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Contents

Original Articles

- *Artificial Intelligence in Social Science: A Study Based on Bibliometrics Analysis* pp. 149–162
Juan-Jose Prieto-Gutierrez, Francisco Segado-Boj,
Fabiana Da Silva França
- *Information Literacy, Data Literacy, Privacy Literacy, and ChatGPT: Technology Literacies Align with Perspectives on Emerging Technology Adoption within Communities* pp. 163–177
Brady D. Lund, Daniel A. Agbaji, Zoë A. Teel
- *Do it Users Behave Responsibly in Terms of Cybercrime Protection?* pp. 178–206
Hanna Yarovenko, Serhiy Lyeonov,
Zoltán Szira, Krzysztof Andrzej Wojcieszek
- *It Software Purchase Decisions in Terms of Business Customer Experience* pp. 207–219
Anna Szwajlik
- *Credibility of Social Media Influencers: Impact on Purchase Intention* pp. 220–237
Maria Francisca Coutinho, Álvaro L. Dias, Leandro F. Pereira
- *Payment Implants as an Element of Human Enhancement Technology* pp. 238–261
Łukasz Sułkowski, Dominika Kaczorowska-Spychalska
- *Factors Influencing Acceptance of Indonesian Contact Tracing APP: Development of the Technology Acceptance Model* pp. 262–282
Rifki Nur Priyansyah, Ikhsan Fuady, Benazir Bona Pratamawaty
- *Sexting, Fear of Missing Out (FOMO), and Problematic Social Network Use Among Adolescents* pp. 283–301
Rene Szotkowski, Łukasz Tomczyk

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ARTIFICIAL INTELLIGENCE IN SOCIAL SCIENCE: A STUDY BASED ON BIBLIOMETRICS ANALYSIS

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Abstract: *Artificial intelligence (AI) is gradually changing the planet. Data digitisation, computing infrastructure and machine learning are helping AI tools to spread across all sectors of society. This article presents the results of a bibliometric analysis of AI-related publications in the social sciences over the last ten years (2013-2022). Most of the historical publications are taken into consideration with the aim of identifying research relevance and trends in this field. The results indicate that more than 19,408 articles have been published, 85% from 2008 to 2022, showing that research in this field is increasing significantly year on year. Clear domains or disciplines of research related to AI within the social sciences can be grouped into sub-areas such as law and legal reasoning, education, economics, and ethics. The United States is the country that publishes the most (20%), followed by China (13%). The influence of AI on society is inevitable and the advances can generate great opportunities for innovation and new jobs, but in the medium term it is necessary to adequately face this transition, setting regulations and reviewing the challenges of ethics and responsibility.*

Keywords: *artificial intelligence, bibliometric analysis, social science, machine learning, Scopus.*



INTRODUCTION

Today, artificial intelligence could be identified as a field of science and engineering concerned with the computational understanding of what is commonly referred to as intelligent behavior, and the creation of artefacts that exhibit such behavior (Shapiro, 1992).

The origins of artificial intelligence date back to the mid-19th century, and it has been a subject of constant reflection up to the present day ever since Ada Lovelace published the first algorithm for a machine in 1843 (Aiello, 2016) thanks to which she can be considered the first programmer, and, years later, Charles Babbage designed his Analytical Engine (Babbage, 1973).

Many writings by Homer, René Descartes, Ramon Llull or Jules Verne used robots, mechanical beings and animals or artificial creations and have served as inspiration for many researchers interested in artificial intelligence.

In 1950, Alan Turing laid the foundations of computer science and automatic decoding, motivating the development of artificial intelligence through his advances and positing the Turing machines or the Turing test as simple abstract computational devices designed to help investigate the scope and limitations of what can be computed (Turing, 1950). Thus, it was confirmed that the computer was the most promising means to implement a great dream: to create intelligence made by man but not reproduced through the propagation of the species (Buchanan, 2005) and innovations began to appear in different areas of engineering, mainly in the military.

Years later, during World War II, Professor Aiken built the first mechanical digital machines at Harvard, with the help of IBM (Cohen, 2000). They gave rise to the first large-scale, automatically sequenced, general-purpose, functional digital computer produced in the United States (Aiken, 1964), which made decisions that until then could only be made by humans. They were used in the early 1960s by large companies such as General Motors (Robot Surg, 2007). A few years later, Stanford University marked a new era by presenting the first robot, named Shakey, capable of analysing instructions (Nilsson, 1984).

Around this time, the term "artificial intelligence" appeared for the first time in connection with a project of several American institutions. The study proceeded on the basis of the conjecture that every aspect of intelligence learning can, in principle, be described so precisely that a machine can be created to simulate it. Since then, the term has stuck around (McCorduck, et al., 1977).

Most of the 1970s is known as the "AI winter", meaning that, after a period of reduced funding and interest, fewer significant developments have originated (Floridi, 2020). Although other "winters" also occurred in later decades (Hendler, J. (2008). It was not until the 2000s that fundamental advances in AI took place.

With the year 2000, many of the existing limitations were overcome, giving way to a spring where AI systems began to analyze complex algorithms and self-learning became widespread (Havenstein, 2005). For example, in 2007, IBM created an open domain question and answer system, called Watson, which competed with human participants and won first place on the TV show Jeopardy! in 2011 (Kaul, et al. 2020). This technology, called DeepQA, used language processing and various searches to analyze data on unstructured content to generate probable answers (Ferrucci, et al, 2013). There is no doubt that the development of mobile Internet brought more artificial intelligence application scenarios (Zhang & Chen, 2020). Today,

thousands of AI applications are deeply embedded in the infrastructure of all industries and sectors: automotive industry with mainly driverless cars (Tubaro & Casilli, 2019); financial markets with machine learning or bigdata (Duan, et al., 2019); smart payment systems through facial and voice recognitions (Dijmărescu, et al., 2022); health through healthcare, pharmaceuticals or disease detection (Ravi, et al., 2017); smart homes, through home automation and sensing systems (Kassens-Noor, et al, 2021); in the teaching and learning environment with ChatGPT (Baidoo-Anu & Owusu Ansah, 2023), etc.

When it comes to knowing what has been published throughout the history of artificial intelligence in the area of bibliometrics, we have a very detailed perspective by speciality and under-represented by the main disciplines (STEM, Life Sciences, Social Sciences and A&H). Bibliometrics, used as an evaluation criterion (Álvarez-Betancourt and García-Silvante, 2014) to generate really useful quantitative and statistical analyses (Pritchard, 1969), uses various methods to estimate scientific production, the analysis of journals, their authors, the activity of countries, institutions and even collaboration between them.

Currently, analyses related to IA in the field of health and medicine stand out, where (Guo, et al., 2020) show a growth in research articles of 45.15 % between 2014 and 2019. In a broader study from 1977 to 2018, it is exposed that the number of publications related to cancer was the highest, followed by heart disease and stroke (Tran, et al., 2019). To a lesser extent, AI research has been published in the areas of engineering (Shukla, et al, 2019), e-commerce (Bawack, et al, 2022), education (Song & Wang, 2020), university management (Prieto-Gutierrez, 2023), maritime (Munim, et al, 2020), agri-food chains (Monteiro, & Barata, 2021) and finance (Goodell, et al., 2021).

Of the scarce global research, we found one, not current, where through the Science Citation Index database it is concluded that scientific production increases widely from the 1990s, that computer science and engineering were the most active subjects in AI and the United States was the country that published the most on the subject (Niu, et al, 2016).

Against this background, this study aims to provide a holistic view of AI research in the social science discipline over the last ten years by assessing the conceptual development, composition, intellectual structure and dynamics of the research field (Zupic, & Čater, 2015). There is no doubt that this analysis is an essential resource for those who are fascinated by AI.

MATERIALS AND METHODS

For the bibliometric analysis, the core collection of the Scopus database (Elsevier, 2018) is used to search for all existing AI publications. This database was chosen over others such as Web of Science because it is one of the largest multidisciplinary databases of academic literature, has greater coverage and provides advanced search capabilities.

After preparing the query, the search was carried out on 25th May using the criteria TITLE, KEYWORD and ABSTRACT as shown in the query. Using Boolean logical operators, the following search was conducted. Search query text:

TITLE-ABS-KEY ("artificial intelligence") AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013))

A total of 19,408 scientific documents obtained were used in the pre-established bibliometric analysis. In order to obtain the largest number of articles in a specific period, the articles were limited to the last ten years (the year 2023 was excluded as it was incomplete) and no document types, languages or media types were excluded.

Therefore, the bibliometric study includes grey literature, conference proceedings, or books/book chapters. Articles written in any language other than English are included.

The data exported for the analysis focus on publication characteristics, content or contribution to the research topic, where activity indicators such as year of publication, number of documents, journals, countries, authors, universities, and other indicators of impact on scientific productivity such as the H-index in journals are considered. As it handles bibliographic information from thousands of documents, the download has been limited to several blocks of 2,000 documents, in order to carry out a bibliometric mapping focused on keywords and relationships between authors. The structural analysis of the networks and their representation was carried out using the specific software, Pajek (Batagelj, & Mrvar, 1998).

The data were prepared for analysis using information in Microsoft Excel where, through a statistical analysis of the metadata identified, the annual growth trajectory is sought.

RESULTS

Table 1 show the initial research results retrieve 19,408 publications from the Scopus database related to IA research in Social Sciences discipline. As shown in figure 1 they were divided into 11 document types for the period 2013-2022. Articles represent 49.68% with 9,642, followed by Conference Papers with 33.24%, both types of documents account for around than 83% of the total number of publications.

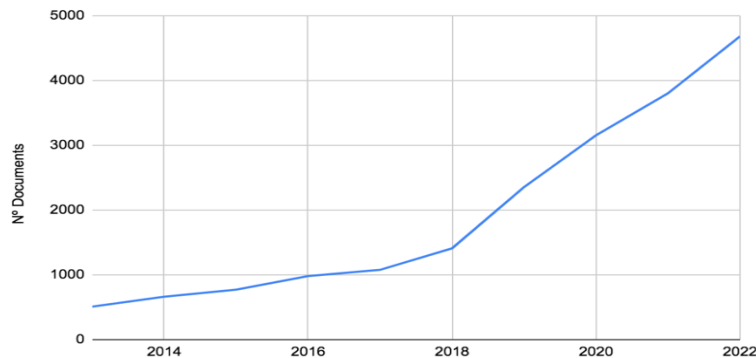
Table 1. Number and types of documents in artificial intelligence publications.

Document type	Number of results
Article	9.642
Conference Paper	6.453
Book Chapter	1.653
Review	840
Book	332
Editorial	174
Note	111
Conference Review	100
Erratum	41
Data Paper	23
Letter	19

Annual Production of Published Papers

The scientific production obtained in the period of this research is presented by year in Figure 1. Two periods of development of AI research in the Social Sciences could be identified in terms of the number of articles published, according to the behavior of the curve.

The first period, from 2013 to 2018, shows the low introduction of AI, with a very low academic output (before this period it would be considered residual). The second period, from 2018 to 2022, shows an exponential explosion in output, with a growth from 1,000 papers per year to around 5,000 in 2022. Arguably, 85% of publications are produced from 2008 to the present, and the rate of growth is expected to continue.

**Figure 1.** Annual publications on Scopus core database.

Contribution by Country or Region

Authors from 150 different countries participated in the publication of the retrieved documents (644 documents with undefined country stand out). The top 10 active countries (see Table 2) participated in the publication of 13,833 documents (representing 70.91% of the total number of publications). The United States ranked first (3,625 documents with 19.58%) in terms of the number of publications. China is a close second (2,589 documents with 13.27%). The following positions are gradually declining in terms of presence.

Table 2. Top 10 Contribution by country or region 2013–2022.

	Country	No. of contributions
1	United States	3,625
2	China	2,589
3	United Kingdom	1,616
4	India	1,187
5	Germany	1,025
6	Italy	945
7	Australia	815
8	Spain	800
9	Canada	661
10	Russia	570

Figure 2 shows the results of network analysis on the international collaborations between the high productive countries in AI in SSCS, from which we can see that the most internationally collaborative country is the United States, followed by China and United Kingdom, which are all developed countries. Some developing countries (such as India and Iran) present international collaboration, even with a very high academic production, as is the case of India.

In order to analyze the relationships of the different countries to publish on artificial intelligence in the area of Social Sciences, figure 2 illustrating a graph is shown.

For the elaboration of a network of co-authorships as adequate as possible, given the large number of countries that have published (150), a minimum threshold of 5 frequencies or publications has been set to appear in the maps. Approximately 30% would not meet this condition.

The analysis in Figure 2 shows 4 clusters according to the colours of the nodes. Two of them (yellow and green) are the most active and prominent. The cluster led by the United States exercises control over the rest of the countries, both in the number of publications and in the number of relations or contacts it maintains. It maintains strong links with countries on all continents, from Europe to Asia and the East. The relationship with China stands out, being very intense and the most numerous between two countries, which indicated by the thickest edge in the network, greater than that between the United States and the United Kingdom. China is placed with a yellow node because it is closely linked to the United States and because it has not created a unique and exclusive network. China's relations with neighboring countries such as Hong Kong, Singapore, India and Taiwan stand out.

The second most prevalent cluster is green and is led by United Kingdom, both in terms of number of publications (1,616) and relationships (10). Its largest and best link is the United States with 165 shared documents.

On the opposite side, and in an isolated and even withdrawn way, are the blue and red clusters, formed by the relationship of two countries (Portugal-Brazil and Saudi Arabia-India, respectively). The first two countries have no contact with the rest of the network. India, on the other hand, is this cluster's link to the East (China) and the West (the United States and the United Kingdom).

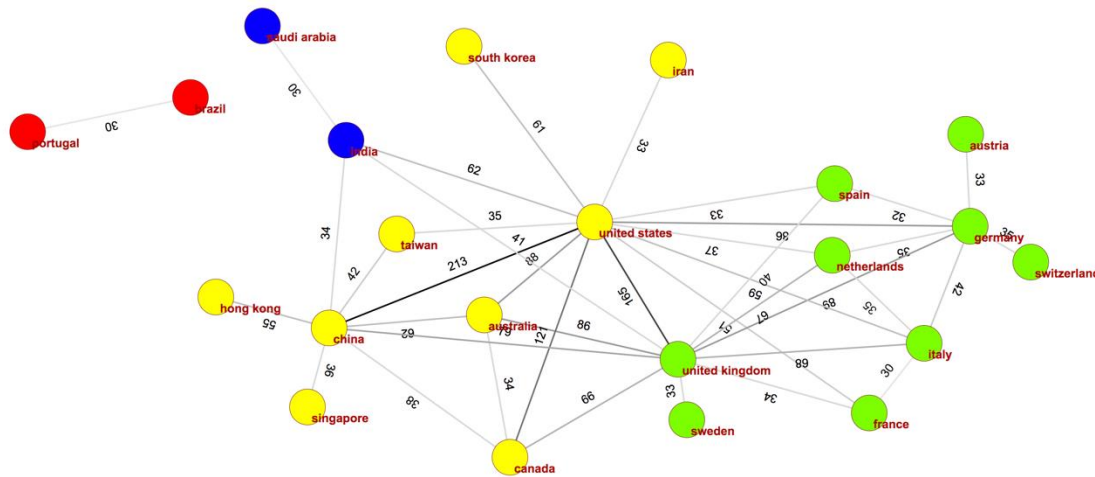


Figure 2. Network analysis of the international collaboration among the high productive countries.

Co-occurrence Analysis of Keywords

In order to understand the knowledge components and knowledge structure of publications on artificial intelligence in the social sciences, the co-occurrence network of keywords is analysed by examining the links between keywords. It was decided to remove the term "Artificial Intelligence" because as the common term, it would be the huge centre of the network and would not allow to appreciate the relationships between terms.

Figure 3 illustrates this section with a network graph of keyword co-occurrences using the Pajek social network analysis tool. Authors select more than one keyword to define and guide the direction of their publication and are therefore essential indicators to analyse the lines and utilities of artificial intelligence in the area of Social Sciences.

Keywords are essential indicators that authors carefully select to define and represent the direction of their research article, encapsulating the basic theory, practical information and relevance of the article.

The network diagram not only shows the characteristics of a single concept related to artificial intelligence, but also describes the complex conceptual relationship between other concepts. Comparing keywords between AI-related concepts can also help to reveal their common associations and unique characteristics (related results are shown in Figure 3).

The most numerous nodes (keywords) are given in different colours. The links between the nodes are the co-occurrences of those two words. The number between the two is the weight

Leading Authors and Network of Co-authorships

Table 3 shows the 10 most prolific IA authors in the Social Sciences from 8 different countries: United Kingdom is the country contributing the most authors to the ranking. The remaining countries have only one representative.

The author with the most published articles, in the given period, is Gwojen Hwang, from the National Taiwan University of Science and Technology with 22 publications. Hwang started publishing on AI in 2020 in a remarkable way. The second author is the British Trevor Bench-Capon, from the Department of Computer Science at the University of Liverpool, who started publishing on IA in 1987.

Table 3. Top 10 contributors and their productivity for 2013–2022.

	Authorship pattern	Affiliation country	No. of contributions
1	Hwang, G.J.	Taiwan	22
2	Bench-Capon, T.	United Kingdom	20
3	Dadios, E.P.	Philippines	19
4	Hassanien, A.E.	Egypt	18
5	Prakken, H.	Netherlands	18
6	Walton, D.	United Kingdom	17
7	Dale, R.	USA	16
8	Governatori, G.	Australia	16
9	Atkinson, K.	United Kingdom	14
10	Bizon, N.	Rumania	14

Within the analysis of research, it is necessary to understand scientific collaboration in order to discover the interaction between two or more scientists. In this case, co-authorship of a paper is an official statement of the participation of two or more authors.

In order to develop a network of co-authorships as appropriate as possible, given the large number of authors (41,860), a minimum threshold of 5 frequencies or publications has been set to appear in the maps.

Figure represents the visualization of the collaboration network of authors. The nodes, shown in colour, represent authors who are connected to each other.

Each node represents an author who published at least five papers in the selected period on artificial intelligence. Each line connects two authors and indicates the presence of at least one co-authored publication. The numbers associated with the lines show the activity between the two.

Figure 4 shows the network of authors publishing on artificial intelligence in the area of Social Sciences and includes 40 authors with more than 5 papers published during the period 2013-2022 and contains 19 relationships or components, 17 of which are outstanding co-authorships with between 6 and 9 collaborations each.

The visualization of collaborative networks in Figure 4 shows a very weak network of authors from different institutions in the field of macro-level research.

Even so, and according to the Scopus database, the most visible networks are the component formed by Atkinson K. and Bench-Capo (integrated to the University of Liverpool and experts in legislation) followed by the component Darwish A. and Hassanien A.E. integrated into the

University of Helwan and Cairo, respectively, and experts in ethical aspects, impacts of climate change, etc. of AI) having collaborated bilaterally 13 and 10 times respectively and would have the highest degree of centrality and the highest strength of collaboration with other authors. The largest network consists of the Greeks, of Patras University, Perikos, Grivokostopoulou and Hatzilygeroudis with no more than 6 publications among the group (seeking advances in the area of learning and education through the use of artificial intelligence).

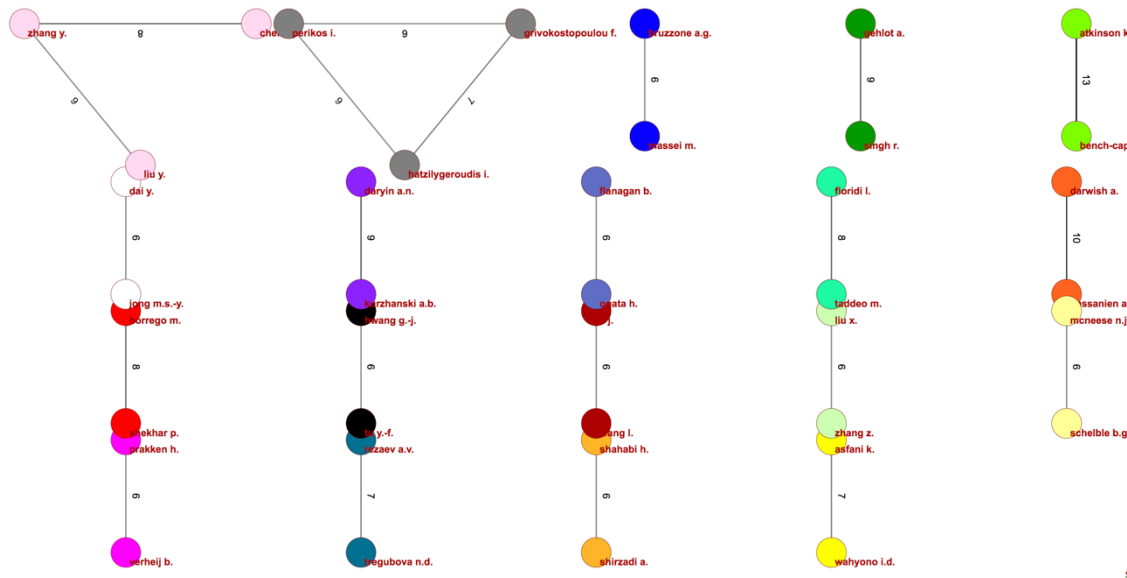


Figure 4. Authors cooperation network in Artificial Intelligence.

CONCLUSIONS

Research in artificial intelligence in recent years has grown extensively, reaching everywhere and being used in our daily lives, in our jobs, in our leisure plans and in our homes, generating that many areas of activity can be transformed.

Given the tendency towards the dispersion or branches of application of artificial intelligence at present, this article has focused on the domain or discipline of social sciences. The social sciences are those that study the social and cultural aspects of human behaviour, which is why advances or transformations, as is the case with artificial intelligence, can lead to economic growth, build theories, generate changes in education, sociology, the application of laws and policies, etc. In short, it could improve the quality of life of many people and help to overcome global challenges, but as has been seen in an acceptable number of publications, aspects such as privacy or data protection can guarantee the ethical use of artificial intelligence.

