civil servants and officials
of local self-government bodies by gender

	[Working with standard office programs (Microsoft Office, Internet browsers, mail services, etc.)]		[Working in the electronic document management system of your institution]		[Communication using digital technologies (Viber, Telegram, Zoom, etc.)]		[Search for necessary information and digital content on the Internet]		[Protection of personal data on the Internet]		[Working with databases (for example, EDEBO, etc.)]	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
High level	58.05%	68.28%	48.87%	44.14%	60.31%	64.83%	69.01%	75.86%	34.80%	51.03%	22.29%	27.59%
Average	39.09%	29.66%	43.03%	42.07%	33.85%	30.34%	27.41%	20.00%	46.25%	37.24%	40.52%	38.62%
Low level	1.31%	0.69%	3.34%	5.52%	1.91%	2.76%	1.31%	2.76%	6.79%	4.83%	9.65%	11.72%
Not used during operation	0.72%	0.69%	3.34%	4.83%	2.86%	0.00%	0.72%	0.00%	5.48%	2.76%	20.74%	15.86%
It is difficult to estimate	0.83%	0.69%	1.43%	3.45%	1.07%	2.07%	1.55%	1.38%	6.67%	4.14%	6.79%	6.21%

In this context, it is necessary to pay attention to the existing digital gap, which is determined by many factors: the level of well-being, the region of residence, age and, of course, gender.

According to recent statistics, there is still a gender gap in digital skills and technology-related fields, with women being underrepresented in these areas. Here are some recent statistics on women's digital skills. For example, a survey (Women in the ICT Sector, 2023) found that in 2020, only 17% of people employed in the ICT sector in the EU were women. Moreover, on a global scale, 69 per cent of men are using the Internet, compared with 63 per cent of women. This means there are 259 million more men than women using the Internet in 2022 [13]. Overall, these statistics suggest that there is still work to be done to close the gender gap in digital skills and technology-related fields. Initiatives that aim to encourage and support women and girls in STEM fields, such as mentorship programs, scholarships, and networking opportunities, may help to address this gap.

The confirmation of the hypothesis about the influence of digital skills on the quality of life are the results of the survey "Digital economy, impact of ICT on human capital and formation of future competencies", which was conducted in November 2020–February 2021 within the framework of the research project of KNU – HUAWEI "Digital economy, impact of ICT on human capital" capital and formation of future competencies". The survey was conducted anonymously using the Computer Assisted Web Interviewing (CAWI) method using the functionality of the Google forms survey toolkit. The object of the study was representatives of the scientific community, civil service, business and entrepreneurship, and the public sector, who comprehensively represent the peculiarities of the development of the digital economy in Ukraine. The volume of the sample totaled 1181 experts [1, p. 46]. "It was found that a higher level of digital skills contributes to improving the quality of respondents' everyday life; there is an increase in the share of respondents who use Internet resources in everyday life" [10, p.46]. "The key conclusions are as follows: 1) focused efforts on the development of digital skills will contribute to an increase in the share of optimistic and pragmatic assessments of digitalisation; 2) the detected digital gap between the possession of skills and the need for them (2–3 times) actualises the implementation of policies aimed at overcoming it; 3) the awareness of the impact of the level of digital skills on the development of citizens and satisfaction with the products of the digital economy is growing; 4) the digital transformation of the economy radically changes its structure, the landscape of the labor market, and has a major impact on every citizen" [10, p. 46].

Usually, the digital divide is caused by such indicators as: basic media literacy, access to digital technologies, digital inclusion, basic digital skills and digital involvement of the population and others [11]. Moreover, based on a management approach, the efforts on reducing the digital divide could be categorized into activities aimed at improving the digital skills of smart city residents and civil servants and officials of local self-government bodies, who must implement the policy of inclusion by digital means on the ground. In this sense, the results of a study conducted jointly with the National Civil Service Agency of Ukraine by the authors of the article in 2021 are important. A data collection method was Computer Assisted Web Interviewing (CAWI) method with the functionality of the Google forms survey toolkit. During the survey in the city of Kyiv, 984 respondents from among civil servants and officials of local self-government bodies were interviewed. This study made it possible to determine, among other things, gender-based differences in the digital skills of civil servants in the Ukrainian city that implements the concept of smartness – the city of Kyiv. Detailed results of the survey are given in Table 2.

