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Social perception of 5G technology

Społeczna recepcja technologii 5G

Summary: The aim of the article is to take a broader look at the current situation related to the implementation of 5G technology in Poland from a social perspective. The analysis was conducted in a broader context – Poles' attitudes towards science and technology as well as their knowledge about modern technologies. In addition to an analysis of the literature on the subject, the article will present the results of two parallel studies conducted using three research methods: the focus method, in-depth expert interviews and a questionnaire conducted on the basis of direct interviews at respondents' homes. The article reflects on, inter alia, questions about the attitudes of Poles to the development of science and technology, in particular to 5G technology, and whether the development of modern technologies is a cause of social anxiety among Poles. Research on the social perception of the 5G network in Poland shows that Poles are not familiar with 5G technology. Their ignorance results from poorly conducted technological education, insufficient public information provided by state authorities, public distrust of the authorities as an unreliable source of information, and the hermetic language used by telecommunications specialists. The disinformation aimed at delaying the implementation of this technology in Europe, also being related to the war over 5G technology between the United States and China, has a great impact on the negative perception of the 5G technology in Polish society.

Keywords: 5G technology, telecommunication society, disinformation

Streszczenie: Celem artykułu jest szersze spojrzenie na obecną sytuację związaną z wdrażaniem technologii 5G w Polsce z perspektywy społecznej. Analiza została przeprowadzona w kontekście postaw Polaków wobec nauki i techniki oraz wiedzy o nowoczesnych technologiach. Oprócz analizy literatury przedmiotu w artykule zostaną przedstawione wyniki dwóch równoległych badań z wykorzystaniem trzech metod badawczych: fokusowych, pogłębionych wywiadów eksperckich oraz ankiety przeprowadzonej metodą wywiadów bezpośrednich w domach respondentów. W artykule refleksji zostały poddane m.in. pytania o to, jaki jest stosunek Polaków do rozwoju nauki i techniki, w szczególności do technologii 5G oraz czy rozwój nowoczesnych

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technologii jest przyczyną społecznego niepokoju Polaków. Z badań nad odbiorem społecznym sieci 5G w Polsce wynika, że Polacy nie znają technologii 5G. Ich niewiedza wynika ze źle prowadzonej edukacji technologicznej, niedostatecznego informowania społeczeństwa przez władze państwowe, braku zaufania społeczeństwa do władz jako niewiarygodnego źródła informacji oraz ze względu na hermetyczny język, którym posługują się specjaliści z telekomunikacji. Duży wpływ ma także dezinformacja mająca na celu opóźnienie wdrożenia tej technologii w Europie, również związana z wojną o 5G między Stanami Zjednoczonymi a Chinami, dodatkowo wpływa na wyjątkowo negatywne postrzeganie technologii 5G w polskim społeczeństwie.

Słowa kluczowe: technologia 5G, telekomunikacja, społeczeństwo, dezinformacja

Introduction

The leaders of many countries around the world are aware of the strategic nature of the 5G network. This is probably why this technology was the cause of the so-called *cold war on tech*¹ and the information war, largely based on disinformation. It is a phenomenon in the history of the telecommunications sector – when communication technology has become the subject of such a broad trade war and geopolitical game. The global, public discussion on 5G and its role in the transformation of the world, both in the political and economic spheres², has become a field of intensified disinformation activities, the aftermath of which are social protests mounting in Europe and elsewhere. Protesters demand a complete ban on 5G technology, and their actions are not limited only to verbal actions but also to acts of destroying critical infrastructure – setting fire to the masts.

The purpose of the article is to take a broader look at the current situation related to the deployment of 5G technology in Poland from the social perspective. The analysis will be conducted in a broader context – Poles' attitudes towards science and technology as well as their knowledge about modern technologies. Among others, the following research questions will be put: What is the attitude of Poles to the development of science and technology? What is the attitude of Poles to the development of 5G technology? What is the scale of use of se-

- 1 A. Segal, *Year in Review 2019: The U.S.–China Tech Cold War Deepens and Expands*, Council on Foreign Relations, 18 December 2019, <https://www.cfr.org/blog/year-review-2019-us-china-tech-cold-war-deepens-and-expands> [15.06.2021].
- 2 U. Soler, *Political and Economic Contexts of Implementing 5G in Poland and in Selected European Countries*, "Journal of Telecommunications and Information Technology" 2021, no. 2, pp. 38-48.

lected modern technologies by Poles? How are technologies that emit electromagnetic radiation perceived by Poles? What is the role of modern technologies in the everyday life of Poles? Is the development of modern technologies associated with an increase in the emission of electromagnetic radiation and is this the cause of social anxiety among Poles?

The analysis will be conducted in the context of increasing disinformation activities which result in social protests. Presented here will be the specific social phenomena related to 5G technology.