Using the Scopus database, a search of titles, abstracts and keywords retrieved over 19,408 papers published in the last 10 years (2013-2022) focused on the Social Sciences, showing that artificial intelligence is a topic with a broad perspective global.

As has been seen in the analysis, IA has been a very active research field over the last 10 years, with 85% of all disclosures published in the last 5 years thanks to an exponential increase in publications. This fact demonstrates the gradual interest in AI in all fields and domains of Social Sciences in pursuit of the need to improve life development through continuous machine learning.

Pajek proves to be an effective tool for observing maps of relationships between authors, keywords and countries, revealing emerging trends in AI research, the intensity of keyword usage and visualizing the evolution of terms.

In terms of activity by country, China and the United States stand out for their dynamism and presence, both accounting for around 35% of the publications.

The United States, both in terms of volume and in terms of collaboration and contact, is the main focus of the publications network. It maintains relations with a large number of countries, either directly or indirectly, with collaboration with China standing out in an outstanding way.

The study of the network of collaboration between authors leads to the conclusion of the existence of small, well-defined, stable and secure groups over time. Two groups of three researchers stand out, with six or more publications together, whose origin is from Greece (in its totality) and the other trio is from China and Australia. The rest of the relationships are peer-to-peer and most of them are generated in their own institutions.

This shows that the most active groups are created and developed in their own organizations. Although, as mentioned above, there are dynamic collaborations between countries, these are still very scarce in terms of volume of activity.

The most active collaborative networks, Figure 4, focus on several fields. For example, the area related to legislation, due to the rapid advances and evolution of artificial intelligence, has generated research and subsequent publications in this field on the regulatory aspects and legal bases applicable to this new technology. In general, the research promotes innovation, ensures security and protects human rights.

Another active collaborative network, of researchers from Egypt, focuses on the impacts that IA can have on human activity. For example, in the recent covid-19 health crisis, they demonstrated the monitoring, surveillance, safety and recovery from disease using IA techniques, improving people's quality of life. Another topic of vital importance to society has focused on improving farming systems, water management, flood forecasting and climate change prediction through the power of data and artificial intelligence. They have even dared to forecast the GDP (Gross Domestic Product) of certain oil-exporting OPEC (Organisation of Petroleum Exporting Countries) members.

But the most active group, of Greek origin, has specialised in the area of teaching and learning by promoting innovative techniques. The field of education probably presents one of society's greatest challenges and, for this reason, research groups are active. In this case, the advances come from truly reforming experiences such as automatic learning; intelligent tutoring systems; the activation of virtual reality platforms to learn aspects of entrepreneurship; language learning; techniques that detect the state and behaviour of students through human-computer interaction; etc. In short, technological innovation in education, in terms of artificial intelligence, seeks to improve the quality of teaching processes in the institutions of each of the students by helping to fully personalise learning.

As shared in Figure 3, the largest percentage of publications deal with machine learning, covid and big data, but to a lesser extent, some research examines far-reaching aspects of the consequences and good use of artificial intelligence. Ethics is crucial because of its influence on automated decision-making that can affect individuals, organisations and society as a whole. On a planet, in which artificial intelligence is predicted to be booming, transparency is a decisive pillar of technological complexity and ethical implications. Against this backdrop of ethical dilemmas, standards and regulations from around the world are emerging to provide guidance and direction on ethical implementation.

With all the above, it can be confirmed that, the results confirm evident trends of growth in artificial intelligence studies and increases towards new challenges in a variety of research fields.

Even so, it would be appropriate to address the limitations of this bibliometric study. First, a limitation in the bibliometric analysis has been detected because, although Scopus is the most extensive database, it is possible that some important articles may have been missed as they are available in other databases, such as WoS or PubMed. It may even provide a varied understanding of other authors or contributors in the field under investigation and, in addition, may provide a new understanding of the main contributors in the field and reorganize the rankings among keywords, most influential researchers, and countries or regions. However, this research aims to reveal trends, not to offer a fixed formula or a ready-made recipe, and it fully complies.

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INFORMATION LITERACY, DATA LITERACY, PRIVACY LITERACY, AND CHATGPT: TECHNOLOGY LITERACIES ALIGN WITH PERSPECTIVES ON EMERGING TECHNOLOGY ADOPTION WITHIN COMMUNITIES

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Abstract: *This research delves into the interplay between three pivotal literacies in the digital age—information literacy, data literacy, and privacy literacy—and the receptivity towards the adoption of emerging technology within communities, with a specific focus on the chatbot ChatGPT. Data was gathered through online surveys conducted among adults residing in a four-county region in northern Texas during a two-week period in late 2022, yielding 130 valid responses. The results of regression analysis indicate a positive association between the inclination to utilize ChatGPT for enhancing one's community and proficiency in information literacy and privacy literacy. However, an unexpected observation emerges as data literacy skills do not exhibit a significant relationship with this inclination, despite ChatGPT's standing as a data science innovation. Moreover, age, gender, educational attainment, and internet usage patterns are identified as influential factors in these associations. These findings hold substantial importance in comprehending the intricate dynamics of how diverse literacies and individual and community-related variables mutually shape each other's development.*

Keywords: *Information Literacy, Data Literacy, Privacy Literacy, ChatGPT, Technology Adoption*



INTRODUCTION

The role of both virtual and physical communities is pivotal in individuals' lives. Understanding how beliefs about community adoption of emerging technology relate to an individual's information, data, and privacy literacy is crucial for fostering a communal information society that supports the development of these literacy skills. While research on information literacy, data literacy, and privacy literacy as distinct constructs is abundant, the connections between these literacies remain largely unexplored. Gaining insight into these relationships and the impact of different literacy skills on the community's adoption of emerging technology can help identify and assist individuals with potential literacy gaps.

Information literacy involves a set of skills that empower individuals to efficiently locate and evaluate a variety of information sources, such as books, articles, websites, and databases. It also entails the ability to assess the credibility and reliability of information. The Association for College and Research Libraries (2022) offers an extensive definition of information literacy, emphasizing its multifaceted nature. This includes the skills needed for reflective discovery, comprehension, and appreciation of information's creation and significance, as well as its ethical use within learning communities.

In our information-rich era, where information is abundant, the capacity to distinguish credible and reliable sources is crucial. Jones-Jang et al. (2019) conducted a study showing that individuals with higher information literacy skills are better at identifying false news. This underscores that existing studies on information literacy largely focus on the identification, retrieval, evaluation, and utilization of information. It also highlights the role of information literacy in recognizing and combating misinformation.

Pennycook et al. (2021) conducted an extensive investigation demonstrating that information literacy not only aids in identifying misinformation but also promotes the identification of accurate information, resulting in a significant decrease in the dissemination of misinformation. Afassinou (2014) explored the correlation between educational attainment and the spread of rumors using the SIR (Susceptible, Infected, Recovered) rumor spreading model. The study found that educated individuals in a population tend to have smaller final rumor sizes, underscoring the impact of education in curbing rumor spread. In a study by Bartol et al. (2018) involving first and second-year students, it was found that students' information literacy levels improved as they progressed in their education. This suggests that education has a positive influence on the development of information literacy skills. Similarly, Dolničar et al. (2020) identified a significant association between education and information literacy, indicating that individuals' information literacy skills improve with higher levels of education.

Data literacy, which falls within the realm of information literacy, is crucial. Data, as defined by the National Science Board (2005), encompasses a wide range of digitally stored information types, including text, numbers, images, video, audio, software, algorithms, equations, animations, models, simulations, and more. Borgman (2007) further categorizes data into observational, computational, and experimental types. Mandinach (2013) defines data literacy as the proficient understanding and effective utilization of data for decision-making processes. This encompasses the ability to access, retrieve, manage, critically evaluate, and ethically use data (Calzada Prado & Marzal, 2013). The Association of College Research and Research Libraries (2013) emphasizes data literacy competencies such as locating and

evaluating data, working with different versions of datasets, identifying data sources and custodians, and adhering to ethical guidelines.

Johnson (2012) extends data literacy to include the skills required for sorting, processing, and filtering vast data, involving search techniques, sorting algorithms, filtering mechanisms, data processing methods, and data synthesis. Similarly, Koltay (2016) suggests that data literacy shares similarities with information literacy and serves similar objectives. Pothier and Condon (2019) found that organizations face challenges in transitioning to data-centric infrastructures due to a lack of individuals equipped with data literacy skills. Given the ongoing expansion of data and the limited pool of individuals proficient in handling it, the urgency and significance of nurturing data literacy cannot be underestimated (Haendel et al., 2012).

Privacy, as defined by Trepte (2020), involves selective control over information sharing. Sindermann et al. (2021) identified a moderate yet positive relationship between online privacy literacy and information behavior. Notably, teenagers may willingly disclose personal information to join online social networks. Privacy literacy seeks to empower individuals in their interactions with technology, as highlighted by Hagendorff (2020). Bartsch and Dienlin (2016) found that individuals with higher online privacy literacy tend to feel more secure on platforms like Facebook and are more inclined to implement social privacy settings. By enhancing online privacy literacy, individuals not only gain a limited form of negative privacy but also the ability to engage in a deliberative process regarding privacy, allowing them to exercise agency over the information they choose to disclose, as explained by Masur (2020).

Recent research by Prince et al. (2022) used a survey-based empirical approach to examine the relationship between privacy literacy and privacy concerns among internet users. The study found that individuals with higher privacy literacy expressed heightened concerns regarding their privacy. Interestingly, it noted that an increase in knowledge about privacy laws did not necessarily correlate with increased privacy concerns among internet users. Furthermore, Acquisiti and Gross (2005) conducted a survey involving high school and college students who were members of Facebook to explore the predictive role of privacy concerns in their membership decisions. The study revealed that privacy concerns only weakly predicted membership decisions, as individuals with privacy concerns often disclosed substantial amounts of personal information upon joining the network. It was also observed that a significant portion of respondents expressed high levels of privacy concerns yet lacked the necessary information to make privacy-sensitive decisions (Acquisiti & Grossklags, 2005).

In a survey study using a standard multivariate clustering technique (SAS' partitional clustering), Ackerman et al. (1999) found that 56% of the 381 U.S. internet users fell into the pragmatic majority category concerning their attitudes toward privacy and their responses to specific privacy-related scenarios. Baruh et al. (2017) conducted a meta-analysis encompassing 166 studies from 34 countries, with a total sample size of 75,269 participants, to investigate the relationship between privacy concerns and privacy literacy. Their analysis revealed that individuals with heightened privacy concerns exhibited a reduced likelihood of using online services and sharing personal information while simultaneously displaying an increased likelihood of utilizing privacy-enhancing measures.

Information literacy has been shown to enhance the detection of fake news and reduce the dissemination of misinformation (Jones-Jang et al., 2019; Pennycook et al., 2021). Privacy literacy education assists users of social media sites in assessing the risks of sharing personal

information online (Correia and Compeau, 2017). Research by Burtle et al. (2018) and Dolnicar et al. (2020) revealed that students' information literacy improved as their educational attainment increased. Afassinou (2014) found that educated individuals in a population tend to have smaller final rumor sizes, indicating the positive role of education. Technology adoption research investigates the processes by which individuals, groups, and organizations embrace and utilize new technologies (Venkatesh et al., 2007). Factors affecting technology adoption include perceived benefits, costs, compatibility, innovation level, risk, complexity, ease of use, and social influence (Hansen et al., 2018). This study focuses on ChatGPT, an emerging chatbot technology developed by OpenAI, designed to facilitate human-like conversation and hold potential for various applications.

Research Question

What relationships exist between information literacy, data literacy, privacy literacy, and eagerness to adopt emerging technologies for improving their communities?

METHODS

This study focuses on four primary scale variables, or "constructs": information literacy, data literacy, privacy literacy, and the eagerness of community adoption of emerging technologies. Each construct is based on the mean score from a five-point Likert scale comprising ten questions, ranging from 1 (least ideal response) to 5 (most ideal response). Additionally, several demographic variables are examined in relation to these constructs using ANOVA and regression analyses. These demographic variables include age (open response), gender (categorized from open responses), educational attainment (ranging from high school or less to advanced degrees), political leaning (conservative, moderate, liberal), type of community (rural, suburban, urban), and Internet usage (multiple hours per day, one hour or less per day, a few hours per week, one hour or less per week).

Data was collected through a survey instrument created within Qualtrics and delivered electronically. A paper version was also made available to accommodate participants with varying levels of internet access and comfort. The survey consisted of 50 questions, with the final 40 questions used to construct the four variables related to eagerness to adopt emerging technology (in this case, ChatGPT, a novel AI chatbot), information literacy, data literacy, and privacy literacy (each construct composed of 10 questions). The remaining ten questions gathered demographic information as described earlier. The survey questions were based on previous studies conducted by the researchers in this field, and a copy of the survey instrument is included in the appendix.

The survey was distributed within a four-county area surrounding the researchers' university, selected for its diversity. One county contained a top-fifteen city by population, part of a top-ten U.S. metropolitan area, with a population that's about 30% Hispanic and known for its liberal politics. Another county included a minority-serving, Hispanic-serving institution with over 40,000 students. The third and fourth counties were rural, with populations of 60,000 and 10,000, and heavily supported the Republican Presidential candidate in 2020. These counties have aging, predominantly White populations. Distribution occurred through social

media and flyers posted at local public libraries. Participants had the option to access an online survey or request a mailed version.

After a four-week data collection period, the survey was closed, and the data was analyzed using SPSS. Due to the Likert scales used, non-parametric analyses were employed. Kruskal-Wallis H tests (non-parametric ANOVA) and Spearman rank correlation tests were used to evaluate relationships among variables. ANOVA tests examined variance in the four connectedness/literacy constructs based on categorical demographic variables (ethnicity, gender, educational attainment, political leaning, type of community, and Internet usage). Correlation tests assessed the strength of relationships among the four constructs and the continuous variable of age.

Ordinary least squares regression was used to explore the impact of various variables on each of the four primary scale variables in the study. In each regression analysis, four separate models were computed. The first model included all potential explanatory variables, encompassing demographic variables and the three remaining scale variables. The second model only considered the demographic variables. The third model retained only the demographic variables shown to potentially contribute statistically significantly in the second model. The final model focused exclusively on the three remaining scale variables in relation to the dependent variable of interest.

RESULTS

Out of the 136 surveys returned, 130 were complete and able to be included in the analysis. Table 1 shows the demographics of the respondents. The population was predominantly Hispanic, male, and highly educated, which may be due to the recruitment methods used. The age of the respondents was evenly distributed across three ranges: 18-29, 30-59, and 60+. Political leaning was evenly divided, while rural and urban populations were overrepresented. This may be due to the recruitment methods, which focused more on urban and rural areas than suburbs.

Table 1. Demographics of Respondents

Ethnicity	
Asian	4
Black	3
Hispanic	72
White (non-Hispanic)	51
Gender	
Female	45
Male	84
Not Specified	1
Age	
18-29	44
30-59	46
60+	40
Educational Attainment	
High School or Less	13
2-Year Degree	16

4-Year Degree	81
Advanced Degree	20
Political Leaning	
Conservative	54
Liberal	54
Moderate/Neither	22
Type of Community	
Rural	45
Suburban	32
Urban	53
Internet Usage	
Multiple Hours Per Day	66
One Hour or Less Per Day	35
Few Hours Per Week	17
One Hour or Less Per Week	12

Table 2 provides a comprehensive view of the average scores for emerging technology interest and literacy across different demographic groups. Kruskal-Wallis H tests were employed to detect statistically significant variations among these population segments, denoted by asterisks (*) in the table. Notable findings from this analysis are as follows:

- **Ethnicity:** White respondents showed significantly lower interest in adopting emerging technology, while Asian respondents exhibited notably higher data literacy. However, ethnicity was excluded from subsequent regression analyses due to the limited representation of Asian and Black respondents.
- **Gender:** Female respondents demonstrated significantly stronger privacy literacy scores compared to their male counterparts, although both groups scored similarly on other measures.
- **Education:** Educational attainment emerged as the most influential differentiator among groups. Those with a high school education or less had substantially lower scores for interest in emerging technology. Conversely, individuals with advanced degrees (masters, professional, doctoral) scored significantly higher on the data literacy and privacy literacy scales.
- **Political Leaning:** Political leaning did not yield significant differences on any of the scales.
- **Type of Community:** Minor differences were observed in terms of the type of community. Rural respondents had significantly lower interest in emerging technology, whereas suburban residents had higher scores for privacy literacy. Urban respondents exhibited moderate scores across the board.
- **Internet Usage:** Those with limited internet use tended to score lower in data literacy, whereas individuals with extensive internet usage demonstrated higher privacy literacy.

Table 2. Average Scores on Emerging Technology Interest and Literacy Scores.

Category	Emerging Technology for Community	Information Literacy	Data Literacy	Privacy Literacy
All Respondents	4.1	3.7	3.6	3.7
Asian	4.2	3.8	4.0*	3.8
Black	4.3	3.7	3.7	3.7
Hispanic	4.3	3.7	3.6	3.7
White	3.8**	3.6	3.5	3.6
Female	4.2	3.7	3.6	3.8*
Male	4.1	3.7	3.6	3.6*
High School or Less	3.4**	3.5	3.4	3.5
2 Year Degree	4.2	3.7	3.6	3.7
4 Year Degree	4.2	3.7	3.6	3.7
Advanced Degree	4.2	3.7	3.8**	3.9*
Conservative	4.1	3.7	3.6	3.7
Liberal	4.1	3.7	3.5	3.6
Moderate/Neither	4.2	3.7	3.6	3.7
Rural	3.9*	3.7	3.5	3.6
Suburban	4.3	3.7	3.5	3.8
Urban	4.1	3.6	3.6	3.7
Multiple Hours Per Day	4.0	3.7	3.7	3.8*
One Hour or Less Per Day	4.3	3.7	3.5	3.6
Few Hours Per Week	4.3	3.8	3.5	3.6
One Hour or Less Per Week	4.0	3.5	3.3*	3.5

* Significant difference at $p < .05$ ** Significant difference at $p < .01$

Shown in Table 3 is the correlation values for five scale or continuous variables: age, interest in community adoption of emerging technologies, information literacy, data literacy, and privacy literacy. All of the variables have weak-to-moderate correlations with one another, with the exception of age, which only has a significant correlation with data literacy. All other variables are positively correlated with one another. Particularly strong correlations are found between interest in emerging technology adoption for community uses and data literacy and privacy literacy.

Table 3. Correlation Matrix for Scale Variables.

Variable	Age	Emerging Tech Interest	Information Literacy	Data Literacy	Privacy Literacy
Age	--	-.131	.127	-.157*	-.089
Emerging Tech Interest	-.131	--	.277**	.565**	.559**
Information Literacy	.127	.277**	--	.273**	.430**
Data Literacy	-.157	.565**	.273**	--	.350**
Privacy Literacy	.089	.559**	.430**	.350**	--

* Significant difference at $p < .05$ ** Significant difference at $p < .01$

Table 4 shows the regression findings for the four concepts of emerging tech interest for community use, information literacy, data literacy, and privacy literacy. Model 1 includes all independent variables, Model 2 excludes the scale variables, Model 3 includes only the variables identified as significant in Model 2, and Model 4 looks at only the scale variables. Statistically significant contributors to the models are signified by the asterisks (* for $p < .05$ and ** for $p < .01$). The *unstandardized betas* are shown for each variable along with the standard error in parentheses. For instance, in Table 4, Model 3, we see two variables have a significant effect: age and education. With age, each increase in one-year results in an anticipated drop in interest in emerging tech of .009 points; with education, each increase in one level of accomplishment (e.g., going from “high school graduate” to “two-year degree”) results in an anticipated increase in emerging tech interest of .231 points.

Table 4. Regression Findings for Dependent Variable of Interest in Emerging Tech for Community Use.

	Model 1	Model 2	Model 3	Model 4
Age	-.003 (.003)	-.009 (.003)**	-.009 (.003)**	
Gender (Male = High)	.034 (.105)	-.216 (.112)*	-.195 (.110)	
Education	.166 (.06)**	.241 (.067)**	.231 (.066)**	
Politics (Liberal = High)	-.010 (.066)	-.037 (.075)		
Community (More Urban = High)	-.018 (.056)	-.086 (.060)		
Internet Usage	.066 (.048)	.023 (.052)		
Information Literacy	.643 (.159)**			.707 (.151)**
Data Literacy	-.089 (.156)			-.130 (.144)
Privacy Literacy	.447 (.153)**			.508 (.143)**
Adjusted R ²	0.341	0.181	0.163	.329

* Significant difference at $p < .05$ ** Significant difference at $p < .01$

DISCUSSION

This study sought to explore the relationship between demographic factors and individuals' attitudes and competencies in adopting emerging technology for community use. The findings offer valuable insights into how demographics influence these aspects. Notably, the sample was primarily composed of Hispanic, male, and highly educated participants. This sample composition might be attributed to the study's recruitment methods, potentially favoring these particular groups. It's essential to recognize that the generalizability of these findings to other populations may be limited due to the sample's composition.

The age distribution of respondents was fairly even across three categories: 18-29, 30-59, and 60 or older. An interesting observation was that age exhibited a negative correlation with interest in adopting emerging technology but positive correlation with information literacy. In other words, as individuals grew older, their interest in technology adoption decreased, while their scores in literacy increased. This suggests that older individuals may have lower enthusiasm for adopting emerging technologies but possess higher levels of information literacy compared to their younger counterparts. This finding underscores the importance of tailoring technology interventions and educational programs to cater to the distinct needs and preferences of various age groups.

The limited representation of Asian and Black individuals in the sample led to their exclusion from subsequent regression analyses. Nevertheless, it's noteworthy that Asian respondents displayed significantly higher data literacy compared to other ethnic groups, while White respondents exhibited significantly lower interest in adopting emerging technology. These disparities suggest potential variations in technology-related attitudes and competencies among different ethnic groups, warranting further exploration in future research with more diverse samples.