The analysis of the received answers made it possible to determine the biggest gaps between women and men who are civil servants and officials of local self-government bodies in digital skills. Thus, general data showed that the most developed skills are those connected with standard office programs, communication skills on using digital technologies (Viber, Telegram, Zoom, etc.) and skills connected with search for necessary information and digital content on the Internet – among both women and men. However, there are clearly defined gender gaps in skills shown in Fig.1. So, in particular, women are better concerned with electronic document management issues, while men, in general, rate all their digital skills higher. The biggest gap is observed in office programs usage performance – 68% of men rate these skills at the highest level, among women this percentage was only 58%, as well as in the assessment of such skills as personal data protection – 51% against 38% – assessment of a high level of skill development in men and women, respectively (Fig. 1).

According to the results of this survey, it is considered to pay special attention to training for women on the basics of personal data protection, since this is one of the most priority areas for preventing the inhibition of the digital inclusion process in smart cities.

The question of the education role in the processes of increasing digital inclusion, including among women, is also important
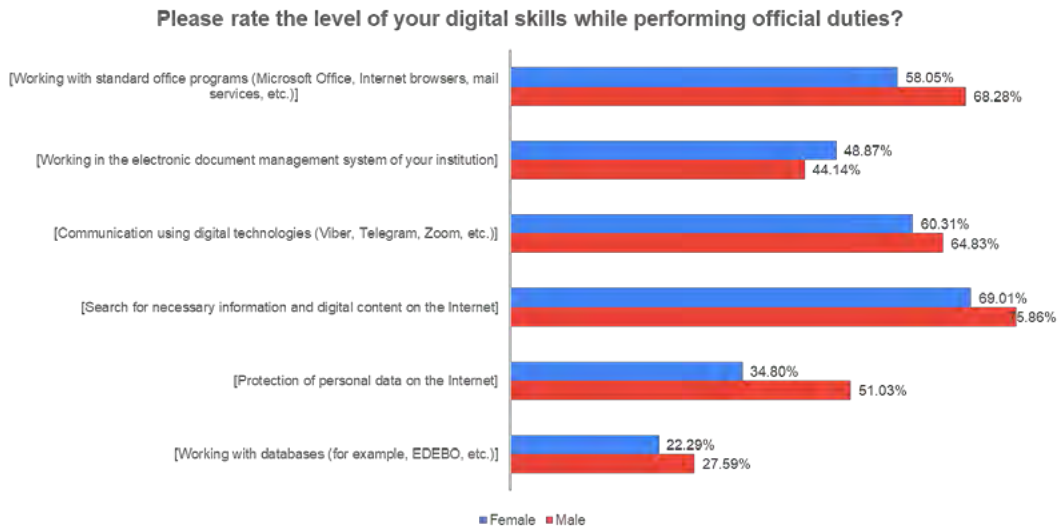
Fig. 1. Gender gaps in the digital skills of civil servants and officials
of local self-government bodies

in the context of achieving the Sustainable Development Goals. In particular, goal 4 "Quality education" has indicator 4.4.2 "Population by level of education and sex, %", the analysis of which showed (Fig. 2) that at the age of 25-64 the share of women with complete higher education is greater than among men of the same age. However, the gender distribution among specialities shows that the vast majority of STEM-specialities students are men. Thus, this confirms the opinion that overcoming the digital gender gap is possible precisely through the

means of specialized education for women. In addition, the development and implementation of such courses requires a change in stereotypical attitudes to the distribution of roles in society, including professional roles.

We consider the level of development of digital skills as a factor in expanding opportunities for women's public participation in public life. Thinking about smart cities as an environment that more intensively involves citizens and public authorities in direct interaction than traditional forms of city administration, we proceed from the thesis that
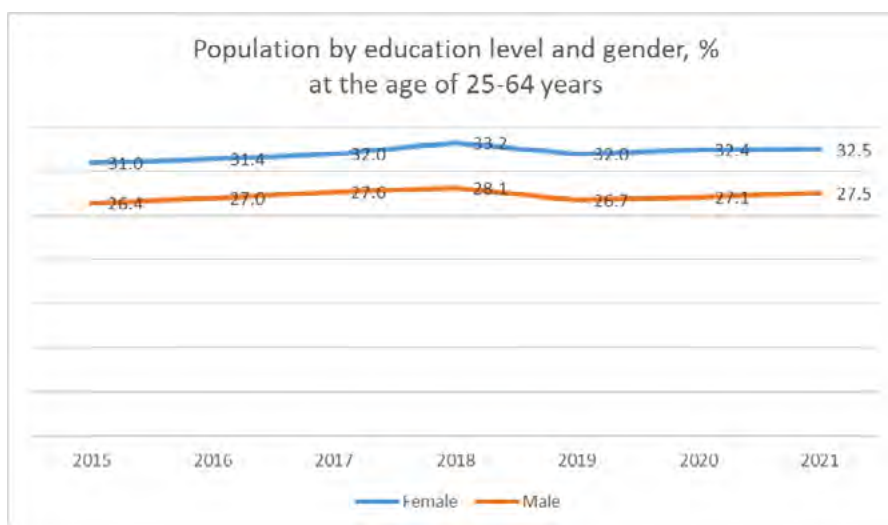