1. The method

In addition to an analysis of the literature on the subject, the article will present the results of two parallel studies using three research methods: focus research, in-depth expert interviews and a survey conducted using face-to-face interviews at respondents' homes (Computer Assisted Personal Interview). The first study (focus groups and interviews) is the author's own research conducted in the spring of 2021. The second (CATI – computer-assisted telephone interviewing) was conducted in June 2021 in cooperation with the Polish Chamber of Information Technology and Telecommunications and concerned the attitude of Poles to electromagnetic fields and new technologies, e.g., 5G technology. The interviews were carried out on the basis of structured questionnaire forms among 1,005 Polish citizens. The structure of the research sample was balanced in terms of respondents' gender, age and education level.

2. Literature review

The review of the literature on the social reception of 5G technology in Poland is aimed at uncovering the current findings in this field as well as research limitations. Based on current reports and literature, it is possible to determine what the approach adopted by government agencies to this technology is and what practices they apply in implementing the proposed strategies for the regulation of wireless connectivity in the context of 5G technology. Unfortunately, little is said in the literature about the social perception of 5G technology.

In the literature on the subject, a lot of space has been devoted to modern technologies, including 5G communication technology. Most of the literature refers to technical issues³, with the deployment of networks, compatibility and other similar technical aspects of 5G technology⁴, the benefits of 5G⁵, the economic contexts of 5G implementation⁶, an assessment of 5G infrastructure strategies in relation to mobile traffic growth and the possible development of the Internet of Things (IoT), Smart Cities and other technological developments (services) dependent on digital connectivity (examples are the experiences of Great Britain, Netherlands and India⁷) and the laws and regulations necessary to implement 5G⁸. According to Fettweis and Alamouti⁹, 5G technology is a critical step in the development of the wireless sphere.

- 3 S. Asif, *5G Mobile Communications: Concepts and Technologies*, Taylor and Francis Group, 2019; *5G Mobile and Wireless Communications Technology*, A. Osseiran, J.F. Monserrat, P. Marsch (eds.), Cambridge University Press, 2016; *Fundamentals of 5G Mobile Networks*, J. Rodriguez (ed.), Wiley, 2015; B. Rao, A.J. Harrison, B. Mulloth, *Defense Technological Innovation. Issues and Challenges in an Era of Converging Technologies*, [in:] *New Horizons in Innovation Management series*, Cheltenham 2020; E. Dahlman, S. Parkvall, J. Skold, *5G NR: The next generation wireless access technology*, Academic Press, 2020; K. David, H. Berndt, *6G Vision and Requirements: Is There Any Need for Beyond 5G?*, "IEEE Vehicular Technology Magazine" 2018, vol. 13, no. 3, pp. 72-80.
- 4 E.J. Oughton et al., *Towards 5G: Scenario-based assessment of the future supply and demand for mobile telecommunications infrastructure*, "Technological Forecasting and Social Change" 2018, vol. 133, pp. 141-155.
- 5 *Spectrum for 4G and 5G*, Qualcomm, November 2019, <https://www.qualcomm.com/media/documents/files/spectrum-for-4g-and-5g.pdf> [18.06.2021].
- 6 *5G: The chance to lead for a decade*, Deloitte, 2018, <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5g-deployment-imperative.pdf> [21.05.2021].
- 7 V. Weerakkody, G. Dhillon, *Moving from E-Government to T-Government: a study of process reengineering challenges in a UK local authority context*, "International Journal of Electronic Government Research" 2008, vol. 4, no. 4, pp. 1-16; E.J. Oughton et al., *Assessing the capacity, coverage and cost of 5G infrastructure strategies: Analysis of the Netherlands*, "Telematics and Informatics" 2019, vol. 37, pp. 50-69; S. Saxena, *Enhancing ICT infrastructure in public services, Factors influencing mobile government (m-government) adoption in India*, "The Bottom Line" 2017, vol. 30, no. 4, pp. 279-296.
- 8 W. Lemstra, M. Cave, M. Bourreau, *The Towards the successful deployment of 5G in Europe: What are the necessary policy and regulatory conditions?*, project report, Centre on Regulation in Europe (CERRE), 2017, <https://cerre.eu/publications/towards-successful-deployment-5g-europe-what-are-necessary-policy-and-regulatory/> [25.06.2021].
- 9 G. Fettweis, S. Alamouti, *5G: Personal mobile internet beyond what cellular did to telephony*, "IEEE Communications Magazine" 2014, no. 52(2), pp. 140-145.

Some authors also focus on the security-related aspects of 5G¹⁰, especially in relation to Huawei and China's position in the technological race. The considerations concern both standardisation¹¹ as well as particular Chinese interests in Europe¹².

The literature on 5G technology is very rich; however, it is difficult to find an entry on the sociological contexts of implementing 5G technology. Pandey et al.¹³ write about the social, technical and economic challenges of 5G technology, but in the context of India. Insight from the UAE is given by AlRaeesi and Habibur¹⁴, who describe a proactive approach to the deployment of 5G technology.