Gender differences were apparent in privacy literacy, with female respondents outperforming their male counterparts. However, no significant gender disparities were observed in other measures. This finding indicates that females may possess a relatively stronger understanding of privacy concepts in the context of emerging technology. Further investigations are needed to delve into the factors contributing to this gender difference, which can inform targeted interventions for enhancing privacy literacy.

Educational attainment emerged as a prominent factor in differentiation among respondents. Individuals with higher educational levels, including advanced degrees, demonstrated significantly better scores in data literacy and privacy literacy. Moreover, those with lower educational attainment, particularly high school or less, exhibited notably lower interest in adopting emerging technology. These results underscore the pivotal role of education in shaping individuals' engagement with technology and their competency levels. Efforts should be made to offer accessible educational opportunities to individuals with lower educational attainment to bridge the digital divide and promote inclusive technology adoption.

While political leaning and type of community showed limited differences in the measures of interest and literacy, respondents from rural areas expressed lower interest in adopting emerging technology compared to those from suburban and urban areas. Additionally, individuals with limited internet usage tended to score lower in data literacy, while those with extensive internet usage fared better in privacy literacy. These findings indicate that an

individual's residential context and access to technology infrastructure can impact their technological engagement and competencies.

The correlation analysis unveiled weak-to-moderate relationships among the variables. The positive correlations observed among interest in emerging technology adoption, information literacy, data literacy, and privacy literacy highlight the interconnectedness of these constructs. However, older adults appeared to defy this pattern, displaying a lower level of interest in technology adoption despite having higher literacy levels. These findings underscore the need to consider multiple dimensions when examining individuals' engagement with emerging technologies.

The regression analyses provided further insights into the factors influencing interest in adopting emerging technology. The models indicated that age and education significantly contributed to the variance in emerging tech interest. Older age was associated with reduced interest in emerging technology adoption, while higher educational attainment predicted increased interest in this domain. This finding about age aligns with the existing literature, which often cites reluctance among older adults to adopt emerging technology. However, the discovery of conflicting findings regarding literacy and aging underscores the need for tailored interventions and educational programs that consider age and educational background to foster interest and engagement in emerging technologies.

It's crucial to acknowledge the limitations of the study. The sample's predominant composition of Hispanic, male, and highly educated individuals restricts the generalizability of the findings to other populations. Additionally, the study relied on self-reported survey data, which can be subject to response biases and social desirability effects. Future research should aim to incorporate more diverse samples and employ mixed-methods approaches to gain a comprehensive understanding of the complex factors influencing individuals' attitudes and competencies in adopting emerging technology.

CONCLUSIONS

This study delves into the intricate relationship among four key constructs: information literacy, data literacy, privacy literacy, and the interest in adopting emerging technologies within communities. The findings illuminate a multifaceted interplay between these variables, influenced by an individual's age, gender, level of education, and internet usage. The model suggests that young, highly educated females who frequently use the internet are most likely to exhibit high levels in all four constructs. However, it also demonstrates that an individual can possess high levels of interest or literacy in one or two areas while having comparatively lower levels in others. This study's results provide valuable insights, highlighting the significance of recognizing various literacy skills required to tailor the appropriate learning plans or curricula for different demographic groups. Practically, these findings can be applied to situations where a deep understanding of the necessary literacy skills is vital for adapting to emerging technologies like generative artificial intelligence, such as ChatGPT. Notably, a deficiency in one construct often corresponds to lower achievement in the other three, although individual differences play a role.

IMPLICATIONS FOR RESEARCH, APPLICATION, OR POLICY

The findings highlight the need for tailored educational programs that consider individuals' age, gender, and educational background. To promote inclusive technology adoption, efforts should be made to provide accessible educational opportunities, especially to individuals with lower educational attainment. Policymakers and educators should focus on designing curricula that cater to the specific needs and preferences of different demographic groups.

The positive correlations among interest in emerging technology adoption, information literacy, data literacy, and privacy literacy suggest that these constructs are interrelated. Researchers and educators should consider these interconnections when designing interventions and assessments to comprehensively evaluate individuals' technological engagement and competencies.

The study confirms the commonly observed reluctance among older adults to adopt emerging technologies. Policymakers and technology developers should focus on creating user-friendly interfaces and providing additional support to older individuals to encourage their participation in the digital age. These are all important considerations as the fourth industrial revolution and AI technologies become more ubiquitous in society.

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Appendix

Survey Questions

1. What is your age?
2. What is your gender?
3. What is your ethnicity?
4. What is the highest level of education that you have achieved?
5. Which of the following best describes your political beliefs?
6. In what type of community do you currently live?
7. Which of the following best describes the area where you live?
8. Which of the following statements best describes your preferred living situation?
9. Which of the following statements best describes your Internet use?
10. Which of the following statements best describes your online community participation?

For each of the following select the one option that best describes you:

11. I am very interested in using ChatGPT in my community.
12. I have used ChatGPT before.
13. I think ChatGPT would be a useful resource for my community.
14. I think ChatGPT could replace or augment existing community resources.
15. I am concerned about the potential privacy implications of using ChatGPT.
16. I am comfortable with using Chatbot technology in general.
17. I think ChatGPT would be easy to use for members of my community.
18. I would be willing to help promote ChatGPT in my community.
19. I have suggestions for how ChatGPT could be used in my community.
20. I am likely to recommend ChatGPT to others in my community.
21. I can easily find the information I need online.
22. I know how to use a wide range of online search strategies.
23. I find it challenging to decide what keywords to use for online searches.
24. I am not sure whether the information I find online is reliable or not.
25. I am always skeptical of the information I encounter.
26. I look for answers to questions across multiple sources before forming an opinion.
27. I normally look at the top answers to a question on Google.
28. I am more cautious with what I share online compared to in-person.
29. I feel confident in my ability to evaluate the credibility and reliability of information sources.
30. I am able to effectively use library databases and other research tools to find relevant information.
31. I know how to use Microsoft Excel to add, subtract, multiply, and divide a set of numbers.
32. I am not sure how to find vote totals for the most recent county election.
33. I understand what is meant by the phrase "a margin of error of +/- 3 percent"
34. I would prefer to read a summary of findings from a survey and never look at the details myself

35. I find it challenging to decide whether to believe statistics or believe what I am told by people I trust
36. I feel confident in my ability to analyze and interpret data.
37. I often have difficulty understanding data visualizations.
38. I understand how to use data to inform decision making.
39. I know what the abbreviations AI and ML stand for.
40. I am familiar with different sampling methods (e.g., convenience, random, stratified).
41. I know how to access the browsing history on my favorite web browser.
42. I am not sure whether the National Security Agency (NSA) can track the information I am accessing on my computer.
43. I understand what is meant by the phrase "social engineering and phishing pose major threats to the confidentiality of organizational data."
44. I believe that I can request a record of all the personal data that websites have collected about me.
45. I know which web browsers are more secure than others.
46. I always read the privacy policy or statement for the websites that I use.
47. I feel confident that I know how to protect my personal information when using the internet.
48. I am familiar with the privacy settings on the websites and apps that I use.
49. I am aware of the potential risks of sharing personal information online (e.g., identity theft).
50. I regularly review and update my private information.

DO IT USERS BEHAVE RESPONSIBLY IN TERMS OF CYBERCRIME PROTECTION?

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Abstract: *This study aims to analyze the behaviour of IT users regarding their personal protection against potential cybercrimes. The research data set is based on surveys conducted by the European Commission in 2020-2021 for 35 European countries. Canonical analysis revealed that 66.67% of cybercrime cases (Phishing, Pharming, Online identity theft, etc.) determine individuals' choice of personal protection method (using a security token, social media logins, electronic identification, etc.). Kohonen's self-organizing maps were used to form 9 clusters of countries depending on the attitude of IT users to personal cybersecurity. The map results showed that individuals behave less responsibly using a security token, electronic identification certificate or card, pin code list or random characters of a password, and other electronic identification procedures. Users from Denmark, the Netherlands, Iceland, Norway, the UK, Austria, and Finland were the most responsible Europeans in terms of personal protection, while people from Bulgaria, Romania, Serbia, Albania, North Macedonia, Bosnia and Herzegovina were the least conscientious about protection.*

Keywords: *cybercrime, IT user, Kohonen map, personal cybersecurity, responsible behaviour, protection.*



INTRODUCTION

The consequences of Industry 4.0 and the beginning of its new 5.0 phase have been influencing the development of social life. Although the Fourth Revolution was focused on automating many processes and simplifying their execution by a person, the next stage aims to achieve a balanced interaction between humans and computer technologies based on artificial intelligence and intricate robotic complexes. On the one hand, these processes positively impact society, the economy, and the environment and ensure sustainable development. On the other hand, rapid digitization and automation have given rise to new types of crime. Cybercrimes are illicit actions conducted by a person or a group of persons aimed at individual users, companies, governments, and even countries that use information and communication technologies. They result in theft or leakage of personal data, especially financial data, malfunctioning of mobile devices, computers, enterprise infrastructure, damage to software, etc.

Statistics show that the level of cybercrime in the world is constantly increasing. In 2001, six people per hour became victims of cybercrimes. In 2022, this number increased almost 15 times to 91 people, although the maximum number reached 97 victims per hour in 2021 (Surfshark, 2022). Comparitech research team estimated that approximately 71.1 million people suffered from cybercrime annually (Bischoff, 2022). Every ten-thousandth resident of the European Union became a victim of cybercrime in 2020 (Vasilyeva et al., 2022). A 2007 University of Maryland study found that a cyber hacker attack occurred every 39 seconds (Cukier, 2007). However, according to the Internet Crime Complaint Center of the Federal Bureau of Investigation, one successful attack occurred every 1.12 seconds in 2020 (Federal Bureau of Investigation, 2020). This indicates that the frequency and effectiveness of cybercrime is increasing. If cybercrime financial losses per hour in 2001 amounted to \$2,055, this figure increased approximately 572 times by 2022 and amounted to \$1,175,799 (Surfshark, 2022). According to expert estimates, losses from cybercrime in 2018 reached 0.86 trillion U.S. dollars; by 2022, they increased 9.8 times and equalled 8.44 trillion U.S. dollars. In 2027, they may increase to 23.82 trillion U.S. dollars (Fleck, 2022).

The given data show that cybercrime has become a serious problem for ensuring the sustainable development of society. At the same time, it has a peculiar, steady growth trend, facilitated by a significant decrease in the price of computer technologies and an increase in their availability for ordinary IT users. For example, the IT market offers cybercrime devices that start at \$1, making it easy for anyone to become a cybercriminal (Rapp & Hackett, 2017). It is not for nothing that the World Economic Forum (2022) singles out the spread of cybercrime among the ten most critical risks for the world. Thus, in ranking risks that have worsened since the beginning of the COVID-19 pandemic, cybersecurity mistakes leading to the spread of cybercrimes occupy the seventh position. Among the risks that will become the most serious threat worldwide in the next two years, it also ranks seventh, and among those that will be critical in the next five years, it ranks eighth. That is why combating cybercrimes is the prerogative of the cyber defense department. However, 88% of cybersecurity breaches are caused by human factors, and since anti-virus software is only 50% effective, the IT user's behavior influences the success or failure of cyber attacks (MacKay, 2022). According to a survey conducted by KPMG, 86% of respondents believe that it is IT users who are responsible for data security. However, 90% identify the responsibility as government and 91% as business

(Orson & Stein, 2020). It follows from this that an individual's behavior in cyberspace is important in the personal security organization, forming his/her security environment.

What is responsible behaviour, and why is it so important today? It is a key issue surveyed by the Geneva Dialogue on Responsible Behavior in Cyberspace. This project was launched in 2018 by the Swiss Federal Department of Foreign Affairs (FDFA), the Geneva Internet Platform (GIP), the United Nations Institute for Disarmament Research (UNIDIR), ETH Zurich and the University of Lausanne. The main goal was to identify the stakeholders - the state, business entities and civil society - and their roles in using information and communication technologies for security in global cyberspace. Within the framework of the organized webinar "What is responsible behaviour in cyberspace?" it was determined that responsible behaviour is "behaviour by a given actor in a given set of circumstances that can be said to conform to the laws, customs and norms generally expected from that actor in those circumstances" (Gavrilović, 2018). This concept does not fully reveal its essence and needs to be clarified depending on the roles that various subjects perform in cyberspace. It especially applies to the determination of the individual IT users' behaviour, which should be based on their attitude to protecting personal data and applying basic and particular actions to counter cyber threats. For example, ignoring emails received in spam or from unfamiliar addresses, regularly changing passwords, not disclosing personal, especially financial, information in social networks, etc.

The Geneva Dialogue has proposed and implemented many initiatives related to the responsible behaviour of states in cyberspace. 11 central voluntary UN norms define what states can and cannot do as part of their responsible behaviour in cyberspace (Hogeveen, 2022). However, to a greater extent, this activity is directed at the macro and global level of cyberspace. As for ordinary IT users, a mechanism for increasing digital literacy on personal security issues is proposed. Since it is very difficult to regulate the cyber protection of every citizen at the state or global level, the spread of educational activities should deepen individuals' awareness in this area and motivate them to apply more advanced security measures.

Based on the above, should society combat cyber threats? Sure, because the losses from cybercrimes can be quite tangible for their victims. Who should be responsible for personal safety? In most cases, each IT user should be responsible for personal cyber protection, but this should also not abdicate the responsibility of companies, governments and international organizations. How should an IT user behave in such cases? His/her behaviour must be responsible, including applying a set of actions aimed at protecting personal data. Is this how IT users behave today? This study will deal with the answers to this question.

LITERATURE REVIEW

Today, digitization and computerization processes are important factors in achieving the benefits of the economy and sustainable development of the country for the long term (Tiutiunyk et al., 2021; Millia et al., 2022). Thanks to them, the processes of convergence of the cybersecurity system with the economy and business take place (Kuzior et al., 2022). For example, some Internet users directly affect economic growth, especially in transition

economies (Remeikiene et al., 2021). Mobile technologies contribute to increasing the level of human well-being (Rosenberg & Taipale, 2022).

The scope of application of modern information and communication technologies is broad. Their features have been studied and continue to be studied for health care (Alimbaev et al., 2021), construction (Popov et al., 2021), transport (Okunevičiūtė Neverauskienė et al., 2021), finance (Mnoghithnei et al., 2022) and the banking sector (Haddad, 2021), the hospitality and tourism industry (Lustigova et al., 2021), small and medium-sized businesses (León-Gómez et al., 2022), e-commerce (Kiba-Janiak et al., 2022), e-government (Kolosok et al., 2022). Despite the field of activity, global, macro-, micro- or individual level, the key figure is always the person who plays an important role in the digital transformation processes (Tran et al., 2022). Therefore, the effectiveness of the information and communication technologies will depend on its behaviour, which will affect the cybersecurity level, both personal and for enterprises, the country and the world as a whole.

Where is the individual's responsible behavior most important to ensure cybersecurity? The current development of technologies is aimed at their evolution from being used in simple calculations to playing the key role of a decision-maker in a company (Gladden et al., 2022). Therefore, today, humanity wants to consolidate the role of the host in its interaction with artificial intelligence technologies (Tugui et al., 2022). Beño (2022) proved the existence of a direct correlation between the number of highly educated and electronic workers, indicating the intellectualization of work that requires the IT application. On the one hand, it contributes to developing cybersecurity measures. On the other hand, it can lead to the future degeneration of many professions since introducing technological innovations always leads to increased unemployment (Lydeka & Karaliute, 2021). Some individuals have difficulty integrating into digital technologies, such as the oldest generation and members of the younger generation (Dečman et al., 2022). That is why they often become victims of cybercrimes because they do not have enough knowledge to apply basic protection tools. However, the advantages of society digitalization allow the use of electronic learning tools that help to increase the level of digital and cyber literacy of users regardless of age, status, and type of activity (Davidovitch & Eckhaus, 2022).

The global pandemic of COVID-19 contributed to the fact that most companies transferred employees to remote work. On the one hand, it should have contributed to a significant reduction in costs, but this factor may not be confirmed in practice (Navickas et al., 2022). On the other hand, it led to the appearance of vulnerabilities in the cyber defence system due to the influence of the human factor (Kobis & Karyy, 2021). In such cases, it is reasonable to create virtual teams, which contribute to the development of human capital, ensure the organizational sustainability of enterprises and can contribute to increasing the effectiveness of cybersecurity measures (Capolupo et al., 2022). The experience of using virtual reality in tourism confirms it (Florek & Lewicki, 2022). The information technology factor is not influential for knowledge management in enterprises (Gad & Yousif, 2021). However, the exchange of knowledge between company employees can affect the quality of information systems of companies, forming the appropriate knowledge banks for countering cybercrimes (Zamir & Kim, 2022).

The vulnerability of IT users' cybersecurity is noticeable in the electronic services of the financial sphere. For example, electronic banking is firmly rooted among them and is the most used by individuals. Their quality in general and security in particular directly impact the satisfaction and loyalty of electronic customers of banks (Ahmed et al., 2021). Hassan & Lee

(2021) prove that a key factor in the perception of e-commerce is consumers' level of trust in this type of service, which can undoubtedly influence the personal cybersecurity measures they use in online payments. Fülöp et al. (2022) found a positive impact of Fintech Accounting and Industry 4.0 technology on increasing trust in digital accounting services. Blockchain technologies and smart contracts increase the reliability of partners and contribute to the competitiveness of enterprises, although they can act as a source of information vulnerability for cybercriminals (Chen et al., 2022).

Speaking about information technologies and their impact on society, business, and individuals, one should remember the ethics of this issue (Constantinescu & Edu, 2022). It is because disclosing personal data online can become a vulnerable link and create favourable conditions for cybercriminals. Therefore, companies and governments should pay attention to implementing tools that ensure this issue's ethical side.

The possibilities of information and communication technologies are powerful. The introduction of artificial intelligence, industrial robots, blockchains, smart contracts, smart cities, etc., makes life easier and contributes to the country's economic development. At the same time, they create opportunities for cybercriminals. Therefore, the level of cybersecurity will depend on the company employees' behaviour, as well as users of relevant services and technologies. It includes digital literacy, quality of services, intellectualization and virtualization of work, knowledge exchange, cyber ethics, etc.

METHODS AND DATA

Data

The article used data from surveys conducted by the European Commission in 2020-2021 for 35 European countries. Two sets of data were used in the study. The first set includes eight indicators characterizing the number of respondents who have encountered cybercrime cases (Eurostat, 2022c). The second set concerns the interviewees' answers regarding appropriate measures of personal cyber protection.

The first data set identifies the relationship between cybercrime incidents and responsible behaviour. It included an indicator "Fraudulent credit or debit card use" showing what percentage of respondents had fallen victim to fraudulent credit or debit card use. This type of cybercrime is social engineering, which assumes that a fraudster misleads a person and voluntarily gives information related to his/her bank cards. A second indicator "Online identity theft" is the number of individuals who have had their personal information stolen online, allowing the criminal to impersonate the victim and gain some benefit. A third indicator "Phishing" shows the number of respondents who became phishing victims, i.e., received fraudulent messages from cybercriminals. A fourth indicator "Pharming" is the number of victims of pharming, i.e., they were redirected to fake websites that asked for personal information. The fifth indicator "Misuse of personal information available on the Internet" is the number of respondents who experienced abuse of their personal information online, resulting in discrimination, harassment or bullying by cybercriminals. The sixth indicator "Social network or e-mail account being hacked" is the number of victims of social network or email account hacking, as well as posting or sending content without the knowledge of

individuals. The seventh indicator “Data loss due to a virus” is the number of individuals who lost personal information (documents, videos, images, etc.) due to a virus attack and infection of a computer or other device. The final indicator “Identity theft, receiving fraudulent messages or being redirected to fake websites” is the percentage of respondents who experienced financial loss as a result of having their personal information stolen, receiving fraudulent messages, or being redirected to fake websites.

The second data set includes 16 indicators reflecting the percentage of individuals who demonstrate behaviour in the information environment in the form of their implementation of specific cyber protection actions. These are the following indexes: “Using simple login with username and password”, “Using a social media login”, “Using a security token”, “Using an electronic identification certificate or card with a card reader or an app”, “Using a procedure involving the mobile phone”, “Using a single-use PIN code list or random characters of a password”, “Using other electronic identification procedures”, “Using at least 4 identification procedures”, “Individuals know that cookies can be used to trace the movements of people on the Internet”, “Changing the settings in the internet browser to prevent or limit cookies on any devices”, “Using software that limits the ability to track activities on the Internet”, “Reading privacy policy statements before providing personal data”, “Restricting or refusing access to the geographical location”, “Limiting access to profiles or content on social networking sites or shared online storage”, “Rejection of using personal data for advertising purposes”, “Checking the security of the website where personal data is provided”. The data from the first to the eighth indicator were taken from the results of the survey conducted by Eurostat (2022a), and from the ninth to the sixteenth, from Eurostat (2022b).

Methods

Several stages are foreseen in the study. In the first stage, linear dependencies are studied, and the relationships between two sets of variables are identified. One of them is formed by variables characterizing the number of respondents who have encountered cybercrime cases. The second is represented by indicators that determine the responsible behaviour of IT users. For this stage, canonical analysis is used to assess the influence of one set on another and substantiate its statistical significance. The canonical analysis will reveal a group of factors and individual factors of greatest influence. The statistical significance of the correlation between groups of indicators and the statistical significance of canonical roots will be checked using the χ^2 distribution. The calculated value χ^2 is compared to the critical one. If it is smaller, the value of the correlation between groups of indicators is statistically significant. At the same time, the p-value is also estimated, which should not exceed 0.05, confirming statistical significance.