Fig. 2. Population by education level and gender, %
(at the age of 25–64 years) [13]

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Table 3

**Analysis of the representation of women in various spheres
of social involvement [13]**

	2020	**2021**	**2022**
The share of political parties **headed by women** in the total number of political parties, %	22.7	23.2	23.1
The share of legal entities **headed by women**, in % of the total number of legal entities	28.9	29.2	29.3
The share of public organizations **headed by women** in the total number of public organizations, %	27.8	28.1	28.4

the so-called digital readiness of citizens is a key factor in realizing the potential of a smart city.

The proof of the relevance of the thesis about the need for wider inclusion of women in Ukraine is the following statistics (Table 3) Analyzing the involvement of women in various spheres of life in society, we can conclude that the level of such involvement ranges from 20% to 30%, which, of course, is far from gender parity.

Conclusions from this study and prospects for further development in this direction. Despite the fact that Ukraine demonstrates positive dynamics in the development of digital technologies, in particular, access to the Internet has improved in all regions (on average by 289% over the last decade, 2010–2019) [14, p. 2], but this development is uneven and depends on the type of area (rural or urban). Kyiv has the highest level of Internet access in the country (84% of households) [14, p. 2]. This, as well as significant progress in the implementation of digital public services, which has been achieved in Ukraine, actualizes the need for a wider implementation of the concept of a smart city.

However, the wide development of information and communication technologies does not always have a positive effect on the processes of social inclusion in society, especially due to the existence of a digital divide, which also has a gender connectoin.

In this context, the results of the study proved that the management of the development of smart cities must necessarily include activities aimed at overcoming the digital divide, with a special emphasis on the development of digital skills among women. The effective development of a STEM education system for girls and women should include efforts to overcome gender stereo-types that can influence the choice of a field of study by girls.

Ultimately, research on inclusion in smart cities should be based on a system of regular monitoring and assessment of the situation based on developed indicators. In this context, the ICT of smart cities opens up new opportunities for collecting and analyzing such indicators in a more efficient way.

From the point of view of smart city management mechanisms, which should be aimed at reducing the digital divide and increasing social inclusion, the main ones are: improving legislation and developing local policies based on the principles of gender equality; development and implementation of a system for monitoring and assessing the situation and the basis of indicators; dissemination of data on achievements determined through this monitoring in open sources, as well as the use of this information in the process of making management decisions; support for policies aimed at increasing the presence of women in socially significant positions, developing civic competences and digital skills.

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Акімова О., Іщенко А. Розвиток розумних міст в Україні: жінки, цифровий розрив та інклюзія

Стаття присвячена міждисциплінарному дослідженню потенціалу розумних міст для впровадження принципів інклюзивності, рівності та доступності в контексті подолання наслідків цифрового розриву та підтримки жінок. У статті визначено взаємозв'язок між якістю життя та розвитком цифрових навичок, наведено фактори ефективного розвитку цифрових навичок у жінок. Наведені дані гендерної статистики та результати соціологічного дослідження щодо оцінки рівня цифрових навичок державних службовців та посадових осіб органів місцевого самоврядування міста Києва дозволяють визначити розрив між цифровими навичками жінок і чоловіків. та визначити сфери потенційного управлінського впливу для його подолання в умовах розумного міста. Обґрунтовано важливість врахування гендерних питань під час розвитку розумних міст в Україні та потенціал ІКТ для розширення прав і можливостей жінок та надання їм доступу до інформації. Визначено потребу в розробці ініціатив для усунення гендерного розриву в цифрових навичках і сферах, пов'язаних з освітніми технологіями, таких як програми наставництва, стипендії та можливості спілкування. Крім того, у статті досліджується потенціал цифрових навичок для подолання цифрового розриву та сприяння інклюзивності та залученню громадян до ініціатив розумного міста. Визначено низку механізмів управління: удосконалення законодавства та розробка місцевої політики на основі принципів гендерної рівності; розробка та впровадження системи моніторингу та оцінки ситуації на основі індикаторів; поширення даних про досягнення, визначені за допомогою цього моніторингу, у відкритих джерелах; а також використання цієї інформації в процесі прийняття управлінських рішень; підтримка політики, спрямованої на збільшення присутності жінок на соціально значущих посадах, розвиток громадянських компетенцій та цифрових навичок.

Ключові слова: *розумні міста, ґендерний мейнстримінг, належне врядування, цифрові навички, державні службовці, цифровий розрив.*