Interesting contributions from the Anglo-Saxon perspective were made by J. Meese, J. Frith, and R. Wilken¹⁵, who used specific examples from the United States, Great Britain and Australia to describe social concerns related to 5G, mainly around human health. Mentioned there is an example of a group of electro-sensitive people who moved to the town of Green Bank, where no cellular signals were received. The official European documents¹⁶ of the World Health

- 10 R. Khan et al., *A Survey on Security and Privacy of 5G Technologies: Potential Solutions, Recent Advancements, and Future Directions*, "IEEE Communications Surveys & Tutorials" 2020, vol. 22, no. 1, pp. 196-248.
- 11 M.J. Kim, H. Lee, J. Kwak, *The changing patterns of China's international standardization in ICT under techno-nationalism: A reflection through 5G standardization*, "International Journal of Information Management" 2020, vol. 54, <https://doi.org/10.1016/j.ijinfomgt.2020.102145> [25.06.2021].
- 12 B. Kowalski, *Central and Eastern Europe, China's Core Interests, and the Limits of Relational Politics: Lessons from the Czech Republic in the 2010s*, "East European Politics and Societies: and Cultures" 2020, vol. 36, no. 1, pp. 51-74.
- 13 M.K. Pandey, A. Gaurav, V. Kumar, *Social, technical and economical challenges of 5G technology in Indian prospective: Still 4G auction not over, but time to think about 5G in India*, International Conference on Computer and Computational Sciences (ICCCS), Noida 2015, pp. 157-162.
- 14 A.S.A. AlRaeesi, R.M. Habibur, *Proactive Approach to the Deployment of 5G Technology: Insights from the UAE*, 2nd Europe – Middle East – North African Regional Conference of the International Telecommunications Society (ITS): "Leveraging Technologies For Growth", Aswan, Egypt, 18-21 February 2019, International Telecommunications Society (ITS), Calgary.
- 15 J. Meese, J. Frith, R. Wilken, *COVID-19, 5G conspiracies and infrastructural futures*, "Media International Australia" 2020, vol. 177(1), pp. 30-46.
- 16 M. Karaboytcheva, *Effects of 5G wireless communication on human health*, European Parliamentary Research Service, 2021, [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646172/EPRS_BRI\(2020\)646172_PL.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646172/EPRS_BRI(2020)646172_PL.pdf) [15.06.2021]; *Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)*, "Official Journal of the European Communities", 30 July 1999, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999Ho519&from=EN> [12.06.2021]; International Commission on Non-ionizing Radiation Protection, *ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)*, "Health Physics" 1998, no. 74(4), pp. 494-522, <https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf> [15.06.2021]; International Commission on

Organization¹⁷ also refer to health problems, including “myths” concerning the transmission of the coronavirus via the 5G¹⁸ or national network¹⁹.

Electro-sensitivity is extensively covered in Polish scientific literature, mainly from the medical perspective²⁰, but there are also texts on social issues. An example of this is the description of a study conducted by G. Tatoń, P. Kuterba, B. Lisowski, T. Rok, and E. Rokita²¹, the aim of which was to examine the knowledge about the impact of various types of everyday devices, and in particular telecommunications devices, on the human body. Similar studies were previously conducted in other countries²². However, it is difficult to find research on the social perception of 5G technology, its social reception, society’s understanding of this technology, the fear it causes, which results in protests fuelled by disinformation, sometimes even ending up with the telecommunications infrastructure being set on fire. Plenty of journalistic information on the subject can be found on the internet. This primarily concerns 5G conspiracy theories²³, such as the one that 5G

Non-ionizing Radiation Protection, *ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 KHZ to 300 GHZ)*, “Health Physics” 2020, no. 118(5), pp. 483-524, <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf> [15.06.2021]; Scientific Committee on Health, *Environmental and Emerging Risks (SCHEER)*, https://ec.europa.eu/health/scientific_committees/scheer_en [15.06.2021]; Group of Chief Scientific Advisors, https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors_en [15.06.2021]; *Shaping Europe’s digital future*, <https://ec.europa.eu/digital-single-market/en/news/european-electronic-communications-code-updating-eu-telecom-rules> [15.06.2021].