In the second step, data standardization and assessment of the multicollinearity of the data array is carried out. Standardization will help scale the data to the value of the variance and cancel out the effect of the averages. For this purpose, Z-score normalization is used (Kreyszig, 1979). For checking the array of data for the presence or absence of multicollinearity, χ^2 is used which will be calculated based on the data of the entire array. The obtained value is compared with the critical value if $\frac{1}{2}m(m-1)$ – freedom degrees and the corresponding level of significance α . If $\chi^2 > \chi^2_{cr}$, there is multicollinearity in the array of variables, otherwise it is absent.

In the third step, the principal component method is used to reduce the dimensionality of the data and eliminate multicollinearity. This procedure will help to avoid the influence of this phenomenon when justifying the number of clusters.

In the fourth step of the research, the number of clusters is substantiated using the Silhouette technique. Most researchers use the Elbow method to perform this task, but it only calculates the Euclidean distance. The Silhouette method considers various features - dispersion, asymmetry, the difference between maximum and minimum values, etc. This method was proposed by Rousseeuw (1987) to check the consistency of data in clusters using visualization. Its main purpose is to calculate the silhouette coefficient for all observations of the sample and for the cluster as a whole, taking into account the average distance between the group and the average distance to the nearest cluster. Silhouette scores are calculated according to formula (1) (Rousseeuw, 1987):

$$\begin{cases} s(i) = \frac{k(i) - l(i)}{\max\{k(i), l(i)\}}, \text{ if } |O_i| > 1, \\ s(i) = 0, \text{ if } |O_i| = 1 \end{cases} \quad (1)$$

where $s(i)$ is a silhouette score for i -th observation from the data sampling; $k(i)$ is the average distance between i -th observations and other cluster observations; $l(i)$ is the shortest distance between i -th observations in the cluster to other observations of other clusters; $|O_i|$ is a set of observations of one cluster. Accordingly, the average and shortest distances are calculated using formulas (2) – (3) (Rousseeuw, 1987):

$$k(i) = \frac{1}{|O_i| - 1} \sum_{j \in O_i, i \neq j} d(i, j), \quad (2)$$

$$l(i) = \min_{j \neq i} \frac{1}{|O_j|} \sum_{j \in O_j} d(i, j), \quad (3)$$

where $d(i, j)$ is the distance between i -th and j -th observations.

Since the Silhouette score is used to justify the number of clusters in this methodology, the corresponding scores will be calculated for their different number. To make a decision, it is necessary that $s(i) \rightarrow 1$. The estimate close to one indicates that the distribution of observations on a given number of clusters is the most effective.

In the fifth step, self-organizing Kohonen maps, a technique of unsupervised machine learning allowing to create a two-dimensional data representation in the form of maps while preserving the data structure, are built. Maps are formed from neurons or nodes associated with a vector of weight estimates determining their position in space. The learning process consists of moving the weight estimates in such a way as to reduce the distance between neurons. First, the input vector of weights is chosen randomly. Then, there is a transition from neuron to neuron. This process is accompanied by determining the similarity of the input vector and the vector of weight estimates corresponding to a node on the map. The neuron with the smallest Euclidean distance value is assigned the matching unit. Based on this knowledge, the weight

vectors of neurons are updated in combination with the best matching unit (formula (4), Kohonen & Honkela, 2007):

$$W_v(r + 1) = W_v(r) + \theta(u, v, r) \cdot \alpha(r) \cdot (B(t) - W_v(r)), \quad (4)$$

where $W_v(r + 1)$ is the updated vector of weights of the neuron taking into account r -iterations of updating the weights; W_v is the current vector of neuron weights; $\theta(u, v, r)$ is a neighborhood function that defines the distance between two neurons – u and v on the step r ; u is the index of the best matching neuron score in the map; v is the index of the neuron in the map; $\alpha(r)$ are limitations of the learning process or a monotonically decreasing learning coefficient; $B(t)$ is the vector of input weights.

After updating the weight vector, the iteration step r is increased. The procedure is repeated until it reaches the final limit of the iteration. As a result of applying the unsupervised machine learning technique, a Kohonen map is built, demonstrating the distribution of the analyzed elements according to the corresponding clusters. It helps to analyze the elements grouped according to the similarity of their characteristics.

RESEARCH RESULTS

At the first stage of the proposed methodology, a canonical analysis was performed between the two data sets using the STATISTICA analytical package. Figure 1 presents the obtained results.

N=35	Canonical Analysis Summary Canonical R: .95865 Chi ² (128)=155.70 p=.04877	
	Left Set	Right Set
No. of variables	8	16
Variance extracted	100.000%	66.2904%
Total redundancy	66.7662%	48.9594%
Variables:	Fraudulent credit or debit card use	Using a simple login with username and password
1		
2	Online identity theft	Using a social media login
3	Phishing	Using a security token
4	Pharming	Using an electronic identification certificate or card with a card reader or an app
5	Misuse of personal information available on the Internet	Using a procedure involving the mobile phone
6	Social network or e-mail account being hacked	Using a single-use PIN code list or random characters of a password
7	Data loss due to a virus	Using other electronic identification procedures
8	Identity theft, receiving fraudulent messages or being redirected to fake websites	Using at least 4 identification procedures
9		Individuals know that cookies can be used to trace the movements of people on the Internet
10		Changing the settings in the internet browser to prevent or limit cookies on any devices
11		Using software that limits the ability to track the activities on the Internet
12		Reading privacy policy statements before providing personal data
13		Restricting or refusing access to the geographical location
14		Limiting access to profiles or content on social networking sites or shared online storage
15		Rejection of using personal data for advertising purposes
16		Checking the security of the website where personal data is provided

Figure 1. Results of the canonical analysis.

[Source: calculated by the authors]

Figure 1 shows a high value of the canonical correlation ($R = 0.95865$), indicating that there is a strong correlation between the set of selected cybercrime cases (Left Set) and indicators characterizing the responsible behaviour of IT users (Right Set). The statistical significance of the correlation coefficient is confirmed by the high value of the Pearson test ($\chi^2 = 155.70$), the significance level of which does not exceed 0.05 ($p = 0.04877$). The redundancy value for the left set is 66.7662%; i.e., the right set variables, which correspond to IT users' responsible behaviour indicators, explain 66.7662% of the changes caused by cybercrime cases. In two out of three cases, the user's vulnerability in the network depends on incorrectly or insufficiently correctly chosen personal cyber protection tools. In turn, the cases of cybercrimes explain by 48.9594% the variability of the IT users' behaviour regarding

personal cyber protection, i.e., in approximately 50% of cases, the choice of the appropriate person's behaviour regarding its protection depends on the type of cybercrime.

For further analysis, it is necessary to select those canonical roots that are statistically significant. The result of the obtained roots and verification of their statistical significance is presented in Figure 2.

Root Removed	Chi-Square Tests with Successive Roots Removed					
	Canonica R	Canonica R-sqr.	Chi-sqr.	df	p	Lambda Prime
0	0.9586455	0.9190012	155.6953	128	0.048774	0.0007161
1	0.9013787	0.8124835	101.6590	105	0.574071	0.0088413
2	0.8012128	0.6419420	65.6704	84	0.930365	0.0471494
3	0.7208380	0.5196074	43.5886	65	0.980964	0.1316808
4	0.6607936	0.4366482	27.8258	48	0.991270	0.2741108
5	0.5692695	0.3240677	15.4880	33	0.995882	0.4865712
6	0.4537064	0.2058495	7.0673	20	0.996454	0.7198520
7	0.3058713	0.0935572	2.1119	9	0.989569	0.9064428

Figure 2. Evaluation of statistical significance of canonical roots.

[Source: calculated by the authors]

Figure 2 shows that the Chi-square in the first row, corresponding to the analysis without root removal, is statistically significant because $p < 0.05$, so, at least one canonical root is also statistically significant. When it was removed, the authors found that the remaining roots were statistically insignificant. Therefore, the result is one statistically significant root, i.e., it is appropriate to consider one pair of canonical variables. To confirm these conclusions, the authors demonstrate the factor structure and redundancy (Appendix A, Figures 1-2).

The largest factor loadings have indicators to the first root, both for the left and right set, confirming the previous conclusion. Since the factor loadings represent correlations between the set indicators, the responsible IT users' behaviour indicators demonstrate average, above-average and significant correlations. Only the variable related to "Reading privacy policy statements before providing personal data" shows a very weak relationship, which indicates the insignificance of this responsible behaviour type for countering cybercrimes (Appendix A, Figure 1, Row 12). "Using at least 4 identification procedures" and "Using a procedure involving the mobile phone" is the most correlated (Appendix A, Figure 1, Rows 5 and 8). Users who apply multiple cyber protection tools are more likely to use a mobile phone to confirm their actions on the Internet. These measures are the factors reducing the vulnerabilities of users' security and affecting the number of cybercrime cases.

The least correlated cybercrime cases are those related to losing personal information due to a virus attack (Appendix A, Figure 2, Row 7). The highest level of communication is demonstrated by "Fraudulent credit or debit card use" and "Identity theft, receiving fraudulent messages or being redirected to fake websites" (Appendix A, Figure 2, Rows 1 and 8). It suggests that IT users who were victims of fraudulent use of credit or debit cards may also have experienced identity theft. At the same time, phishing cases have a weak connection with other cases of cybercrime.

Canonical weights were determined to understand which responsible behavior measures and cybersecurity cases are the most important (Appendix A, Figures 3-4). The value of

canonical weights, taken by the module, determines the contribution of each indicator to the formation of canonical variables. The greatest contribution to the responsible behaviour of IT users will be made by “Using at least 4 identification procedures” (|0.397156|), “Using a procedure involving the mobile phone” (|0.360203|), “Restricting or refusing access to the geographical location” (|0.351491|), “Limiting access to profiles or content on social networking sites or shared online storage” (|-0.2732531|), “Checking the security of the website where personal data is provided” (|-0.2598138|), “Individuals know that cookies can be used to trace the movements of people on the Internet” (|0.2342221|) (Appendix A, Figure 3). “Using other electronic identification procedures” (|-0.004255596|), “Using a single-use PIN code list or random characters of a password” (|0.008669309|), “Using software that limits the ability to track the activities on the Internet” (|-0.01907673|), “Using an electronic identification certificate or card with a card reader or an app” (|-0.041001|), “Using a simple login with username and password” (|0.06513116|), “Rejection of using personal data for advertising purposes” (|0.04041022|). Positive variables indicate that increasing these measures will effectively increase the cases where IT users become victims of the respective cyber threats (Appendix A, Figure 3). Negative values indicate a decrease in the effectiveness of applying these measures under such conditions.

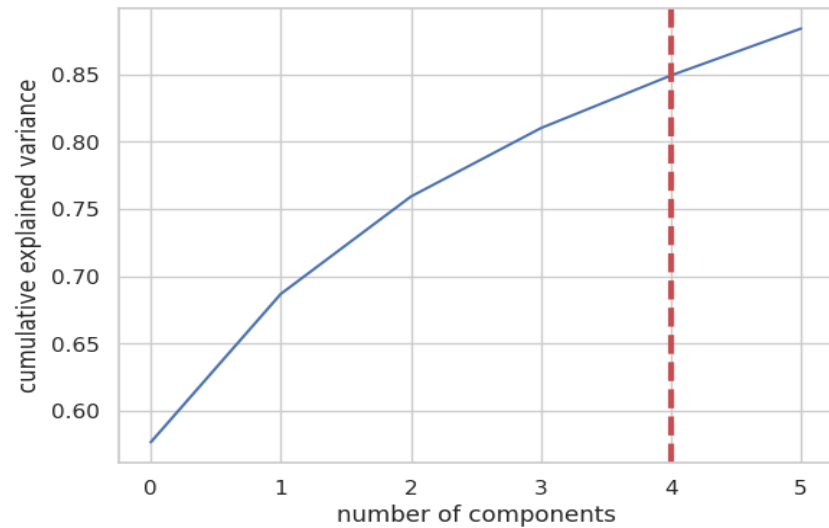
All values are significant when it comes to cybercrime cases. The biggest contribution will be made (Appendix A, Figure 4) by “Misuse of personal information available on the Internet” (|0.6336418|), “Online identity theft” (|-0.4745117|), “Fraudulent credit or debit card use” (|0.374483|), “Data loss due to a virus” (|-0.3130664|), “Identity theft, receiving fraudulent messages or being redirected to fake websites” (|0.2306303|). These variables will strongly influence the responsible behaviour of IT users. Positive values indicate that as cybercrime cases increase, the number of users applying personal security measures will increase. The negative values show feedback. The growth of such cybercrimes affects the decrease in IT users who will install appropriate security measures. It occurs because the security measures in this study that shape the individuals’ responsible behaviour are not effective enough to counter these cyber threats.

The next part of the study defines clusters of countries where the respondents are more or less responsible for personal protection. For this purpose, it was determined whether multicollinearity exists in the array of variables. The calculated value of the determinant of the correlation matrix is equal to $3.8493\text{E-}09$. Its value approaches zero, i.e., there is multicollinearity between the explanatory variables. Accordingly, the calculated value of the Chi-sqr criterion is equal to $\chi^2 = 539.2813$ and exceeds its critical level ($\chi^2_{cr} = 146.5674$), defined for $0.5m(m - 1)$ freedom degrees and significance level $\alpha = 0.05$. It confirms the multicollinearity in the array of variables.

For eliminating and reducing the data dimensionality, the principal component method performed using Python programming was applied. Its results are presented in Figure 3, where it can be seen that the first component explains 57.6619% of the total variation, the second – 11.0215%, the third – 7.2305%, and the fourth – 5.0867%. The other components explain less than 5% of the total variation each. Therefore, the authors decide that the first four components should be chosen for further calculations and justification of clusters, which together explain 81.0006%.

Silhouette Scores were used to determine the potential number of clusters (Figure 4). The results show that the most similar objects correspond to 11 clusters. Since the studied data set

contains observations for 35 countries, using many groups contributed to obtaining those with only one country. Therefore, it was decided to form 9 clusters since this value corresponds to the next highest Silhouette Score. Later, this distribution turned out to be optimal, confirmed by the analysis of average values for each cluster.



	Cumulative Variance Ratio	Explained Variance Ratio
0	0.576619	0.576619
1	0.686833	0.110215
2	0.759139	0.072305
3	0.810006	0.050867
4	0.849109	0.039103
5	0.883951	0.034842

Figure 3. The results of the principal component method.

[Source: calculated by the authors]

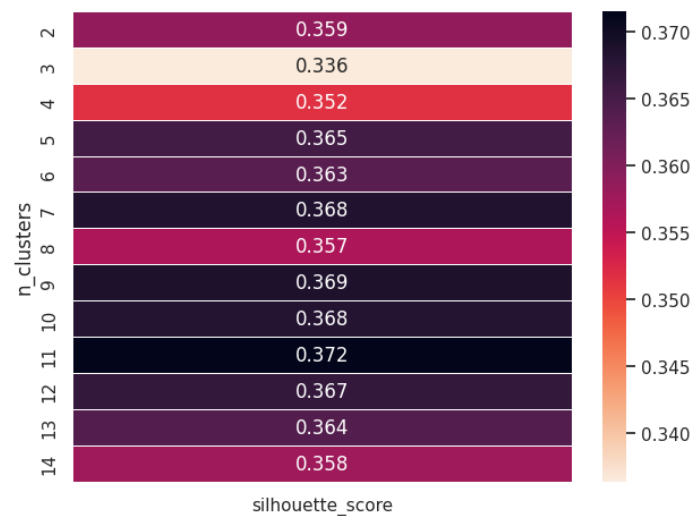


Figure 4. Results of cluster significance assessment using Silhouette Score.

[Source: calculated by the authors]

The Viscovery SOMine analytical package was used to obtain Kohonen maps. Under this process, various methods of its construction were experimentally tested. As a result, a map with 1000 nodes and an automatic ratio of 51:21 was trained. A Normal training schedule with a voltage of 0.5 and temperature of 0.2 was also used. The Ward (hierarchical) method with 9 clusters was chosen as an algorithm for initial clustering. The indicator weights, taken from the canonical analysis results, were set. Based on the given features, clusters of countries were obtained, grouped by the level of responsible behaviour of IT users towards personal cyber protection (Figure 5).



Figure 5. Map of Kohonen.

[Source: calculated by the authors]

The lowest level of responsible behaviour of IT users characterizes the clusters on the right in Figure 5. Thus, the third cluster (C3) includes six countries: Romania, Bulgaria, Serbia, Albania, North Macedonia and Bosnia and Herzegovina (Figure 5, yellow cluster). Analyzing the average values (Appendix B, Table 1), it can be concluded that this group has the lowest level of responsible behaviour of IT users. This means that the respondents from these countries

pay little attention to personal protection in carrying out activities using computers and mobile devices. The first largest cluster (C1) includes eight countries - Montenegro, Lithuania, Greece, Slovenia, Slovakia, Italy, Poland, and Kosovo (Figure 5, turquoise cluster). Their averages (Appendix B, Table 1) show that the number of respondents who used the analyzed personal security tools is more significant than for the third group, i.e., IT users are more responsible for their protection.

The share of respondents from the countries in the left clusters in Figure 5 is the highest, indicating their high level of responsibility for personal cybersecurity. So, cluster 6 (C6) includes three countries – Denmark, Iceland, and Netherlands (Figure 5, pink cluster), cluster 8 (C8) – United Kingdom and Norway (Figure 5, blue cluster), cluster 9 (C9) – Finland and Austria (Figure 5, brown cluster). Their average values (Appendix B, Table 1) for most indicators are the highest, confirming the conclusion about the high level of responsible behavior of IT users from these countries.

As for the other clusters, closer to the centre of Figure 5 (green cluster – C4, red cluster – C2, purple cluster – C5, olive cluster – C7), they are characterized by moderate behaviour of individuals regarding personal cyber protection. This conclusion is confirmed by the average values for each indicator under the created group (Appendix B, Table 1).

The authors analyze the Kohonen maps for each of the selected indicators. The map generated for “Using a simple login with username and password” (Appendix C, Figure 5a) shows an exemplary distribution by clusters. IT users from Norway, Great Britain, the Netherlands, Iceland, the Czech Republic and Germany prefer this tool. Respondents from the third cluster and Montenegro countries use this security measure less actively. Figure 5b in Appendix C shows the behaviour for “Using a social media login”. According to this indicator, the distribution is uneven for some clusters. For example, in the first cluster, respondents from Kosovo preferred this protection method more than respondents from other countries. Users from Luxembourg and Belgium have diametrically different attitudes towards the use of this measure for working on the Internet.

The map showing the distribution of clusters according to the indicator “Using a security token” (Appendix C, Figure 5c) also has certain exceptions for Croatia, Luxembourg, Montenegro, Malta, etc. This type of cyber protection is most popular among IT users in Norway. It is the least popular for the third cluster countries. Such discrepancies indicate that this tool is quite specific, and perhaps not enough people are ready to use it for security purposes. Figure 5d of Appendix C shows the behaviour regarding using an electronic identification certificate or card with a card reader or an app. The results of distribution by clusters are also heterogeneous. It can be clearly observed in Iceland, Sweden, Estonia and Lithuania. Although this security measure is quite famous for calculation in various Internet services, for the respondents from most countries, there is no suitable application for personal protection.

The map created for “Using a procedure involving the mobile phone” (Appendix C, Figure 5e) shows a reasonably weighted distribution by clusters, clearly visible in the example of the sixth and eighth clusters countries, using this security measure the most. It is the least popular for residents of the third cluster. Figure 5f of Appendix C shows the behaviour for “Using a single-use PIN code list or random password characters”. The colour gradation of the map indicates the uneven application of this measure for most clusters. Residents of Denmark and Finland give the greatest preference to its use. IT users in the vast majority of countries limit

the use of this security measure, possibly due to the difficulty to remember complex random passwords and the loss of further access to their account.

The map showing the distribution of clusters according to the indicator “Using other electronic identification procedures” (Appendix C, Figure 5g) shows some exceptions for the Netherlands, Spain, Denmark and Hungary. In general, a situation shows the unpopularity of other security measures. In most cases, IT users apply well-known traditional tools; a relatively low percentage try to use other additional ones. Figure 5h of Appendix C shows the behaviour of using at least four identification procedures. The colour distribution of the map indicates the uniformity of this security measure in the middle of individual clusters. At the same time, it is preferred by Iceland, the Netherlands, Denmark, Norway and Great Britain residents. The lowest level of responsibility in this case is demonstrated by IT users of countries belonging to the third cluster.

Figure 6a of Appendix C shows the behaviour of individuals who know that cookies can be used to trace people's online movements. The colour gradation of the map indicates a good balance of the distribution of values for most clusters. This type of behaviour is one of the popular activities among others. It is preferred by respondents from those countries that belong to high-responsibility clusters. It is the least popular among users of the third cluster. The map shows a fairly even distribution for the indicator “Changing the settings in the internet browser to prevent or limit cookies on any devices” (Appendix C, Figure 6b). But some clusters have intra-group differences, for example, fifth, seventh, sixth and ninth.

The map in Figure 6c of Appendix C shows the cluster distribution according to the “Using software that limits the ability to track the activities on the Internet” indicator. Generally, it shows a balanced formation of clusters, although there are exceptions for Belgium, Malta and Cyprus. At the same time, this tool is the most popular among individuals from Belgium and the least - from Cyprus. If we compare this measure with others, users give it a much lower preference than “Using a simple login with username and password”, “Using a procedure involving the mobile phone,” or “Individuals know that cookies can be used to trace the movements of people on the Internet”. Figure 6d of Appendix C shows the distribution by group for “Reading privacy policy statements before providing personal data”. Most respondents from Finland, Austria, Germany, and Cyprus chose this type of protection. Not preferred by IT users from Luxembourg, Belgium and Albania.