- 17 International Agency for Research on Cancer Publications, <https://publications.iarc.fr/126> [15.06.2021].
- 18 *Mythbusters*, World Health Organization, 19 January 2022, <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters> [16.06.2021].
- 19 *Effect of electromagnetic millimeter waves on the health of employees in the in the designed 5G networks and the general population*, K. Rydzyński (ed.), Łódź 2020.
- 20 E. Sobiczewska, S. Szmigielski, *Electromagnetic fields hypersensitivity*, “Occupational Medicine” 2009, no. 60(3), pp. 235-241.
- 21 G. Tatoń et al., *The influence of electromagnetic fields on the human health – survey studies*, “Przeгляд Elektrotechniczny” 2019, vol. 95, no. 12.
- 22 A. Verrender et al., *IEI-EMF provocation case studies: A novel approach to testing sensitive individuals*, “Bioelectromagnetics” 2018, vol. 39, no. 2, pp. 132-143; S. Eltiti et al., *Aggregated data from two double-blind base station provocation studies comparing individuals with idiopathic environmental intolerance with attribution to electromagnetic fields and controls*, “Bioelectromagnetics” 2015, vol. 36, no. 2, pp. 96-107.
- 23 I. Eliassen, P. Pena, *Real 5G issues overshadowed by Covid-19 conspiracy theories*, Investigate Europe, 12 June 2020, <https://www.investigate-europe.eu/en/2020/5g-covid-conspiracy/> [16.06.2021]; T. Destiny, *Conspiracy theories about 5G networks have skyrocketed since COVID-19*, The Conversation, 2 June 2020, <https://theconversation.com/conspiracy-theories-about-5g-net>

is spreading the coronavirus. The subject of the research presented below was to examine the attitude of Poles to new technologies, especially to 5G technology.

3. 5G in the eyes of Poles

The research discussed here was conducted in two stages. In the first stage, two methods were used: focus studies conducted among students and working people, and expert interviews with specialists dealing in theory and practice with new technologies. In the second stage, a survey conducted with the use of face-to-face interviews at respondents' homes (Computer Assisted Personal Interview) was carried out on a representative research sample of 1,005 Poles with a diverse structure of sex, age, education, work, place of residence and economic situation.

Are Poles afraid of 5G technology?

In the first stage, during two focus-group sessions, a total of 16 people were examined. The first group consisted of people aged 20-24, students, 50% technical field of study, 50% social or humanities field of study, mixed group in terms of gender, also using smartphone functionalities other than telephone communication. The second group included people aged 25-29, working professionally, 50% higher technical education (engineer), 50% education in social sciences or humanities, also a mixed group in terms of gender, using smartphone functionalities other than telephone communication. Simultaneously, five in-depth interviews were conducted with experts who, for professional reasons, deal with the issue of 5G.

The following conclusions can be drawn from the focus-group studies; these are the views of the respondents:

- there is a lack of knowledge in Polish society about 5G;
- there is a large amount of information on 5G on the internet – good, mixed with a huge amount of fake news, but this topic

works-have-skyrocketed-since-covid-19-139374 [16.06.2021]; L. La, *5G myths, debunked: 5G won't replace 4G, doesn't cause COVID-19 and is still rolling out*, cnet.com, 1 June 2020, <https://www.cnet.com/tech/mobile/5g-myths-debunked-5g-wont-replace-4g-doesnt-cause-covid-19-and-is-still-rolling-out-during-the-pandemic/> [16.06.2021].

is presented on the internet in a mocking manner, people are easily misinformed;

- there is no such information at all by the Polish authorities, and the government is not considered a reliable source of information;
- the research of the scientific institutions should be the basis for the authorities informing the public about new technologies, but there is the need for universities to maintain their independence, and their research should not be financed by telecommunications companies;
- there is the lack of reliable information regarding the impact of this technology on human health and life;
- the problem of novelty – we are afraid of what we do not see and what we do not understand (this thesis has already been verified many times in the past with the introduction of other technologies, such as electrification or sewage in Warsaw²⁴);
- 5G technology is associated with atomic radiation and X-ray radiation, and the differences between these types of radiation are not explained widely by specialists;
- the war over 5G technology between the United States and China is not conducive to a positive social perception of this technology because it is associated with a conflict, which is also conducted in the information sphere;
- people are not in the habit of verifying the truthfulness of information; they are also unable to do it – there is insufficient public education in this sphere;
- a concern that it may be a threat to national security or a wire-tapping threat;
- there is no open discussion about 5G, and related topics are being silenced;

24 U. Soler, M. Busiło, *Taming with technology. On the example of UK electrification and 5G technology*, "Przegląd Elektrotechniczny" 2019, vol. 95, no. 12, pp. 97-100; eidem, *Education of society as a tool to counteract disinformation in implementing new technologies. On the example of 5G mobile telecommunications network and Warsaw sewage system*, Proceedings of the International Conference "Applications of Electromagnetics in Modern Engineering and Medicine", June 2019, Janów Podlaski.

- professional organizations that operate in an anti-systemic manner are created in societies, and it is these organizations that protest against masks, 5G, vaccinations, etc. They also serve to spread disinformation.

These concerns resulted in protests against the 5G network that took place in various European countries, including Poland²⁵.

How do Poles perceive 5G technology in comparison with other modern technologies?

The third empirical study was conducted on a representative sample of Poles (1,005 people aged 15 and over). The research focused on Poles' attitudes towards electromagnetic fields and new technologies. As part of it, Poles were asked what an electromagnetic field is, what its source is and in what technologies it is used. As a consequence, questions about 5G technology also emerged.

We decided to check how Poles perceive 5G technology in regards to its impact on human health and life versus other devices, products and phenomena. We learned that 5G transmitters were in fourth place, *ex aequo* with base stations of the cellular network and climate change (54%), and they it was mentioned as having a negative impact on human health and life, right after contamination of drinking water (62%) and smoking (61%) and high voltage lines (59%). Radars (46%) as well as microwaves and mobile phones (49%) are perceived slightly less negatively. Interestingly, we are still afraid of life-saving technologies, such as tomography machines (43%) and ultrasound (38%). Computers (41%) and wearables (34%) are no less worrisome. It seems that a large proportion of Poles are still afraid of modern technologies despite the fact that they use them on a daily basis. According to the Office of Electronic Communications, in 2019, 92.9% of Poles used a mobile phone, while 70.5% used the internet, with most users having mobile internet access on the phone (91.2%)²⁶. What makes

25 *Seria podpaleń masztów 5G w Holandii. Wieże będą dodatkowo chronione*, Polsat News, 5 June 2020, <https://www.polsatnews.pl/wiadomosc/2020-06-05/seria-podpaleń-masztów-5g-w-holandii-wieze-beda-dodatkowo-chronione/> [17.06.2021].

26 Office of Electronic Communications, *Public opinion poll on the functioning of the telecommunications services market and consumer preferences. Report on the study of individual clients*, 29 November 2019, Warsaw–Gdańsk.

it interesting is that over 30% of respondents did not have an opinion on whether the above-mentioned technologies have an impact on human life. This may indicate that society still has little knowledge of how a given technology works.

At the same time, it turned out that over half of Poles (57%) aged 15 and over are not willing to accept infrastructure which emits electromagnetic fields (EMF), while nearly 16% do not accept such infrastructure under any conditions, and 41% generally do not accept it, but could under some exceptional circumstances. 33% of Poles aged 15 and over are willing to accept EMF-emitting infrastructure, but with some limitations. Only 10% accept such infrastructure without any restrictions. In the entire population, the following groups are more often inclined to fully accept mobile telephony infrastructure: men, younger people (aged 25-44), singles, people with a higher level of formal education (at least secondary), people living in the largest Polish cities (over 500,000 inhabitants), white-collar workers, people with a net monthly income of at least PLN 3,000, people with left-wing / strongly left-wing, centre-left, centre-right views and internet users.

As a consequence, we asked Poles what would most convince them to install a mobile telephony antenna in close proximity to their place of residence. Two points were mentioned in response: the level of the EMF caused by this antenna in the place of residence must be checked; and the importance of cellular coverage (36%). These two elements seem to be crucial for the respondents: visual verification of the level of security and usability and the need to use technology, such as the mobile phone. Nevertheless, lack of coverage would not convince as many as 23% of respondents to install the antenna. Similar results were obtained from those with poor internet in the place of residence (33% to 23%, respectively). However, a large group (33%) might be convinced if the investor were to consult the residents on the issue. The respondents had the least trust in the supervision of local self-government and inspections by competent authorities (31%). It is disturbing that there was a very large group of people (over 40% in each of the answers) who failed to point to what could convince them to agree to the installation of the antenna near their place of residence. People with a degree of knowledge about EMF were more accepting of the installation

of a mobile telephony antenna in close proximity to their place of residence. The most difficult group to convince would be people declaring a lack of knowledge of the EMF phenomenon.

At a further stage of the research, we checked how Poles perceive modern technologies. Poles aged 15 and over proved to be characterised by relatively positive assessments of the role of technology and science in the modern world as a whole. Nonetheless, they are definitely less enthusiastic about 5G technology. Slightly less than half (44%) of Poles aged 15 and over can be described as people with an anti-technological orientation, while almost 7% reject modern technologies unconditionally, and slightly more than 37% have an anti-technological attitude, but a bit milder. The same proportion of Poles aged 15 and over show a pro-technology orientation, but with certain limitations (45%). However, only 11% of the respondents are fully pro-technology oriented. The situation is significantly worse in the case of 5G technology. Almost 60% of Poles aged 15 and over can be described as people with an anti-5G orientation, with almost 17% rejecting 5G unconditionally and 42% admittedly showing an anti-5G attitude, but a bit milder. Nearly 8% are fully oriented towards 5G.

In the entire population, those who were more often inclined to a pro-5G orientation are younger people (aged 25-44), singles, people with secondary education, people living in the largest Polish cities (over 500 thousand inhabitants), white-collar workers, professionally inactive people/students, people assessing their own financial situation as at least good, people with a net monthly income of at least PLN 3,000, people with centre-right views and internet users.