Figure 6e of Appendix C demonstrates the behaviour of individuals who restrict or refuse access to the geographical location. The colour gradation of the map shows a fairly even distribution of values for most clusters. This security measure is preferred by users of countries grouped into clusters with the highest responsibility. It is not famous for clusters with a low level of responsible behavior. The map in Figure 6f of Appendix C characterizes the distribution according to the indicator “Limiting access to profiles or content on social networking sites or shared online storage”. Some clusters have within-group differences, such as the third, fourth, and ninth. In general, this security measure is quite popular among IT users of different countries.

The map in Figure 6g of Appendix C refers to the behaviour of individuals to reject of using personal data for advertising purposes. One should be noted the balanced distribution of countries by this type of personal cyber protection, but there are exceptions for Iceland, Kosovo and Latvia. This measure is famous for the countries of the left-hand cluster (Figure 5) and the Germany-Cyprus-Croatia sector. The countries of the third cluster do not prefer it. Figure 6g

of Appendix C demonstrates the behaviour of individuals who check the website's security where personal data is provided. IT users in the Netherlands apply this tool more often than others. Respondents from Albania prefer him less than individuals from other countries.

DISCUSSION

The issue of cybersecurity behaviour is an understudied area of research to date, as evidenced by Oliveira & Baldi (2022). But despite the limited information on this problem, Pollini et al. (2022) believe that human components of sociotechnical systems are its weakest and most vulnerable component. Therefore, their responsible behaviour in the computer environment affects the level of personal, corporate or state cybersecurity. This statement is synchronized with the obtained results of this article. Although there are many best practices today, IT users' application of the most effective security and privacy methods remains relatively low (Krsek et al., 2022).

People's awareness of cyber threats strongly influences proactive cybersecurity behaviour, especially after the global pandemic (Alsmadi et al., 2022). Therefore, increasing the level of responsible behaviour should occur for different population categories. Witsenboer et al. (2022) investigated the issue of personal cybersecurity in the school system, and based on the results, they suggested that cybersecurity education should start in elementary school, as the lack of relevant knowledge can affect them and the organization to which they belong. Also, students' awareness of cyber threats and risks has a positive effect in situations where students become targets of cybercrimes (Mohammed & Bamasoud, 2022). Older people tend to share their passwords, which creates a favourable environment for cyber criminals (Patel & Doshi, 2022). Therefore, this category of IT users needs unique approaches for forming special knowledge on personal cyber protection.

As for businesses and government institutions, the formation of responsible user behaviour should become vital in ensuring cyber protection. Boritz et al. (2022) proved that employees who are accountable for cybersecurity are less likely to become victims of cyber crimes. At the same time, bank employees are more susceptible to phishing than employees of professional services companies. Also, highly motivated public institution employees with a high level of responsiveness and self-efficacy contribute to ensuring reliable information protection (Sulaiman et al., 2022).

To increase the level of responsibility, it is vital to promote users' motivational behaviour to protect themselves and companies from cyber threats (Li et al., 2022). One should also be aware that a person's activities on the Internet can have a digital footprint that can lead to distortion of information about him and help cybercriminals (Nicol et al., 2022). Therefore, cyber hygiene should be observed, i.e. changing passwords, updating software, limiting the disclosure of personal information on social networks, etc. (Schoenherr & Thomson, 2021). Since not only individuals but also companies must be responsible for the security of their customers' data, protection methods must evolve towards using more reliable and advanced technologies. For example, the individual characteristics of a person typing on a keyboard, moving a cursor using a mouse, trackball, touchpad, etc., are unique and difficult to steal (Nnamoko et al., 2022). Therefore, implementing biometric technologies in online and mobile applications will reduce users' vulnerability to cyber criminals. For easy perception of

cybersecurity information, it is possible to use computer games to teach different categories of the population about personal protection (Hwang & Helser, 2022). Although the level of cybersecurity is formed under the influence of many factors, the responsible behaviour of IT users may be the critical aspect that will create favourable or unfavourable conditions for developing cybercrime.

CONCLUSIONS

The consequences of Industry 4.0 have had a positive impact on the life of society, which is manifested in the economic growth of the countries, increasing business efficiency, and improving the quality of individuals' lives. The results of the literature review confirm these facts. But scientific and technical progress also causes cybercrime, showing in the illegal appropriation of personal and financial information, violation of the software and technical support functioning. Therefore, the issue of ensuring cybersecurity is relevant for IT users, companies, and the government. In this research, it is stated that in the processes of digitization and informatization, a person is a crucial link, and his behaviour in the computer environment affects the level of cyber protection. The more responsible an individual is about cyber safety, especially personal security, the less likely he is to become a cyber victim.

The article, based on a survey of IT users from the European Union, confirmed the existence of a high correlation between cybercrime cases and indicators characterizing the responsible behaviour of individuals. At the same time, the impact of cybercrime cases is more significant on the choice of security measures. The number of users applying personal security measures will increase with growing cybercrime cases. All variables characterizing cases of cybercrimes proved essential for the respondents, indicating the expansion of cyber threats and the increase in the types of cyber victims. The authors found that the most significant contribution to the responsible behaviour of IT users will be made by such security measures as using at least four identification procedures and a procedure involving the mobile phone, restricting or refusing access to the geographical location, limiting access to profile or content on social networking sites or shared online storage, checking the security of the website where personal data is provided, understanding that cookies can be used to trace movements of people on the Internet. The results showed a slight influence of such variables as using other electronic identification procedures, single-use PIN code lists or random characters of a password, the software that limits the ability to track the activities on the internet, electronic identification certificate or card with a card reader or an app, simple login with username and password and refusing to allow the use of personal data for advertising purposes. The obtained results will enable us to conclude that the growth of cybercrimes determines the choice of security measures, and their application will not guarantee the complete freedom of IT users from various types of cyber threats.

The second part of the study concerned the construction of Kohonen maps to identify regions characterized by the responsible or irresponsible behaviour of individuals to ensure personal cyber protection. As a result, 9 clusters were identified and substantiated using Silhouette Scores. Romania, Bulgaria, Serbia, Albania, North Macedonia and Bosnia and Herzegovina are countries whose respondents' behaviour can be characterized as the least responsible. IT users of Montenegro, Lithuania, Greece, Slovenia, Slovakia, Italy, Poland, and

Kosovo behave more responsibly concerning personal cyber protection than the respondents of the previous cluster. Still, they can also be classified as those who need to be more attentive to cybersecurity. It was found that a high level of responsible behaviour is characteristic of IT users from Denmark, Iceland, the Netherlands, the United Kingdom, Norway, Finland and Austria. The reliability of the cluster analysis is confirmed by the study of average values and the distribution of each type of individual cyber activity in the clusters.

The obtained results may be of interest primarily to international organizations engaged in developing a sustainable development strategy to ensure a safe and reliable cyberspace for the entire world, as well as for countries, businesses, and individuals. Also, they can become the basis for improving the population's digital and cyber literacy programs, which are developed and implemented by educational institutions and relevant centres engaged in professional development and training.

The main limitation of this study is obtaining survey data from respondents. The article is localized with the results provided by the European Commission, so it is impossible to conclude the behaviour of IT users from other countries. Also, the range of cybercrime cases and personal cyber protection tools that shape the appropriate behaviour of individuals is represented only by official data. It does not allow the conclusion about the different categories of respondents and consider various aspects of the IT users' responsible behaviour, which include psychological, social, economic, and other factors.

It is advisable to focus future research on studying the following questions. Firstly, a potential direction is the assessment of risks associated with non-compliance or inappropriate application of personal protection measures and identification of expected consequences for IT users. Emphasis should be placed on different groups of individuals - ordinary users, company employees, decision-makers, officials, etc. The obtained results will contribute to the formation of more precise preventive measures that will reduce the risk of cyber threats in a specific situation. Secondly, the next direction is the study of psychological and social factors that can affect the vulnerability of IT users, for example, emotional state, level of education, communication activity in social networks, level of digital and cyber literacy, trust in outsiders and their actions, etc. The potential results will identify the most critical factors for IT users that cybercriminals can use in the process of cybercrime. This knowledge should be taken into account, for example, by representatives of e-commerce or banks in the process of improving security measures in online or mobile applications.

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Appendix A

Results of factor structures and canonical weights

Variable	Factor Structure, right set							
	Root 1	Root 2	Root 3	Root 4	Root 5	Root 6	Root 7	Root 8
Using a simple login with username and password	0.7275	0.0062	0.2535	0.1502	0.1615	-0.1639	0.1353	-0.0983
Using a social media login	0.7418	0.0123	-0.0435	0.0706	-0.0852	-0.1544	-0.3002	-0.0818
Using a security token	0.6852	-0.1391	0.4003	0.0295	-0.1462	0.1254	0.0780	-0.3447
Using an electronic identification certificate or card with a card reader or an app	0.6107	0.0216	-0.1726	0.2098	0.0914	0.1279	0.1832	0.2248
Using a procedure involving the mobile phone	0.8404	-0.1283	0.1629	0.1178	0.0791	-0.0733	-0.0379	-0.0975
Using a single-use PIN code list or random characters of a password	0.5952	0.2725	-0.2600	0.2596	-0.1724	-0.1978	-0.0605	-0.2053
Using other electronic identification procedures	0.5866	-0.0468	-0.1715	-0.0653	-0.1044	-0.4235	-0.1569	-0.3725
Using at least 4 identification procedures	0.9480	0.0064	0.0099	0.0974	-0.1696	-0.0917	0.0058	-0.0201
Individuals know that cookies can be used to trace the movements of people on the Internet	0.6780	0.0450	-0.0971	0.1870	-0.0811	0.1644	0.2527	-0.3110
Changing the settings in the internet browser to prevent or limit cookies on any devices	0.5163	0.1489	0.1407	0.3938	0.0139	-0.1462	0.2759	-0.1350
Using software that limits the ability to track the activities on the Internet	0.6442	-0.0549	0.0247	0.1999	-0.0910	-0.1836	0.0086	-0.1967
Reading privacy policy statements before providing personal data	0.1724	0.4170	0.3114	-0.1211	-0.0349	0.0095	0.2183	-0.4352
Restricting or refusing access to the geographical location	0.7421	0.2999	0.0883	0.0016	0.0046	0.1472	-0.0451	-0.0088
Limiting access to profiles or content on social networking sites or shared online storage	0.5173	0.0812	0.1681	0.1675	-0.1764	0.1213	-0.2000	-0.3251
Rejection of using personal data for advertising purposes	0.5362	0.1853	0.0816	0.2721	-0.1379	0.0887	-0.0739	-0.2948
Checking the security of the website where personal data is provided	0.6239	-0.1538	0.1830	0.3393	-0.1617	-0.0302	-0.0634	-0.1773

Figure 1. Factor structure of the right set characterizing the IT users' responsible behavior.

[Source: calculated by the authors]

Variable	Factor Structure, left set							
	Root 1	Root 2	Root 3	Root 4	Root 5	Root 6	Root 7	Root 8
Fraudulent credit or debit card use	0.8398	-0.0549	-0.1020	-0.1618	-0.3889	-0.2090	0.0037	-0.2453
Online identity theft	0.6504	-0.0228	0.4616	0.1571	-0.5029	-0.2055	-0.1332	-0.1606
Phishing	0.7750	0.3117	0.1648	0.2857	0.0522	0.1517	-0.1138	-0.3934
Pharming	0.7702	0.0133	0.2890	-0.1289	-0.4248	0.2528	-0.0852	-0.2341
Misuse of personal information available on the Internet	0.7648	-0.0175	0.2964	-0.0970	-0.0893	-0.3698	0.3882	0.1486
Social network or e-mail account being hacked	0.5812	-0.5956	0.3507	0.2777	0.0449	-0.0289	-0.1437	-0.2897
Data loss due to a virus	0.1008	-0.2835	0.0179	-0.1569	-0.2469	-0.3174	0.8248	-0.2062
Identity theft, receiving fraudulent messages or being redirected to fake websites	0.8285	0.0016	-0.2763	0.3125	-0.2698	0.2546	0.0258	0.0368

Figure 2. Factor structure of the left set characterizing cases of cybercrime.

[Source: calculated by the authors]

Variable	Canonical Weights, right set							
	Root 1	Root 2	Root 3	Root 4	Root 5	Root 6	Root 7	Root 8
Using a simple login with username and password	0.0651	0.0869	0.0363	0.3738	1.0141	-0.7187	-0.0951	0.0064
Using a social media login	0.1782	0.3464	0.0815	0.3232	0.5801	0.2880	-0.5661	0.0417
Using a security token	0.1688	0.1573	0.4065	0.6672	1.1148	0.8591	-0.3190	-0.9391
Using an electronic identification certificate or card with a card reader or an app	-0.0410	0.5157	-0.5853	1.2713	1.4733	0.5971	-0.2054	-0.5930
Using a procedure involving the mobile phone	0.3602	-0.7199	0.3399	-0.4942	0.8296	0.3046	-0.4228	-0.2041
Using a single-use PIN code list or random characters of a password	0.0087	0.4143	-0.8250	1.1622	0.9228	0.2255	-0.2568	-0.7530
Using other electronic identification procedures	-0.0043	-0.1619	-0.5994	-0.4002	0.9391	-0.6570	-0.2051	-0.7557
Using at least 4 identification procedures	0.3972	0.1799	0.9708	-1.7964	-4.9879	-1.3866	0.8463	2.3949
Individuals know that cookies can be used to trace the movements of people on the Internet	0.2342	-1.1448	-1.1725	-0.9201	-0.1718	0.8631	1.2506	-0.4715
Changing the settings in the internet browser to prevent or limit cookies on any devices	-0.0985	0.4340	1.0568	0.2539	0.0320	-0.6453	0.0728	0.3060
Using software that limits the ability to track the activities on the Internet	-0.0191	-0.1229	-0.1019	-0.0986	-0.3712	-0.3548	0.1609	-0.4599
Reading privacy policy statements before providing personal data	-0.1552	0.5593	0.2738	-0.2357	-0.4510	-0.1980	0.8739	-0.3032
Restricting or refusing access to the geographical location	0.3515	0.2555	-0.3204	-0.7235	1.5855	0.7127	0.0093	0.3431
Limiting access to profiles or content on social networking sites or shared online storage	-0.2733	-0.2203	0.6234	-0.4786	-0.4317	0.0656	-1.6637	-0.9600
Rejection of using personal data for advertising purposes	0.0404	1.5063	0.2425	1.0828	-1.0620	-0.0239	-0.7246	0.5950
Checking the security of the website where personal data is provided	-0.2598	-1.3011	-0.5101	1.1490	0.2125	0.2024	1.2212	0.3140

Figure 3. Canonical weights for the right set characterizing the IT users' responsible behavior

[Source: calculated by the authors]

Variable	Canonical Weights, left set							
	Root 1	Root 2	Root 3	Root 4	Root 5	Root 6	Root 7	Root 8
Fraudulent credit or debit card use	0.3745	-0.1452	-1.2003	-0.9257	0.0359	-1.1507	-0.8632	-0.7419
Online identity theft	-0.4745	0.3961	0.5340	1.2503	-1.3537	-0.8327	-0.2824	0.0917
Phishing	0.1466	0.9631	0.0993	0.4957	0.7107	-0.0994	0.3000	-1.1193
Pharming	0.1599	-0.1874	0.7936	-1.3122	-0.2376	1.6642	0.2402	0.0869
Misuse of personal information available on the Internet	0.6336	0.1453	0.5347	-0.4704	0.8055	-0.2516	0.3073	1.1667
Social network or e-mail account being hacked	0.1949	-1.1461	0.1512	0.1183	0.5834	0.0643	-0.2493	-0.2005
Data loss due to a virus	-0.3131	-0.0834	-0.0183	0.3491	-0.4064	0.1417	1.0377	-0.7364
Identity theft, receiving fraudulent messages or being redirected to fake websites	0.2306	-0.2105	-0.6307	1.0219	-0.5209	0.5359	0.3577	0.7995

Figure 4. Canonical weights for the left set characterizing cybercrime cases
 [Source: calculated by the authors]

Appendix B

The calculated average values of indicators

Table 1. Average values of the indicators in accordance with the cluster profile.

Indicator	C1*	C2	C3	C4	C5	C6	C7	C8	C9
Using a simple login with username and password	65.3700	76.4200	46.2200	70.7000	71.1400	84.3600	71.3100	89.4200	74.0400
Using a social media login	32.7300	37.2100	20.1600	42.6600	28.7000	46.6400	36.8300	49.4700	30.2000
Using a security token	15.3000	13.0600	4.2800	24.1400	15.6500	29.5600	23.2400	58.0000	6.6200
Using an electronic identification certificate or card with a card reader or an app	14.5800	27.9400	2.3300	32.9400	10.7200	65.8900	44.8200	22.8500	12.4000
Using a procedure involving the mobile phone	31.5000	55.7200	12.0800	52.6000	34.5300	76.8400	42.2100	73.7800	57.1700
Using a single-use PIN code list or random characters of a password	13.0100	13.5400	2.7100	20.2800	10.2200	44.6000	12.1500	32.9600	38.5400
Using other electronic identification procedures	5.4500	8.1800	1.8300	11.5900	3.0900	16.4500	5.4000	13.7100	7.1600
Using at least 4 identification procedures	15.0400	22.9200	2.9400	33.2000	13.1600	58.0500	25.4900	48.2100	18.6500
Individuals know that cookies can be used to trace movements of people on the Internet	50.9700	62.4000	34.4000	64.1000	74.3000	84.4600	70.1800	78.5000	80.3500
Changing the settings in the internet browser to prevent or limit cookies on any devices	22.2700	27.4500	14.8400	28.0000	27.7100	37.3800	35.6000	30.4200	43.8900
Using software that limits the ability to track the activities on the Internet	15.9000	14.3100	8.2500	22.1400	11.4500	27.3600	34.0500	25.9000	17.5100
Reading privacy policy statements before providing personal data	37.4500	37.6800	29.0400	40.0400	46.7700	40.0500	22.0800	40.0300	50.1700
Restricting or refusing access to the geographical location	31.0000	37.7000	24.4100	52.1800	49.2400	71.1500	35.9000	56.8500	63.6300
Limiting access to profiles or content on social networking sites or shared online storage	25.3700	36.6500	13.1500	47.7300	44.6100	51.2400	28.6900	41.0300	55.1600
Rejection of using personal data for advertising purposes	31.4100	41.6600	16.4000	50.2400	57.5500	59.8000	39.4800	51.0400	65.2000
Checking the security of the website where personal data is provided	20.0400	40.0000	6.6700	43.5200	31.2000	49.9300	23.3200	43.3200	42.5500

*C means a cluster

[Source: calculated by the authors]

Appendix C

Kohonen maps

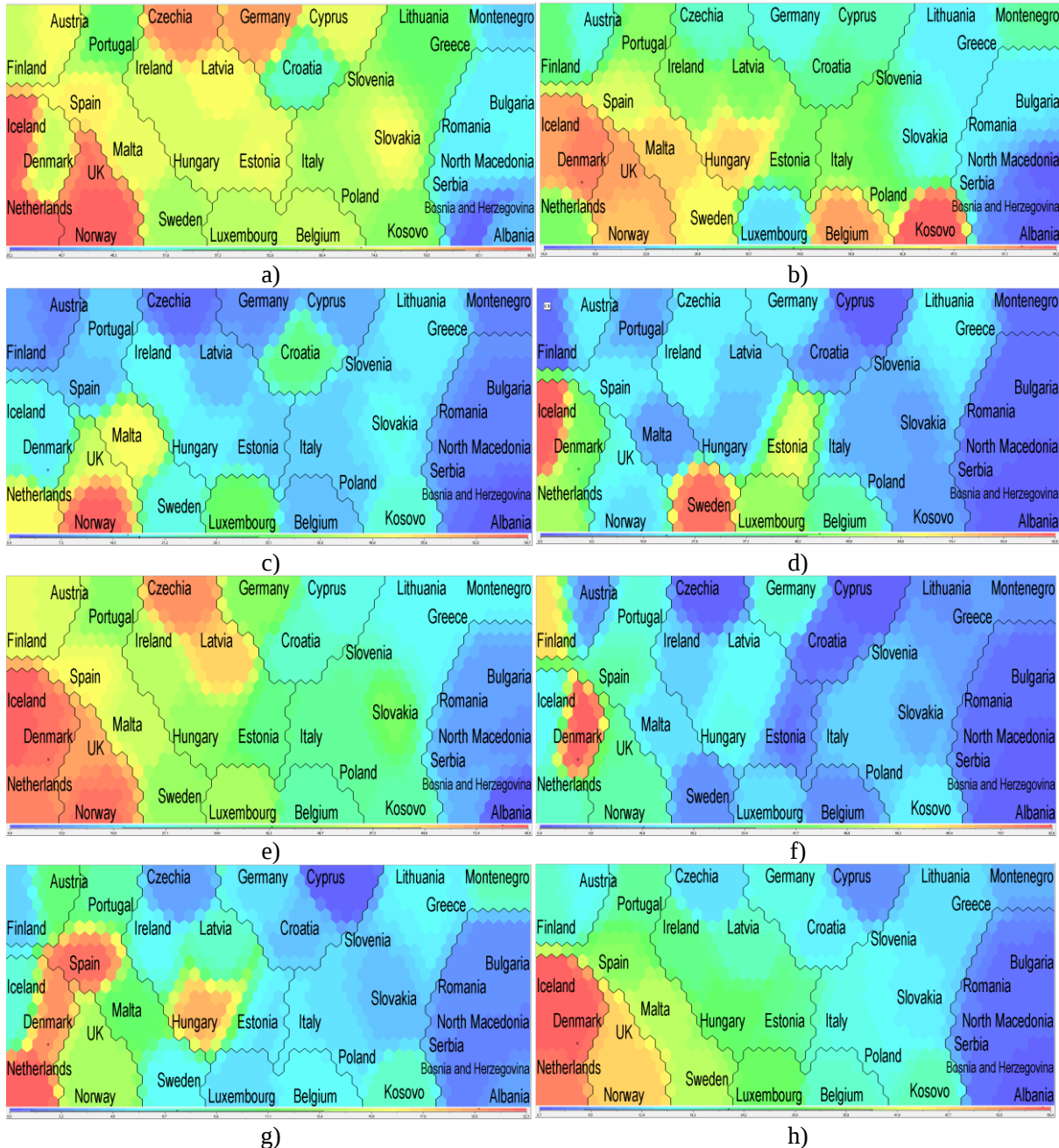


Figure 5. Kohonen maps for indicators characterizing the responsible behaviour of IT consumers: a) Using a simple login with username and password; b) Using a social media login; c) Using a security token; d) Using an electronic identification certificate or card with a card reader or an app; e) Using a procedure involving the mobile phone; f) Using a single-use PIN code list or random characters of a password; g) Using other electronic identification procedures; h) Using at least 4 identification procedures. [Source: calculated by the authors]

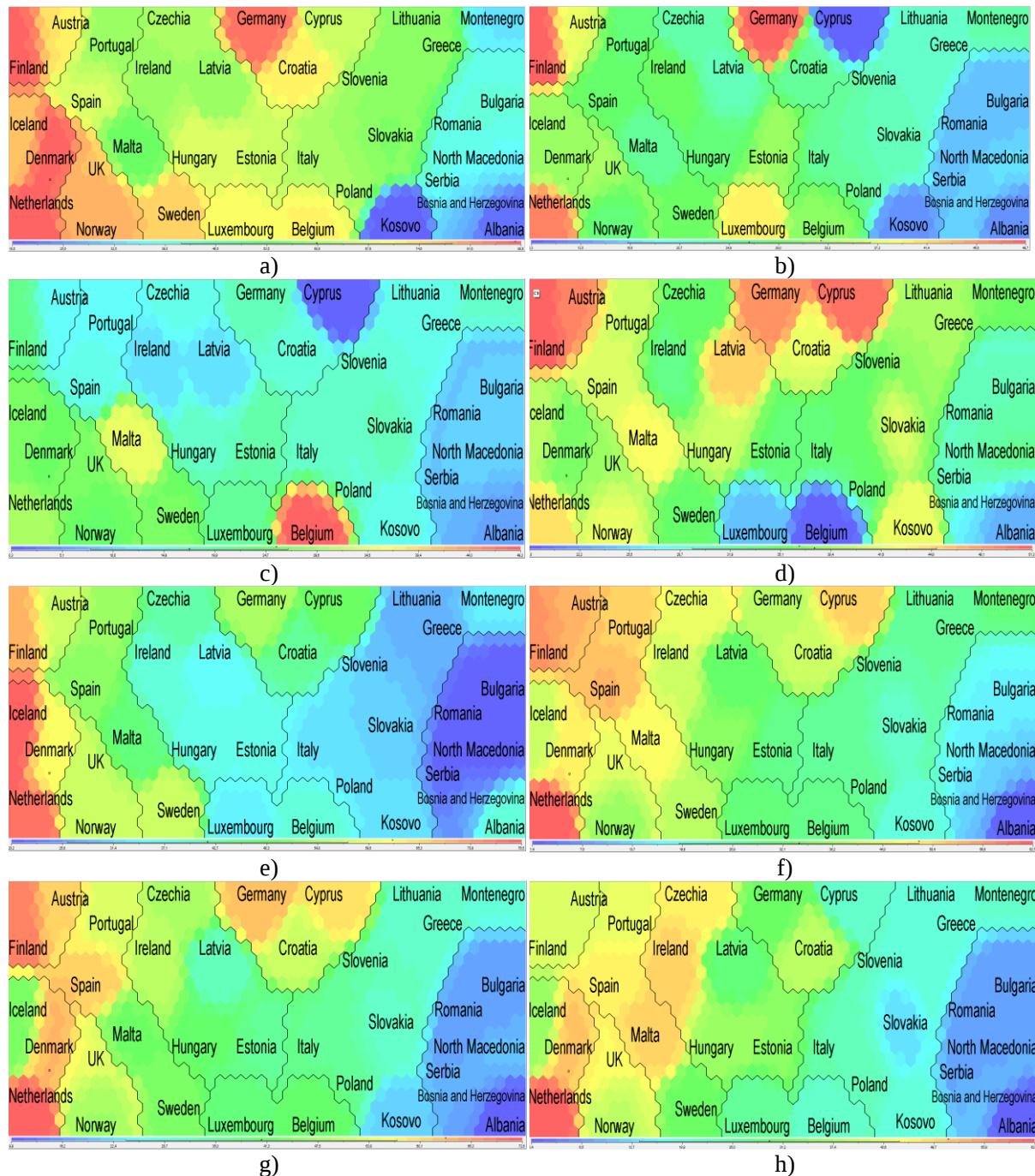


Figure 6. Kohonen maps for indicators characterizing the responsible behaviour of IT consumers: a) Individuals know that cookies can be used to trace the movements of people on the Internet; b) Changing the settings in the internet browser to prevent or limit cookies on any devices; c) Using software that limits the ability to track the activities on the Internet; d) Reading privacy policy statements before providing personal data; e) Restricting or refusing access to the geographical location; f) Limiting access to profiles or content on social networking sites or shared online storage; g) Rejection of using personal data for advertising purposes; h) Checking the security of the website where personal data is provided.

[Source: calculated by the authors]

IT SOFTWARE PURCHASE DECISIONS IN TERMS OF BUSINESS CUSTOMER EXPERIENCE

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Abstract: The aim of this study is to compare experience of customers making decisions in teams and individually during the process of purchasing IT software supporting management processes in their organization. The research sample consisted of 114 companies from all over Poland that purchased management-supporting software in the last 3 years. Quantitative research method was used to achieve the adopted research objective. A questionnaire was applied as a research tool, while Mann-Whitney U test - was used to determine differences in experience levels. This article refers to the models of organizational behavior, paying special attention to group and individual factors that business customer experience. The research results show that the experience of people who decide to purchase software as a team is better at all stages of the decision-making process compared to the experience of people making decisions individually. The collected research material, and, above all, the conclusions drawn from it, contribute to the knowledge about the quality of business customer experience in the IT sector, and outline the differences in the quality of such experience between those making decisions in the organization in a team and in an individual manner.

Keywords: *organizational buyer behavior, customer experience, IT software.*



INTRODUCTION

Over the last two decades, research related to customer experience, understood as a multidimensional construct focusing on cognitive, emotional, behavioral, sensory and social customer responses to the company's sales activities, has gained importance (Lemoni and Verhoef, 2016). Rawson, Duncan, and Jones (2013) noted that organizations that efficiently manage customer experience achieve greater revenues and employee satisfaction, but most of all, better customer satisfaction. Moreover, Klaus (2015) emphasizes greater customer loyalty and the WoM (Word of Mouth) effect in his research.

Nevertheless, it should be noted that the customer experience surveys conducted so far have mainly adopted a consumer perspective (Hirschman and Holbrook, 1982; Homburg, Jozić and Kuehn, 2017; Pine and Gilmore, 1998). Few researchers have investigated the issues of business customer experience (Mikolan et al., 2015). Which is surprising, in the light of the complexity of factors influencing purchasing decisions in business markets.

The aim of this study is to compare the experience of customers making decisions in teams and individually when purchasing IT software supporting management processes in their organization.

The collected research material, and, above all, the conclusions drawn from it, contribute the knowledge about the quality of business customer experience in the IT sector, and outline the differences in the quality of such experience between those making decisions in the organization in a team and in individual manner.

The research sample consisted of companies 114 companies from all over Poland that purchased software supporting management processes in the last 3 years. Quantitative research method was used the adopted research objective. A questionnaire was applied as a research tool, while Mann-Whitney *U* test- was used to determine differences in experiment levels.

This article starts with a theoretical section which presents the factors influencing the purchasing behavior of the organization, and then outlines the stages of the purchase decision-making process. The following parts contain a description of the research methodology and research conclusions. The article ends with a discussion referring back to the set research goal.

THE ESSENCE OF BUSINESS CUSTOMER EXPERIENCE

There is no consensus among researchers regarding the precise definition of business customer experience. Lemon and Verhoef (2016) define business client experience in a holistic approach as a multidimensional construct focusing on the cognitive, emotional, behavioral, sensorial and social reactions of the client to the company's offers and activities. Klaus and Maklan (2012) emphasize in their research that customer experience has both an emotional and functional dimension, and includes the assessment of use value and the social context of the customer. It should be noted that researchers investigating customer experience collectively underscore that experience manifest at various points across three stages of the purchasing process: pre-purchase, purchase and post-purchase. Moreover, Court et al. (2009) refers to customer decisions made in digital realm and introduce three phases of the customer

journey known as the "loyalty loop". In this way, the researcher emphasizes the importance of client experience in each subsequent phase, and interprets the transition between the phases as a positive assessment of the client (Court et al., 2009).

The pre-purchase stage covers customer experience from the initial recognition of a need to the considering satisfying that need with a purchase. Biggemann et al. (2013), emphasizes in his research the importance of informal discussions between the customer and the supplier in order to understand business goals and priorities. The degree of formalization of the information exchange between the customer and the supplier as well as the importance of trust is emphasized by Zaheer (2006). In turn, Court et al. (2009) point out that in the era of developed communication channels, the client engages in searching for information, especially online, and is often guided by the opinions of other buyers posted there. Klaus (2015) believes that from the customer's point of view, during the first stage of the journey, the attributes related to the way products are presented, the behavior of front-line employees, and the quality of the offer, are important. The above-mentioned factors reflect the brand image and influence the customer's decision to continue cooperation at the next stages of the purchase decision-making process. Klaus (2015), in his works, differently than others, describes the first stage of the purchasing process as "experience with the brand".

Van Weele (2002) observes that during the purchasing stage, the customer primarily provides information about their activities and current needs to make the right supplier choice. Other researchers emphasize the importance of business relations and the quality of interaction with the customer, which can significantly prevent customer information overload and support the decision-making process. Court et al. (2009) emphasize in his research that personal contact and the use of various communication channels are important for a business client. It should be emphasized here that the purchasing stage is the most recognizable and often considered the most important stage in the process of making a purchase decision by a business client. It is also referred to as the negotiation stage between the customer and the supplier and is related in particular to the price conditions (Tuli et al., 2007). This approach underscores treating purchases made by the organization as based mainly on rational arguments. A different opinion is presented by Klaus (2015), who regards purchasing decisions as an outcome of the customer's prior experience with the brand (understood as the first stage) and are an equivalent construct of rational and emotional arguments. The researcher draws attention to the essence of such elements as the ease of contact between the customer and the supplier through various communication channels and the need to create personal relations between the customer and the staff during in-person interactions.

The purchasing behavior of business customers at the post-purchase stage, including use, consumption and service requests, has a significant impact on customer satisfaction. The product itself becomes a critical point of contact at this stage. The more extensive and more strategic the exchange, the greater the number of interactions and actors involved at different hierarchical levels of the client's organization (Kowalkowski and Ulaga, 2017). Klaus (2015) emphasizes in his research that activities at the post-purchase stage, such as maintaining contact with the customer and solving emerging problems with the use of the product, are important in the context of purchasing decisions as well as in the case of positive opinions about the supplier.

The concept of the purchasing process stages proposed by Klaus (2015) is a comprehensive construct that exposes the nature of experiences, based on both emotional and

rational aspects of business customer purchasing decisions, as well as proposes specific variables to study these experiences. Due to these reasons, this approach will be used in this article in the research part.

GROUP AND INDIVIDUAL FACTORS IN ORGANIZATIONAL PURCHASING BEHAVIOR

Robinson et al. (1967) divided the purchases made on the B2B market into: rebuy, modified buy, and completely new buy. The more innovative the purchase, the greater the uncertainty and the more people involved in the purchase decision. The same authors emphasized the importance of three fundamental dimensions of the B2B purchasing: the type of purchase, the stages of the purchasing decision-making process and the roles played by people in the purchasing center. On the other hand, Webster (1984) mentioned important models that applied to a wide spectrum of organizational purchases, and identified the most important variables in the process and the relations between them. Among the selected ones are: Sheth (1973), Choffray and Lilien (1978) as well as Webster and Wind (1972). Sheth (1973) in his research on organization purchasing decisions primarily focused on variables describing the behavior of an individual in a purchasing team and the sources of decision conflicts in teams. Choffray and Lilien (1978) proposed a model that essentially focused on the composition and interaction of purchasing group members that formed the purchasing center in the organization. The authors of the model emphasized the fact that organizations with similar needs, but with a different composition of the purchasing center, acquire different products due to differences in the behavior of team members. On the other hand, Webster and Wind (1972) developed a model of organization purchasing behavior based on four types of factors: environmental, organizational, group interactions and individual behavior of individuals in a group. These model's author's concur and emphasize that the purchasing behavior of an organization involves a complex process involving many people at various levels of the organization.

Purchasing centers play a significant role in resolving issues and attaining purchasing objectives within an organization. They don't necessarily need to be a formally designated entity; rather, they constitute a collection of roles performed by various individuals across different purchases. In the context of business customer purchasing decision processes, there exist five typical roles: user, influencer, decision-maker, buyer, and gatekeeper (Webster and Wind, 1972). Purchasing center members collectively make decisions employing one of several principles: weighted probability, proportionality, unanimity, or acceptability (Choffray and Lilien, 1978). As evidenced in literature on the topic, the significance of the group factor grows in tandem with the complexity of the purchasing issue and the level of novelty associated with the purchase within the organization. According to the group dynamics model, the purchasing team may, in a situation of threat or uncertainty, develop an internal functional structure, which will enable the achievement of goals and facilitate understanding of the task by team members (Schindler, 1957).

Individual purchasing decisions within an organization are typically associated with rebuying or minimally modified purchases. While Webster and Wind (1972) underscore that team members ultimately make decisions individually, their support can be crucial for the

quality of decisions, particularly in the case of intricate or novel purchases. Within the scope of this article, such support has a direct bearing on the business customers' experience. Moreover, in a situation where the environment of the organization is changeable and the environmental factors shaping it are difficult to predict, making decisions individually becomes risky for both the decision-maker and the entire organization.

METHODS

The aim of this study is to compare the experience of customers making decisions in teams and individually when purchasing IT software supporting management processes in their organization. The research hypothesis is as follows: there is a significant difference in the business customer experience who make purchasing decisions in a team, and those who make them alone (individually).

The research was carried out using the quantitative method. The research sample consisted of 120 companies that in the last 3 years purchased software supporting management processes in various areas of the company's operations (finance, sales, marketing, logistics, production). The surveyed entities were people who participated in the decision-making process of purchasing software in the surveyed company. After conducting the research, 114 correctly completed questionnaires were obtained and analyzed using the StatSoft (statistica software).

For the purposes of achieving the above goal, the Customer Experience Quality measurement method was used. EXQ measures customer experience in three dimensions: "brand experience", "experience at the purchase stage" and "post-purchase experience" (Klaue, 2015). Respondents rate their impressions on a 7-point scale (1 = strongly disagree, 7 = strongly agree) or as Don't know/Not applicable. The Customer Experience Quality method was chosen to measure the experience of respondents as it assumes that, in order to obtain a comprehensive picture of both C2C and B2B customer experiences, measurement should be made at all three stages of the purchasing process described by Howard-Sheth (1973). Hence, EXQ includes variables describing the purchasing behavior of the organization at all three stages of the purchasing decision process.

The Customer Experience Quality method is characterized by the following features:

1. Holistic Cognitive and Emotional Appraisal. This method centers on an inclusive assessment of cognitive and emotional value from the customer's standpoint, rather than relying on benchmarks or expectations.
2. Utility Value Verification. It evaluates the utilitarian value of an organization's offerings, encompassing more than just the attributes of products and services.
3. Validation through Behavior and Attitudes: The method is substantiated through both behavioral measures and attitudes.
4. Precision and Specificity. In comparison to other related measures like Servqual or NPS, it provides a more accurate and focused analysis of the unique aspects of client experience.

Furthermore, it's worth noting that the EXQ method was developed in accordance with established principles governing the creation of measurement scales.

Moreover, it should be emphasized that the EXQ method was developed in accordance with all requirements defining the principles of creating measurement scales.

RESULTS

In the conducted research, the distribution of the research sample was as follows: 69% were people who were part of the team deciding about the purchase of software, whereas 31% were people who made decisions individually. Due to whether the respondents made the decisions to purchase software in a team or individually, the average response ratings regarding the quality of experience were as shown in Figures 1,2,3.

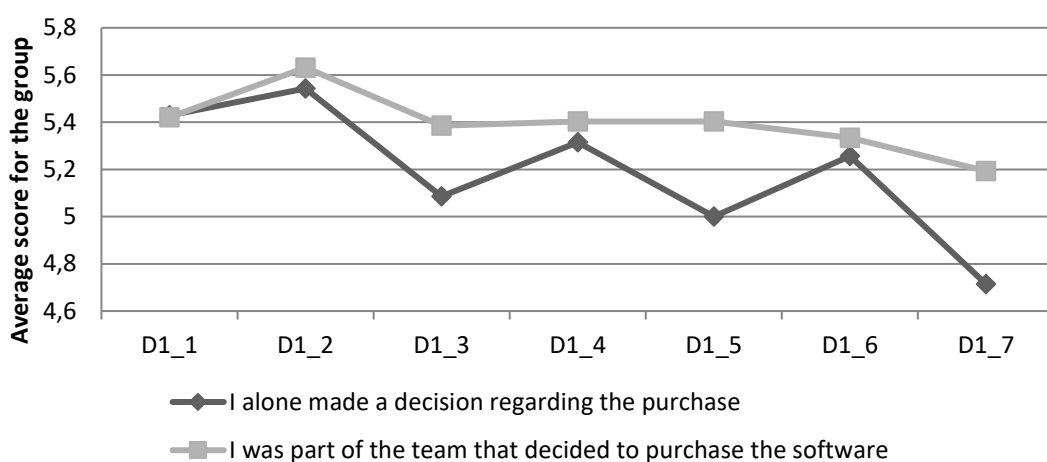


Figure 1. Average assessments the quality of experience with the brand depending on making purchasing decisions as a team or individually.

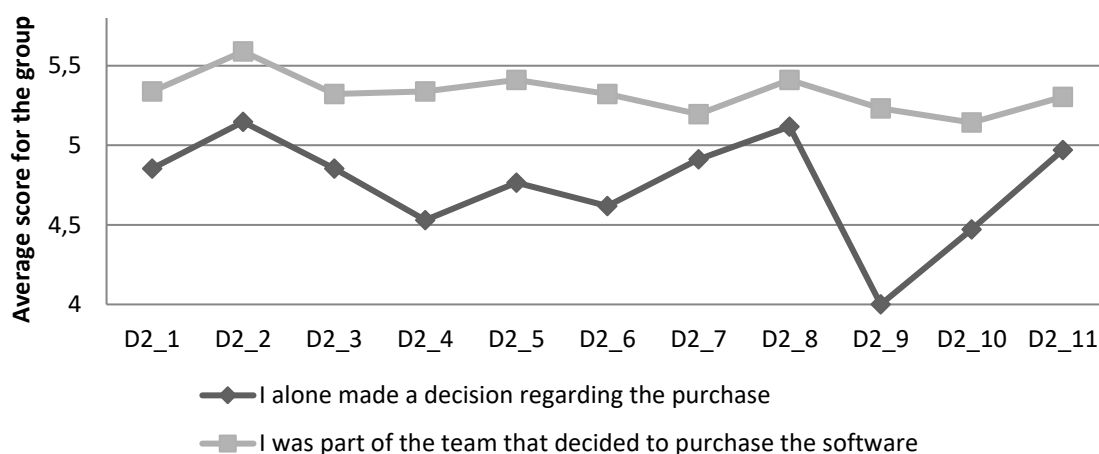


Figure 2. Average assessments the quality of experience at the purchasing stage depending on the purchasing decision made by a team or individually.

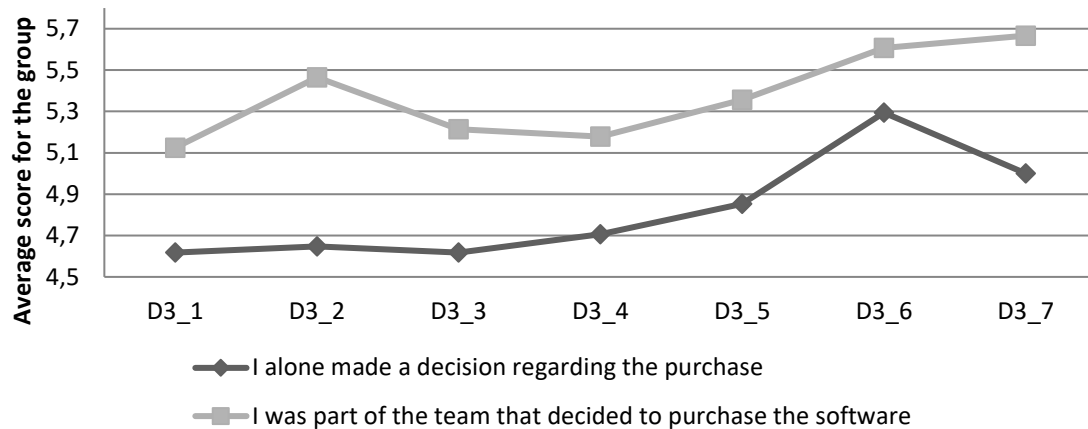


Figure 3. Average assessments the quality of post-purchase experience depending on purchasing decisions as a team or individually.

The research shows that when making a decision to buy software in a team, the average scores are the highest and reach the level of 4 or even above 5. This means that the respondents mostly express positively about the experiences before, during and after the purchases made in IT companies. In a situation where the respondent single-handedly decided to purchase the software, the average scores are the lowest at all the three mentioned stages.