4. Discussion and conclusions

● The present and future development of telecommunications technologies using natural and artificial electromagnetic fields depend on two basic factors. The first is the development of technology determined by the level of technological knowledge, the second is the adaptation and the acceptance of technology by the society. A crucial element of the theory of adaptation of each innovation is the stage

of technology rejection²⁷. The reason for rejection may be the perceived potential danger resulting from the use of a given technology. The problem has been encountered by the creators of numerous previously implemented technologies, e.g., the car. Telecommunications companies implementing the 5G network are struggling with it as well.

Research on the social reception of the 5G network in Poland has found that Poles are not fully certain as to what the 5G technology is. This ignorance results from several factors: poorly conducted technological education (in a theoretical way, not related in a practical way to real life), both for children in schools and for adult social education. An additional problem is that citizens accuse the state authorities of providing insufficient information to the public on this topic (although this information does exist – for example, the White Paper) and, moreover, consider it an unreliable source of information. This is certainly influenced by the high-profile scandals related to state cybersecurity, such as Dworczyk-gate²⁸. Poles would like to learn about new technologies from scientists, but the hermetic, difficult language used by researchers is considered problematic. Their message is incomprehensible to ordinary people, and as a result scientists are considered arrogant and unintelligent²⁹. This causes Poles to search for information on the web, often hitting fake news sites based on causing fear and driving negative emotions regarding the impact of 5G on human health and life. Disinformation aimed at delaying the deployment of this technology in Europe – also related to the war over 5G technology between the United States and China – additionally affects the exceptionally negative perception of 5G technology in Polish society. What is worse, according to the research, Poles are not in the habit of verifying the truthfulness of information, nor are they able to do it, and they frequently spread fake news without reflection. Here, once more the problem of the lack of proper education in society comes into play.

27 *Dyfuzja innowacji*, Encyklopedia Zarządzania, https://mfiles.pl/pl/index.php/Dyfuzja_innowacji [15.06.2022].

28 *Prime minister's office chief Michał Dworczyk steps down*, TVN24, <https://tvn24.pl/tvn24-news-english/polands-pm-office-chief-michal-dworczyk-steps-down-6140311> [30.09.2022].

29 *European citizens' knowledge and attitudes towards science and technology*, European Commission, September 2021.

Organized disinformation, the lack of proper education and an open discussion about 5G in Poland would appear to be the main reasons for protests against 5G technology. Reference is made to the presence of professional disinformation organizations that operate in an anti-systemic way and which are responsible for protests against masks or vaccinations as well as 5G.

Generally, Poles express positive opinions on how science and technology can create more opportunities for the development of society, make our lives easier and more comfortable and make the world a better place. Nevertheless, at the same time, they are not enthusiastic about 5G technology (nearly 60% of Poles can be described as people with an anti-5G orientation). Furthermore, the research shows that, as in other important but socially controversial investments (such as incineration or sewage treatment plants), the NIMBY effect (Not In My Back Yard) is prevalent in Polish society. Poles recognise the need for the country's technological development but would prefer the infrastructure necessary for its construction to be located as far away from their place of residence as possible. There are two factors that could influence a change of this attitude – the first is a sense of security; the second is usability – the ability to use a mobile phone.

It is disturbing that there is a very large group of people (over 40%) who failed to point to what could convince them to agree to installing the antenna near their place of residence. And this group should be the primary focus of educational activities related to modern technologies.

And although, as shown by the research carried out by the Institute for Comparative Survey Research in Vienna as part of the World Values Survey³⁰, Poles are characterised by a relatively high level of trust in technology and the impact of technology on socio-economic development, social concerns about the impact of 5G technology on health and people's lives in Poland are immensely high, while the acceptance for the implementation of this technology is low. As reflected in the research presented here, what is extremely crucial is access to knowledge about the impact of each technology on the environment and the ability to interpret data and information, since they are the ba-

30 WVS, World Values Survey, <http://www.worldvaluessurvey.org/wvs.jsp> [22.06.2022].

sis for shaping our awareness of new phenomena. It is the awareness and attitude of technology users that determine the scale and scope of the future use of technology. In order to prevent similar situations related to the development of technology in the future, it is essential to build long-term social awareness in terms of the perception of the positive and negative effects of each new technology. Social education on disinformation is also of extreme importance. It is worth continuing work on these issues, taking into account the interdisciplinary nature of this subject.

Research on the social acceptance of modern technologies should be conducted annually, e.g., it should be possible to verify whether systemic educational activities yield the expected social results. Of great value would also be the possibility to compare similar research undertaken in other countries, to derive good practices and prepare appropriate recommendations for institutions involved in the implementation of 5G networks in the European Union³¹.