In order to confirm the statistical significance of differences between the experiences of the studied groups of respondents, the Mann-Whitney U test was used. A non-parametric test for comparing two independent groups. The scheme of its calculations consists in ranking the results, i.e. giving them weights in ascending order. It is used when the measurements are not normally distributed or their variances are different but at least on an ordinal scale. It is one of the most popular non-parametric tests for examining differences between two independent groups (Corder and Foreman, 2009).

The test verifies the hypothesis:

H_0 : no difference between groups;

H_1 : there are statistically significant differences between the groups.

The results of the Mann-Whitney U test are presented in Table 1.

Table 1. Results of the Manna- Whitney *U* test.

		making purchasing decisions individually		making purchasing decisions as a team		U	p-value
Variables describing experiences		Mean	Median	Mean	Median		
Experience with the brand	D1_1 XYZ has a good reputation	5.412	5.5	5.421	6.0	0.103	0.918
	D1_2 I am convinced of the expertise of XYZ	5.559	6.0	5.632	6.0	0.357	0.721
	D1_3 XYZ provides independent advice	5.029	5.0	5.386	5.0	1.091	0.275
	D1_4 I chose XYZ not only because of the price	5.294	6.0	5.404	6.0	0.685	0.493
	D1_5 XYZ employees represent their brand well	4.971	5.0	5.404	6.0	1.468	0.142
	D1_6 XYZ's offer is the best in terms of quality	5.265	6.0	5.333	6.0	0.123	0.902
	D1_7 XYZ's offer is exceptional	4.706	5.0	5.193	5.0	1.415	0.157
	D2_1 XYZ advised me throughout the purchase process	4.735	5.0	5.333	6.0	1.395	0.163
Experience at the purchasing stage	D2_2 Working with XYZ is easy	5.147	5.0	5.596	6.0	1.366	0.172
	D2_3 XYZ kept me informed	4.735	5.0	5.333	6.0	1.530	0.126
	D2_4 XYZ was flexible with me	4.441	5.0	5.368	5.0	2.531	0.011
	D2_5 For me, working with XYZ means not changing the rules and/or working with the same people	4.706	5.0	5.439	5.0	2.117	0.034
	D2_6 XYZ employees listen to my wishes and concerns	4.559	5.0	5.351	5.0	2.186	0.029
	D2_7 XYZ employees have good interpersonal skills	4.882	5.0	5.228	5.0	0.800	0.424
	D2_8 XYZ provides good customer service	5.147	5.0	5.439	6.0	0.919	0.358
	D2_9 I built a personal relation with the people of XYZ	3.941	4.0	5.263	6.0	3.068	0.002
	D2_10 Buildings, warehouses, shops, XYZ office are better designed, friendlier than the competition	4.441	4.0	5.123	5.0	2.051	0.040
	D2_11 The XYZ website has been designed in such a way that it is maximally useful for me	5.000	5.0	5.281	6.0	0.603	0.547
Post-purchase experiences	D3_1 I will stay with XYZ because they know me	4.588	5.0	5.140	5.0	1.768	0.077
	D3_2 XYZ knows my needs exactly	4.647	5.0	5.474	6.0	2.482	0.013
	D3_3 XYZ is in constant contact with me	4.559	5.0	5.228	5.0	1.797	0.072
	D3_4 XYZ will also take care of me in the future	4.618	5.0	5.193	5.0	1.752	0.080
	D3_5 XYZ will treat me well even when I get into trouble	4.853	5.0	5.368	6.0	1.407	0.159
	D3_6 I am satisfied with XYZ as my service provider	5.324	6.0	5.614	6.0	0.677	0.499
	D3_7 The fact that I am a customer of XYZ accepts my surroundings	4.971	5.0	5.667	6.0	2.465	0.014

Table 1 shows the results of the Mann Whitney *U* test along with the given values of the mean and median for individual questions in the analyzed groups. At the significance level of 0.05, it can be seen that only in seven cases the differences turned out to be statistically significant. They are on the stage "Experience at the purchasing stage": „XYZ was flexible with me”; „For me, working with XYZ means not changing the rules and/or working with the same people”; “XYZ employees listen to my wishes and concerns”; “I built a personal relation with the people of XYZ”; “I built a personal relation with the people of XYZ”; “Buildings, warehouses, shops, XYZ office are better designed, friendlier than the competition”; “XYZ knows my needs exactly”; “The fact that I am a customer of XYZ accepts my surroundings”

In the mentioned cases, both the mean and median values are noticeably lower in the “making purchasing decisions individually” group than in the “making purchasing decisions as a team” group, which may be related to the emotional reactions of individual group members to specific supplier behaviors support the cognitive component of purchasing decisions. However, in most cases, there are no statistically significant differences in the answers to the questions in these two analyzed groups.

DISCUSSION

This article delves into the aforementioned models of organizational behavior, with a particular emphasis on both group and individual factors that have been subjects of research within the context of business customer experience. The research findings indicate that individuals who make purchasing decisions for software as part of a team experience higher satisfaction across all stages of the decision-making process compared to those making decisions individually. Teams tend to create "peer effects," where individual ratings strongly correlate with the mean scores of the group. These effects are strengthened by improved interaction within the group (Cortez and Johnson, 2017).

Individual and collective experiences mutually reinforce one another. As a result, purchasing groups are more apt to concentrate on the objective cognitive aspects of the experience, such as functional benefits, key performance indicators, purchase and operational costs. Additionally, the emotional responses of individual group members toward specific supplier actions support the cognitive component of purchasing decisions. On the contrary, individuals making decisions in isolation without team support may be susceptible to negative emotions. As suggested by Beer et al. (2006), these emotions can foster unfavorable judgments during the purchasing decision process and lead to an excessive perception of risk.

It's worth noting that the variables identified by the respondents in this study, which distinguish experiences during the purchasing stage, pertain to the quality of relationships ("personal relation") and the manner in which they were established ("it was flexible"). This aligns with the findings of previous research by Klaus (2015) and Court (2009), both of whom underline the significance of direct communication in shaping positive customer experiences. Many conceptual models posit that emotions play a pivotal role in initiating, developing, and sustaining relationships (Andersen and Kumar, 2006).

The inclusion of the place of purchase ("buildings ... are better designed") as a noteworthy variable may seem surprising. However, this can be elucidated by considering the nature of the purchased product (IT software), the ultimate value of which becomes apparent

only upon its usage—often a distant point in the future. Consequently, clients aim to assure the correctness of their decisions, which can encompass tangible aspects like the quality and nature of the place of purchase for an IT product. This parallels cases involving services, where the core often centers around a creative idea.

Returning to the interplay of rational and emotional components that shape business customer experiences, it's important to highlight that the prevailing understanding of the nature of purchasing decisions had largely centered on cognitive elements. Prevailing views suggested that business customers primarily engaged in rigorous cognitive analysis (Erevelles, 1998) and relied on arguments linked to the functionality of the purchased product (Ho et al., 2010) when making purchasing decisions. Additionally, the buyer-seller relationships were often seen as outcomes solely driven by quantifiable business values.

Numerous studies exploring emotions (Helgesen and Nettet, 2011) demonstrate that positive emotions positively impact satisfaction, while negative emotions can influence judgments and lead to an overestimation of risk. Consequently, Simon (1990), aligned with the concept of bounded rationality, advocates for an approximation approach that considers both rational criteria and intuitive components. This approach acknowledges the blending of these dimensions without a distinct demarcation (Lakowski and Evers, 2010). Similarly, Klaus (2015) recommends incorporating both dimensions—rational and emotional—in the method used to measure experiences.

The significance of the environmental factor also deserves emphasis. The author of this article concurs with Spekman and Stern (1979), who contended that environmental uncertainty has an impact on an organization's purchasing decisions and the structure of its purchasing centers. Notably, it has been observed that the technological factor, encompassed within the group of environmental factors, holds particular importance for the purchasing behavior of organizations acquiring IT software. Digital technologies usher in new circumstances for an organization's operation, facilitating broader and more collaborative open actions.

Despite the pervasive nature of digitization, it's worth highlighting that Polish enterprises have yet to fully harness the technological potential within their organizations. Even with widespread access to IT infrastructure, Polish enterprises remain unprepared for a technological revolution. This fact is underscored by the Digi Index survey conducted by Siemens in 2020, gauging the level of enterprise digitization. In this survey, the Polish manufacturing industry scored below two points on a four-point scale (1.9 points), indicating a substantial lag in implementing digital technologies compared to Western European counterparts.

In the context of technology development, it's pertinent to refer to the notion of "technological readiness," which pertains to individuals' inclination to use technology (Parasurman, 2000). Two factors in particular are recognized as inhibitors of technology advancement: discomfort and uncertainty, which evoke fear and resistance towards technology adoption.

Various types of uncertainties have been expounded upon in the literature (Sheinsh, 2004):

- Uncertainty about choice alternatives.
- Uncertainty about the consequences of comparing alternatives.
- Uncertainty about others' reactions within the environment to the choice made.

This article goes beyond Sheinesh's (2004) uncertainty framework by incorporating the uncertainty inherent in customers purchasing technological solutions. This form of uncertainty pertains to the buyers' comprehension of their own needs in the realm of technological solutions and their ability to articulate them. Empirical evidence from business practices demonstrates that this kind of uncertainty amplifies the perceived purchasing risk for buyers. When it comes to software purchase decisions, the sensation of uncertainty and discomfort can be more readily mitigated when decisions are made collectively by a team rather than individually.

It's important to highlight that purchases of software intended to support management processes occur intermittently, and the decision-making teams are formed specifically to achieve the objectives of these processes. This implies that individuals are more likely to find their footing within a team and assume a designated role, as opposed to navigating the decision-making process entirely on their own. Given the relatively low digital competences of individuals in Poland (Głomb, 2020), it's noteworthy that team collaboration, considering group dynamics models, could positively impact the accumulation of knowledge and skills among team members.

Conversely, individuals making decisions independently might be subject to an excessive influence of the uncertainty factor, potentially leading to a constant decline in their experience level.

The research findings presented earlier contribute to the understanding of business customer experiences. By aligning with organizational purchasing behavior models, they underscore the pivotal role of the group factor in shaping customer experiences across distinct stages of the decision-making process.

CONCLUSIONS

In summary, this study suggests that exploring the realm of business customer experience management, especially in the context of novel products, holds considerable potential for both advancing research and informing practical strategies for organizations aiming to cultivate lasting customer relationships and positive brand perception.

IMPLICATIONS FOR RESEARCH

Looking forward, there are noteworthy implications for both research and practical applications in the field. In the realm of future research, there is merit in exploring the realm of business customer experience management, particularly in scenarios involving novel products that hold substantial value for organizations, yet come with an inherent risk for customers during implementation. As expounded upon by Klaus (2015), aligning customer experience management with strategies for increased customer loyalty, satisfaction, and positive word-of-mouth about the brand and product is of paramount importance. However, achieving this necessitates a more profound understanding of organizational operations and the prevailing culture governing customer experience management.

This calls for further investigation into the dynamics of customer experience management within organizations, delving into aspects such as operational procedures, cultural factors, and strategic decision-making. By delving into these facets, researchers can better illuminate how organizations effectively manage customer experiences and foster positive outcomes, even in the face of potential risks associated with new products.

From a practical standpoint, these insights underscore the need for organizations to adopt comprehensive approaches to managing customer experiences. This involves not only focusing on the immediate outcomes of purchasing decisions but also on the broader impacts on customer loyalty, satisfaction, and brand perception. Organizations should strive to create an environment that prioritizes positive customer experiences throughout the entire purchasing journey, and be prepared to mitigate potential risks associated with innovative products.

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CREDIBILITY OF SOCIAL MEDIA INFLUENCERS: IMPACT ON PURCHASE INTENTION

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Abstract: Nowadays a lot of companies use social media influencers as a marketing strategy. They are a tool for any emerging company that wants to increase consumer numbers of a specific target audience, effective for several generations. This research focuses on examining brand equity and consumers' attitude and purchase intentions depending on credibility, measured as the expertise, trustworthiness, and attractiveness of social media influencers. To study these variables, a study hypothesis was made using the PSL-SEM model based on a measured questionnaire. The obtained results suggest that both credibility of social media influencers and brand equity have a positive impact on consumers' purchase intentions and they are positively interrelated. These results also make it possible to infer that although the independent variable, trustworthiness, does not directly influence brand equity, it has indirect impact through other variables.

Keywords: Social media influencers, credibility, expertise, trustworthiness, attractiveness, brand equity, consumer purchase intention.



INTRODUCTION

We live in a time of constant economic, social and political change. One of the main drivers, if not the main driver, is the evolution of technology: what it brings and how the world adapts to it. This evolution has led to the great rise of social media. Social media has given users a voice, an open platform where they can connect, collaborate and co-create content for themselves and others. This user-generated content is perceived as more trustworthy and has been found to have more influence on consumer behaviour and purchasing decisions than traditional media (Sharma & Verma, 2018).

The main focus of this study is how the credibility of social media influencers affects consumers' purchase intentions. Its impact on brand equity is also examined, which highlights the relationship between brand equity and consumer purchase intentions. This study examines three characteristics of athlete endorsers - attractiveness, trustworthiness and expertise - to determine the legitimacy of social media influencers. It aims to investigate how these three attributes are defined by customers and how important each of these qualities is to consumers (Pikas, 2012).

As this topic is very dynamic, there is always something new to add to previous research. Therefore, despite the available studies on this topic (e.g. Hermenda, Sumarwan, & Tinaprilla 2019; Weismueller, Harigan, Wang, & Soutar 2020), it is still possible to discover new relevant information that can be useful. Many companies are attempting to study the impact of influencers on sales and advertising. In this regard, Hence (2015) stated that the ability to identify influencers has become important for companies because the use of social media platforms can spread advertising messages faster and better promote them through influencers' recommendations to their many followers.

The objectives of this research are: (1) to provide a clear idea of the definition of each of the variables studied: trustworthiness, expertise, attractiveness, brand equity and credibility; (2) to provide knowledge of the direct and indirect effects that each of these variables has on each other; and (3) to show, based on the results, the importance of each variable, namely which ones brands need to focus on in order to reach the largest number of people through social media influencers.

The objectives of this research are important for several reasons. It's important to clearly define the variables being studied to avoid any confusion or misinterpretation of the results. A clear understanding of what each variable means will help ensure that everyone involved in the research is on the same page. Understanding how the variables relate and influence each other can help marketers and brand managers create effective influencer marketing campaigns. By understanding how each variable influences the others, they can design campaigns that target the variables that are most likely to have a positive impact on the brand. Knowing which variables are most important can help brands prioritise their efforts and allocate resources more effectively. By focusing on the variables that have the greatest impact on their target audience, they can increase their chances of reaching more people and achieving their marketing goals.

Previous research has shown that social media influencer endorsements can positively influence consumer behaviour, brand image and self-concept. The relationship between online consumer purchase intention, social commerce adoption behaviour and consumer trust, as well as the risk factors that influence online purchase decisions, is also influenced by

source credibility. Perceived influencer credibility (IC) using the source credibility model has a significant impact on purchase intention, attitude towards advertising and product (Hermanda et al., 2019).

This study aims to provide companies that want to expand their brand with an understanding of the relevance of the elements they choose to reach people, in this case social media influencers, in terms of their credibility in what they are actually promoting. Some tools are needed to develop this study. Some articles will be analysed, a questionnaire with several items will be made to several people and finally a Smart-PLS programme will be used as a way to develop hypothesis tests based on the questionnaire. Finally, conclusions are drawn.

In line with these research objectives, this paper starts with a literature review, which includes the presentation of the knowledge that needs to be exposed to complement the conceptual model and the research hypothesis. The literature review is followed by the methodological approach, where the data collection and the quantitative technique are explained. Consequently, the section following the methodological approach presents the research findings on the impact of credibility and brand equity on consumer purchase intention. Finally, the paper discusses the results and draws a conclusion, showing the improvements and limitations of the study and offering suggestions for future research.

Research on the impact of social media influencers' credibility on purchase intention can benefit several groups of people, including Marketers can use the research findings to understand the credibility of social media influencers and their impact on consumer purchase intention. Social media influencers can use the research to understand what factors contribute to their credibility and how they can improve it. This can help them attract more brands to work with them and increase their income from sponsored content. Consumers can benefit from the research by understanding the factors that influence their purchasing decisions when exposed to influencer marketing. Finally, researchers can benefit from the research by adding to the existing body of knowledge on the effectiveness of influencer marketing and identifying gaps in the literature that can be addressed in future studies.

Literature Review

Social Media Influencers and Influencer Marketing

A few years ago, brands started to use traditional media such as television, magazines, newspapers, radio, etc. to influence consumers. However, today, partly due to the pandemic we are facing (COVID 19), technology has been forced to move at the fastest pace. Brands around the world are well aware of people's adoption of social media activities and are increasingly capitalising on the use of social networking sites such as Facebook, Twitter and Instagram (Statista, 2017).

In terms of the relevance of social media in marketing, it provides an invaluable opportunity to build sustainable bonds with consumers and create and facilitate brand advocacy by encouraging positive conversations about the brand among consumers. Thus, these consumer conversations have necessitated a redesign of the content of marketing messages and the way they are distributed (Landry, Ude, & Vollmer, 2007). Parr (2008)

highlights the efficiency of message distribution and defines social media as the use of electronic and Internet tools to share and discuss information and experiences with other people in a more efficient way. The fact that consumers can discuss and ask questions about brands creates a connection and relationship between the consumer and the brand itself. This is not only good for the consumer, but also for the brand, as it is an opportunity for the consumer to provide real-time feedback (Chen, Ching, Tsai, & Kuo, 2008), and this is an asset for the company.

In order for companies to communicate with consumers through social media, so-called influencers have emerged. To participate in a brand's campaign to increase reach, sales or engagement, individuals with influence over a particular target audience or medium are identified and activated. This process is known as influencer marketing (Litsa, 2016). It is a form of relationship building that can be very helpful for brands looking to expand their audience and convert them into loyal customers through trust and authenticity (Sudha, & Sheena, 2017). It is a form of native advertising, a variety of techniques in which advertising messages are designed to be integrated into non-advertising content (Wojdyski, 2016).

For example, Makgosa (2010) identified social learning theory as a theory that provides ideas about socialisation agents that can convincingly explain the impact of celebrities on consumer behaviour. In line with Makgosa's assertion, social learning theory is proposed as a contextual basis for understanding social media influencers, as they represent a novel type of independent third-party endorser who can shape audience attitudes and decision-making through the use of social media.

Social media influencers are "ordinary people" who have become "online celebrities" by creating and posting material on social media, as opposed to celebrities or public figures who are known through traditional media. Some researchers highlight that target audiences perceive social media influencers as more accessible, believable, intimate, credible and influential in purchasing behaviour than traditional celebrities (Djafarova & Rushworth, 2017). Social media influencers engage in complex activities as they are content creators and therefore advertising creators, opinion leaders and entrepreneurs (Carpenter, & Childers, 2018). They typically have some expertise in niche areas such as active living, travel, food, lifestyle, beauty or fashion. According to a recent Twitter survey, consumers may have the same level of trust in social media influencers as they do in their friends (Swant, 2016). They "can range from celebrities to more micro-targeted professional or non-professional 'peers'" (IAB, 2018, p.5).

Their influence lies in the fact that their ideas and behaviour are not only positively perceived by their followers, but also imitated. The products presented online are sold. However, a larger number of followers does not necessarily mean more influence. Apart from the problem of fake followers that can be bought online, more and more marketers prefer to work with so-called micro-influencers, who have thousands instead of tens of thousands of followers, but a higher engagement (Nirschl, & Steinberg, 2018). In particular, micro-influencers have a strong interaction with their group (Delia, & Maria, 2019). The literature on this topic, based on the range of followers, identifies several types of influencers: peer-to-peer or micro-level influencers (500-10,000 followers), macro-influencers (up to 1 million followers), influencer celebrities with more than 1 million followers (Gottbrecht, 2016). There is a relationship between the number of followers and opinion leadership (Hwang, 2015; De Veirman, 2017).

Social media influencers can develop some influencer status, but only if they become regular content creators. They are also consumers, consumers who share information about products on social media. In markets where traditional advertising methods no longer produce significant results, consumer expressions are much more valued than advertising impressions (Kelley, & Fay, 2012; Long, 2016; Carpenter Childers, 2018).

According to a recent survey on social media trends, influencer marketing strategies were successful for 94 per cent of marketers who used them (Ahmad, 2018). The same article also stated that influencer marketing produced an ROI that was 11 times higher than traditional advertising. In today's world, it is important to be aware of our surroundings on multiple levels, which is exactly why this topic is relevant. Social networks are now used by people of almost all ages, which means that the audience that influencers can reach is very large. Of course, it depends on what they are advocating, but the main idea is that they can reach a huge number of people.

Influencer marketing is a relatively new advertising tool, so the literature on the subject is relatively new. It "works best when the content is natural, genuine and realistic coming from the social media influencers" (Carpenter, & Childers, 2018, p.12). Successful influencer marketing is a delicate balance between the authentic voice of the influencer and the brand's promotional strategies. Previous findings have highlighted that in an increasingly cluttered media environment, too much advertising can damage bloggers' reputations: the source of their persuasion can become the source of their downfall (Colliander, & Erlandson, 2015).

Credibility and its elements

Credibility

In addition to the growing use of social media, other factors, such as the increasing trust in personal recommendations rather than advertising when purchasing products, support influencer marketing as a relevant advertising tool. Research has highlighted the link between platform usage and increased trust in advertising on that particular platform (Stewart, & Cunningham, 2017). Source credibility refers to consumers' perceptions of the source of information. People tend to believe certain sources when others do (Metzger, 2010).