31 U. Soler, *UE Regulations on 5G cybersecurity*, Proceedings of the 38th International Business Information Management Association Conference (IBIMA), 23-24 November 2021, Seville, Spain. Vision: Innovation Management and Sustainable Economic Development in the Era of Global Pandemic, International Business Information Management Association (IBIMA), pp. 2502-2508.

References

- 5G Mobile and Wireless Communications Technology*, A. Osseiran, J.F. Monserrat, P. Marsch (eds.), Cambridge University Press, 2016.
- 5G: The chance to lead for a decade*, Deloitte, 2018, <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5g-deployment-imperative.pdf>.
- AlRaeesi A.S.A., Habibur R. M., *Proactive Approach to the Deployment of 5G Technology: Insights from the UAE*, 2nd Europe – Middle East – North African Regional Conference of the International Telecommunications Society (ITS) “Leveraging Technologies For Growth”, Aswan, Egypt, 18-21 February 2019, International Telecommunications Society (ITS), Calgary.
- Asif S., *5G Mobile Communications: Concepts and Technologies*, Taylor and Francis Group, 2019.
- Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)*, Official Journal of the European Communities, 30 July 1999, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999H0519&from=EN>.
- Dahlman E., Parkvall S., Skold J., *5G NR: The next generation wireless access technology*, Academic Press, 2020.
- David K., Berndt H., *6G Vision and Requirements: Is There Any Need for Beyond 5G?*, “IEEE Vehicular Technology Magazine” 2018, vol. 13, no. 3.
- Destiny T., *Conspiracy theories about 5G networks have skyrocketed since COVID-19*, The Conversation, 2 June 2020, <https://theconversation.com/conspiracy-theories-about-5g-networks-have-skyrocketed-since-covid-19-139374>.
- Dyfuzja innowacji*, Encyklopedia Zarządzania, https://mfiles.pl/pl/index.php/Dyfuzja_innowacji.
- Effect of electromagnetic millimeter waves on the health of employees in the in the designed 5G networks and the general population*, K. Rydzyński (ed.), Łódź 2020.
- Eliassen I., Pena P., *Real 5G issues overshadowed by Covid-19 conspiracy theories*, Investigate Europe, 12 June 2020, <https://www.investigate-europe.eu/en/2020/5g-covid-conspiracy/>.
- Eltiti S. et al., *Aggregated data from two double-blind base station provocation studies comparing individuals with idiopathic environmental intolerance with attribution to electromagnetic fields and controls*, “Bioelectromagnetics” 2015, vol. 36, no. 2.
- European citizens' knowledge and attitudes towards science and technology*, European Commission, September 2021.
- Fettweis G., Alamouti S., *5G: Personal mobile internet beyond what cellular did to telephony*, “IEEE Communications Magazine” 2014, no. 52(2).

- Group of Chief Scientific Advisors, https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors_en.
- International Agency for Research on Cancer Publications, <https://publications.iarc.fr/126>.
- International Commission on Non-ionizing Radiation Protection, *ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)*, "Health Physics" 1998, no. 74(4), pp. 494-522, <https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf>.
- International Commission on Non-ionizing Radiation Protection, *ICNIRP Guidelines for limiting exposure to electromagnetic fields (100 KHZ to 300 GHz)*, "Health Physics" 2020, no. 118(5), pp. 483-524; <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf>.
- Karaboytcheva M., *Effects of 5G wireless communication on human health*, European Parliamentary Research Service 2021, [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646172/EPRS_BRI\(2020\)646172_PL.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646172/EPRS_BRI(2020)646172_PL.pdf).
- Khan R. et al., *A Survey on Security and Privacy of 5G Technologies: Potential Solutions, Recent Advancements, and Future Directions*, "IEEE Communications Surveys & Tutorials" 2020, vol. 22, no. 1.
- Kim M.J. et al., *The changing patterns of China's international standardization in ICT under techno-nationalism: A reflection through 5G standardization*, "International Journal of Information Management" 2020, vol. 54, <https://doi.org/10.1016/j.ijinfomgt.2020.102145>.
- Kowalski B., *Central and Eastern Europe, China's Core Interests, and the Limits of Relational Politics: Lessons from the Czech Republic in the 2010s*, "East European Politics and Societies: and Cultures" 2020, vol. 36, no. 1, pp. 51-74.
- La L., *5G myths, debunked: 5G won't replace 4G, doesn't cause COVID-19 and is still rolling out*, cnet.com, 1 June 2020, <https://www.cnet.com/tech/mobile/5g-myths-debunked-5g-wont-replace-4g-doesnt-cause-covid-19-and-is-still-rolling-out-during-the-pandemic/>.
- Lemstra W., Cave M., Bourreau M., *The Towards the successful deployment of 5G in Europe: What are the necessary policy and regulatory conditions?*, project report, Centre on Regulation in Europe (CERRE), 2017, <https://cerre.eu/publications/towards-successful-deployment-5g-europe-what-are-necessary-policy-and-regulatory/>.
- Meese J., Frith J., Wilken R., *COVID-19, 5G conspiracies and infrastructural futures*, "Media International Australia" 2020, vol. 177(1).
- Mythbusters*, World Health Organization, 19 January 2022, <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/myth-busters>.
- Office of Electronic Communications, *Public opinion poll on the functioning of the telecommunications services market and consumer preferences*.

- Report on the study of individual clients*, 29 November 2019, Warsaw–Gdańsk.
- Oughton E.J. et al., *Towards 5G: Scenario-based assessment of the future supply and demand for mobile telecommunications infrastructure*, “Technological Forecasting and Social Change” 2018, vol. 133, pp. 141-155.
- Oughton E.J. et al., *Assessing the capacity, coverage and cost of 5G infrastructure strategies: Analysis of the Netherlands*, “Telematics and Informatics” 2019, vol. 37, pp. 50-69.
- Pandey M.K., Gaurav A., Kumar V., *Social, technical and economical challenges of 5G technology in Indian prospective: Still 4G auction not over, but time to think about 5G in India*, International Conference on Computer and Computational Sciences (ICCCS), Noida 2015.
- Rao B., Harrison A.J., Mulloth B., *Defense Technological Innovation. Issues and Challenges in an Era of Converging Technologies*, New Horizons in Innovation Management series, Edward Elgar Publishing Ltd, Cheltenham 2020.
- Fundamentals of 5G Mobile Networks*, J. Rodriguez (ed.), Wiley, 2015.
- Saxena S., *Enhancing ICT infrastructure in public services, Factors influencing mobile government (m-government) adoption in India*, “The Bottom Line” 2017, vol. 30, no. 4, pp. 279-296.
- Scientific Committee on Health, *Environmental and Emerging Risks (SCHEER)*, https://ec.europa.eu/health/scientific_committees/scheer_en.
- Seria podpaleń masztów 5G w Holandii. Wieże będą dodatkowo chronione*, Polsat News, 5 June 2020, <https://www.polsatnews.pl/wiadomosc/2020-06-05/seria-podpalen-masztow-5g-w-holandii-wieze-beda-dodatkowo-chronione/>.
- Segal A., *Year in Review 2019: The U.S.–China Tech Cold War Deepens and Expands*, Council on Foreign Relations, 18 December 2019, <https://www.cfr.org/blog/year-review-2019-us-china-tech-cold-war-deepens-and-expands>.
- Shaping Europe's digital future*, <https://ec.europa.eu/digital-single-market/en/news/european-electronic-communications-code-updating-eu-telecom-rules>.
- Sobiczewska E., Szmigielski S., *Electromagnetic fields hypersensitivity*, “Occupational Medicine” 2009, no. 60(3).
- Soler U., Busiño M., *Education of society as a tool to counteract disinformation in implementing new technologies. On the example of 5G mobile telecommunications network and Warsaw sewage system*, Proceedings of the International Conference “Applications of Electromagnetics in Modern Engineering and Medicine” June 2019, Janów Podlaski.
- Soler U., Busiño M., *Taming with technology. On the example of UK electrification and 5G technology*, “Przegląd Elektrotechniczny” 2019, vol. 95, no. 12.
- Soler U., *UE Regulations on 5G cybersecurity*, Proceedings of the 38th International Business Information Management Association Conference (IBIMA), 23-24 November 2021, Seville, Spain. Vision: Innovation Management and Sustainable Economic Development in the Era of Global

- Pandemic, International Business Information Management Association (IBIMA).
- Soler U., *Political and Economic Contexts of Implementing 5G in Poland and in Selected European Countries*, "Journal of Telecommunications and Information Technology" 2021, no. 2.
- Spectrum for 4G and 5G*, Qualcomm, 2020, <https://www.qualcomm.com/media/documents/files/spectrum-for-4g-and-5g.pdf>.
- Tatoń G. et al., *The influence of electromagnetic fields on the human health – survey studies*, "Przegląd Elektrotechniczny" 2019, vol. 95, no. 12.
- Prime minister's office chief Michał Dworczyk steps down*, TVN24, <https://tvn24.pl/tvn24-news-in-english/polands-pm-office-chief-michal-dworczyk-steps-down-6140311> [30.09.2022].
- Verrender A. et al., *IEI-EMF provocation case studies: A novel approach to testing sensitive individuals*, "Bioelectromagnetics" 2018, vol. 39, no. 2.
- Weerakkody V., Dhilon G., *Moving from E-Government to T-Government: a study of process reengineering challenges in a UK local authority context*, "International Journal of Electronic Government Research" 2008, vol. 4, no. 4.
- WVS, World Values Survey, <http://www.worldvaluessurvey.org/wvs.jsp>.