Media credibility is a concept in communication science that has not lost its relevance for communication research over the past decades due to the constant changes in the media environment (Metzger, 2010; Lazer, 2018). As expected, when consumers perceive social media influencers as credible, they are more likely to intend to purchase the product, perhaps because consumers form an overall evaluation of an influencer's credibility to assess the value of the product endorsement in their decision-making process. This process may include whether influencers can be trusted to communicate valuable and accurate information, and whether they are expected to have appropriate experience with a product or general expertise. If influencers are seen as credible, a product endorsement is likely to have a higher value to the consumer, increasing purchase intention.

According to the communication-persuasion model (McGuire, 2001), there are five components of persuasive communication that determine the effectiveness of advertising: the source, the message, the channel, the receiver and the target. This research addresses the issue of perceived source credibility. It focuses on social media influencers and influencer

marketing as an advertising tool that is gaining popularity among users and marketers (Carpenter, & Childers, 2018).

Customers are more likely to adopt the views, attitudes and behaviours of an endorser if they believe they share certain interests, values or characteristics (Cialdini, 1993; Kelman, 2006). Identification results from both actual and perceived similarity, or the degree to which one perceives that one has things in common with another person, as well as desired identification, or the desire to be like the other person (Hoffner, & Buchanan, 2005).

With regard to influencers, studies in the more general area of electronic word of mouth (eWOM) have shown that the effectiveness of eWOM on consumers' product attitudes and purchase intentions is determined by the endorser's credibility (Reichelt, Sievert, & Jacob, 2014; Erkan, & Evans, 2016). In particular, the findings of Chapple and Cownie (2017) and Djafarova and Rushworth (2017) indicate that endorser credibility has a significant impact on purchase behaviour.

Furthermore, Ohanian's advertising course (1990) defines three constructs implicit in the credibility source to quantify the effectiveness of influencers by looking at their perceived expertise, trustworthiness and attractiveness. Therefore, this study also shows how these three dimensions are related to consumer purchase intention.

Expertise

Influencers' perceived level of expertise can influence purchase intention for two reasons. First, it matters whether an influencer can be expected to have a specific level of experience with a product or general expertise. Second, it is important whether an influencer can be expected to be a valuable source of knowledge in the purchase decision process. The perceived expertise of influencers defines the expected value of the information they provide (Cheung, 2008).

In order to make certain claims about a particular subject or issue, a source must be competent or qualified, including having the necessary knowledge or skills (McCroskey, 1966). Individuals or consumers with an interest in a particular area can follow and interact with influencers to keep up to date with the latest news and trends. Thus, influencers can be at the centre of a sufficiently large, engaged and trusted community (Hair, 2010; Hall, 2016) to attract the interest of relevant brand marketers who need to engage with such influencers.

People no longer believe only the content that brands themselves disseminate. Instead, social media has enabled consumers to get information about products and services not only from people they know IRL (in real life), but also from people they perceive as well-informed about the brands (Cooley, & Parks-Yancy, 2019). Their perceived expertise comes from their social media activity (Dasgupta, & Kothari, 2018).

Influencers on social media are usually well known because they specialise in certain areas. This suggests that when influencers work with brands that are relevant to their particular areas of expertise, customers are more likely to accept or trust the ideas of such influencers (Hall, 2016).

If social media influencers can demonstrate their expertise in a particular field through their profile or in a relevant post, this is likely to increase purchase intention, suggesting the following hypothesis:

H1: Influencer expertise positively affects consumer purchase intention.

Trustworthiness

Influencers' perceived trustworthiness can affect purchase intention because influencers' credibility defines the expected value of the information provided by their product endorsements (Cheung, 2008). Most researchers have found a positive relationship between source trustworthiness and purchase intention (Pornpitakpan, 2003; Gunawan, & Huarng, 2015; Wang, & Scheinbaum, 2018). The recipient's view of a source's honesty, sincerity, or truthfulness is known as source trustworthiness (Giffin, 1967). However, trust in a social media platform, as well as influencer, celebrity, or follower endorsements of specific products, may depend on the product itself (Arnold, 2017; Lim, 2017).

While an endorser's expertise refers to the relevant knowledge, skills, or experience they are believed to possess, their trustworthiness refers to perceptions of their honesty, integrity, and plausibility (Erdogan, 1999). It has been described by Ohanian (1990, p.41) as the degree of confidence that consumers place in the intentions of influencers to deliver the claims they find most credible. The level of trust and loyalty between consumers and their influencers has been found to have a positive impact on the sustainability of follower-influencer relationships, sales and the brand (AlFarraj, 2020). FullScreen and Shareable (2018) concluded that approximately 50% of a sample, aged between 18 and 24 years, trust the posts of their influencers. Furthermore, 40% of them trust the influencer more than the brand advertising itself. These conclusions, in turn, confirm the critical role of the trustworthiness of social media influencers.

Millennial consumers place their trust in social media influencers, people they follow, and their own followers, for example, to learn about fashion trends, to keep up to date with a brand, and to obtain information about a brand (Cooley, & Parks-Yancy, 2019). Social media is influencing the purchasing behaviour of millennials (Greenwood, 2016). Therefore, it is important for researchers and practitioners to investigate whose social media content they trust in relation to their purchasing decisions and which social media sites are sources of trust for millennials in relation to product information (Cooley, & Parks-Yancy, 2019).

In this regard, celebrities, influencers, followers and people consumers know IRL are sources of social capital regarding product information. They are seen as knowledgeable and trustworthy in terms of their opinions about certain goods. This encourages consumers to believe in the advertising of a product (Lim, 2017; Talavera, 2015). In conclusion, an influencer's trustworthiness is considered when, for example, Instagram users perceive them as dependable, honest, reliable, sincere, or trustworthy (Ohanian, 1990). Based on this statement, the following hypotheses are made in this study:

H2: Influencer trustworthiness positively affects consumer purchase intention.

H3: Influencer trustworthiness positively affects expertise.

H4: Influencer trustworthiness positively affects attractiveness.

Attractiveness

McGuire (1985) proposed beauty as a third factor in source trustworthiness, referring to the likeability or physical attractiveness of a source. Patzer (1983, p.229) noted that in most research, attractiveness is defined as "the degree to which a person's face is pleasing to observe". This view is adopted in this study of social media influencers.

The focus of source attractiveness is on the physical characteristics or qualities of an endorser (Erdogan, 1999). Many previous studies have found a positive relationship between source attractiveness and both consumer attitudes and purchase intentions (Petty, 1983; Erdogan, 1999).

McGuire (1985) found that source attractiveness has a direct effect on the effectiveness of an endorsement. For example, Wand & Scheinbaum (2018) found that physically attractive influencers are often considered by advertisers when designing and implementing their advertising campaign, as they have more influence in shaping customers' attitudes towards the target brands. An attractive social media influencer is able to influence consumers with positive outcomes. Endorsers with attractive qualities can influence buyers' attitudes, which can lead to purchase intention (Till, & Busler, 2000).

Physical beauty is the ability of the face to elicit positive responses from other people. The research conducted focused on measuring purchase intention and consumer attitude based on two dimensions: Likability and Attractiveness. The results predict that there is a greater influence of an attractive celebrity on consumer product liking compared to an unattractive celebrity. At the same time, attractive celebrities were found to be more persuasive than unattractive celebrities in creating purchase intention. When comparing both genders, attractive female endorsers are preferred to attractive male endorsers. Advertisers selected celebrities based on their physical appearance in order to benefit from the dual effects of physical attractiveness and celebrity status. A famous quote from Aristotle states that "beauty is a greater recommendation than any letter of introduction" (Aamir, Gul, Iqra, & Laila, 2018, p.4).

Accordingly, the current study proposes the following hypothesis:

H5: Influencer attractiveness positively affects consumer purchase intention.

Brand Equity

In today's materialistic world, brands play a central role in our lives. They are no longer just symbols of the company or product; they now define a person's personality, lifestyle, social and economic background and what they value most. Because of this relationship, consumers have a deeper connection with the brands they buy and use (Hasan, 2008). It's no longer just about functionality and usage, it's more than that; it's a deep, everlasting and unbreakable bond and relationship that is created between the brand and the customer (Muhammad, & Sameen, 2016). The brand isn't just about the slogans and logos, it includes the whole experience, the whole package that is given by the company and perceived by the consumers.

The brand represents the opinions and perceptions of the customers, and a strong brand is always at the forefront of the customer's mind. Some brands have a high level of awareness and customers easily buy them based on their perceived quality and credibility, and some have little to no awareness, which is also cited in Hoyer's book on consumer behaviour (Hoyer, 2011). Another way of looking at how brands work is that once they have established customer-based brand equity, they can also charge a premium price for their offerings (Shimp, 2013). Many customers are brand loyal, they buy and choose one brand over another simply out of loyalty (Muhammad, & Sameen, 2016).

When a person chooses one brand over another, even when the alternative has more features, it is simply due to the influence of brand equity. Brand equity helps us to explain this phenomenon. Brand equity allows you to measure how synchronised, involved and deep a consumer is with a brand. So much so that he or she is reluctant to even consider other offerings in the same category. Brand equity tells us why a person is even willing to pay a premium for the brand he or she wants to acquire (Muhammad, & Sameen, 2016).

Customer-based brand equity is the difference between how well informed consumers are about a brand and how they respond to its marketing (Keller, Strategic Brand Management, 2009). The sources of brand equity are therefore crucial and are divided into two components: brand awareness and brand image. As Keller (Strategic Brand Management, 2009) states, for customer-based equity to occur, there must be a high level of brand awareness and familiarity so that consumers can create strong and favourable links and associations in their minds with the brand. When a customer associates a functioning good or service with a brand name, it is perceived as adding value (Aaker, 1993).

Credibility influences perceived trust, brand awareness, brand equity and also purchase intention. In particular, previous studies have shown that three of the credibility elements: trustworthiness, competence and attractiveness have positive effects on perceived trust, brand awareness, brand equity and purchase intention. In addition to credibility, the value of advertising content, in this case influencer-generated content, consisting of informational and entertainment value, can have positive effects on these behaviours. The relationship between brand credibility and consumers' brand purchase intention may vary with high/low levels of brand awareness and brand image (Pae, Samiee & Tai, 2002). The effect of brand credibility on consumers' brand purchase intention tends to be greater when they perceive the brand image to be stronger, more favourable and more unique than when they perceive the brand image to be less strong, less favourable and less unique (Wang, & Yang, 2010).

Therefore, we can say that credibility and brand equity have an indirect relationship, which means that one only exists if the other is present. It can also be described as a moderate relationship. This leads to three further hypotheses:

H6: Influencer expertise positively affects brand equity.

H7: Influencer attractiveness positively affects brand equity.

H8: Influencer trustworthiness positively affects brand equity.

To reinforce all these statements, the following hypothesis has been suggested:

H9: Brand equity positively affects consumer purchase intention

In addition to direct influence between variables, this study also hypothesises indirect influence. That is, whether or not the fact that one variable can influence another variable through a third variable. The following hypotheses have been formulated:

H3a: Influencer expertise mediates the relationship between influencer trustworthiness and brand equity.

H4a: Influencer attractiveness mediates the relationship between influencer trustworthiness and brand equity.

H6a: Brand equity mediates the relationship between influencer expertise and consumer purchase intention.

H7a: Brand equity mediates the relationship between influencer trustworthiness and consumer purchase intention.

H8a: Brand equity mediates the relationship between influencer attractiveness and consumer purchase intention.

As we can see in the figure below and in the hypotheses presented above, the dependent variable can be identified as trustworthiness. Expertise, attractiveness, brand equity and consumer purchase intention are independent variables that also influence each other. This study is based on the degree of this influence. This model explains the role of source credibility, which is implied by expertise, trustworthiness and attractiveness, on consumer behaviour and redefines the concept of trust in the context of influencers. In addition to credibility, advertising content value, in this case influencer-generated content, consisting of informational and entertainment value, can also have positive effects on perceived trust, brand equity and purchase intention.

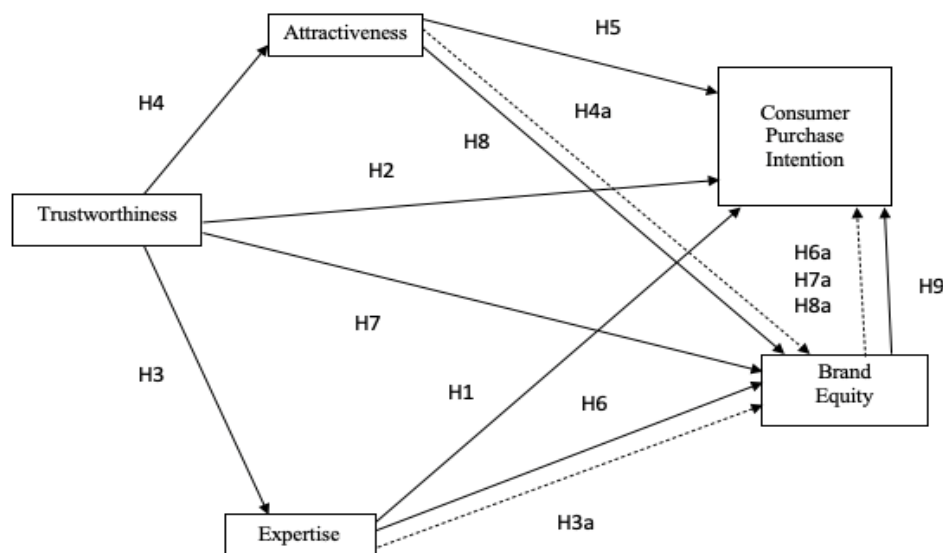


Figure 1. Conceptual Model.

*The mediating effects are represented by the dashed arrows.

METHODS

As far as the empirical study is concerned, we adopted a quantitative approach. To begin this research, which complements previous studies, the method used was a survey on Google forms. This survey, using a Likert scale developed by Holzwarth (2006), used several questions to assess consumers' perceptions of the importance of social media influencers' credibility and brand equity to their purchase intention. Essentially, the variables used are measurable in a way that participants can answer. The sources for this research in relation to the attractiveness, trustworthiness and expertise variables were taken from the article by

Ohanian (1990). The variables of brand awareness, brand attitude, brand equity and brand loyalty were taken from the article by Yoo, Donthu and Lee (2000). Finally, the variable of purchase intention was taken from the article of Bruhn, Schoenmueller, and Schafer (2012). The main target group was people aged between 18 and 65 who use social networks.

The questionnaire was based on a clothing brand chosen by each participant, taking into account several hypothetical brands given. 210 responses were received, of which 59% were between 18 and 25 years old, 23.4% between 25 and 40 years old, 7.6% between 40 and 55 years old, and 10% over 55 years old. In terms of gender, 56.2% were female and 43.8% were male. It can also be mentioned that 44.8% have a bachelor's degree, 41.4% a master's degree, 11% are postgraduates, 1.4% have a doctorate and the 1.4% have a professional degree. As we can see, this topic has a very broad target, which is advantageous due to the large adherence of all age groups, meaning that through social media, brands can reach a large number of people.

In order to measure each variable of the presented model through the questionnaire, some points were taken into account, as we can see in the table in the appendices. In addition to the five variables presented in the model, as shown in the same table, three other variables were added to the questionnaire (brand awareness, brand attitude and brand loyalty), which in turn are implicit in the brand equity variable.

Once the responses were in, the results were evaluated using the Smart PLS software, which made it possible to extract information on the reliability and validity of the measurement model, and then to evaluate the structural model in order to understand precisely not only the impact that each variable has on the model itself, but also the relationship that it has with the other variables.

RESULTS

Structural Equation Modelling (SEM), specifically Partial Least Squares (PLS), was used to evaluate the hypothesised model. PLS is a statistical method technique, using Smart PLS 3 software. A two-step approach was used to analyse and interpret the results. First, the reliability and validity of the measurement model were assessed, and then the structural model was evaluated. Franke and Sarstedt (2019) extend recent simulation studies on discriminant validity measures, contrasting the use of cut-off values with inferential tests. Their results provide further evidence for the robustness of the heterotrait-monotrait ratio of correlations (HTMT) criterion as an estimator of disattenuated (perfectly reliable) correlations between constructs, with performance comparable to that of Jöreskog's (1971) standard constrained phi approach. In addition, the authors identify McDonald's (1999) procedure as a promising complementary test for assessing discriminant validity (Hair, 2019). To assess the quality of the measurement model, we examined the square roots of the AVE (average variance extracted), which are the bold numbers in the diagonal of Table 1. The elements below the diagonal are the correlations between the constructs, and the elements above the diagonal are the HTMT ratios.

The existence of internal consistency reliability was confirmed by the Cronbach alphas of all constructs, and the composite reliability (CR) values exceeded the cut-off of 0.7 (Hair, 2017). The minimum value of discriminant validity was assessed by comparing the values of

the square roots of the AVE with the square of the correlation between the factors (Table 1). According to Malhotra (2011) and Larcker and Fornell (1981), a square root of AVE that is higher than the coefficient of correlation between factors provides evidence of discriminant validity. Table 1 shows that this criterion was met in terms of discrimination between all constructs. The attractiveness and brand equity factors (square roots of AVE were 0.76 and 0.85, respectively; both of these values are higher than the correlation between the factors, which was 0.265), the attractiveness and expertise factors (square roots of AVE were 0.76 and 0.89, respectively; both of these values are higher than the correlation between the factors, which was 0.544), the attractiveness and expertise factors (square roots of AVE were 0.76 and 0.89, respectively), the attractiveness and expertise factors (square roots of AVE were 0.76 and 0.89, respectively). 544), the attractiveness and consumer purchase intention factors (square roots of AVE were 0.76 and 0.88, respectively; both these values are higher than the correlation between the factors, which was 0.235), and the attractiveness and trustworthiness factors (square roots of AVE were 0.76 and 0.92, respectively; both these values are higher than the correlation between the factors, which was 0.641). The same is true for the other factors, i.e. the square roots of the AVE are higher than the correlations between the factors in all cases. In short, the fact that all constructs have a square root of AVE greater than all interfactor correlations provides some evidence of discriminant validity.

The Heterotrait-Monotrait Ratio (HTMT) criterion (Hair, 2021) was used to provide further evidence of discriminant validity. As shown in Table 1, all HTMT ratios are below the more conservative threshold of 0.85 (Henseler, 2015), supporting the claim for further evidence of discriminant validity.

Collinearity was assessed prior to the structural model analysis. The VIF values ranged from 1.000 to 1.962, which is below the indicative critical value of 3 (Hair, 2021). These values do not indicate collinearity. The structural model was assessed by the Stone-Geisser's Q² for the four endogenous variables, the values of which are used as a measure of the predictive relevance of the model (Hair, 2017). These values were 0.226, 0.051, 0.266 and 0.133 for the attractiveness, brand equity, expertise and purchase intention variables, respectively. No value was assigned to the trustworthiness variable as it is an independent variable. As we can see in Table 1, all the values were above zero, indicating the predictive relevance of the model.

Table 1. Composite reliability, average variance extracted, correlations, and discriminant validity checks.

Latent Variables	α	CR	AVE	1	2	3	4	5
(1)Attractiv	0.815	0.870	0.575	0.76	0.314	0.618	0.276	0.704
(2)Br_equity	0.869	0.911	0.718	0.265	0.85	0.254	0.459	0.198
(3)Expertise	0.912	0.938	0.791	0.544	0.230	0.89	0.155	0.625
(4)Purch_intention	0.856	0.912	0.776	0.235	0.402	0.141	0.88	0.221
(5)Trust	0.955	0.965	0.847	0.641	0.182	0.585	0.201	0.92

The next figure shows the results of the conceptual model, which extends the results of the PLS-SEM by also considering the performance of each construct and by showing the direct relationships between the constructs.

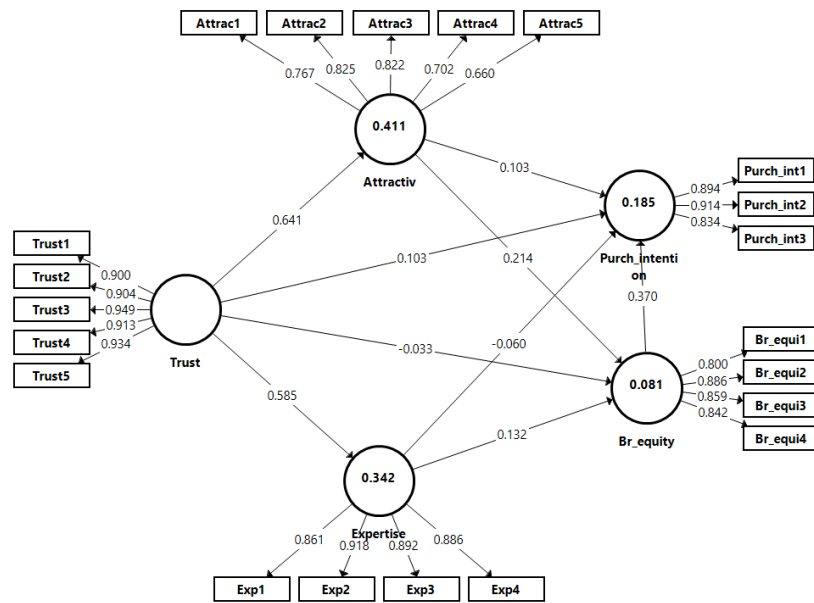


Figure 2. Conceptual model results.

The direct effects that the variables have on each other can be seen in Table 2. The results show that the attractiveness of a social media influencer has a positive effect on brand equity (Beta=0.214, $p < 0.05$), which means that H7 is supported, the value is significant. On the other hand, the p-value of attractiveness in relation to consumer purchase intention is higher than 0.05 and a beta of 0.103, so this hypothesis (H5) is not supported, it is not a significant value. With the same p-value of 0.000 and all lower than 0.01, we can see very significant evidence of a positive effect of the variables of brand equity on consumer purchase intention, trustworthiness on attractiveness and trustworthiness on expertise. This supports hypotheses H9, H4 and H3 respectively. With regard to the effect of the expertise variable on brand equity, the expertise variable on consumer purchase intention, and the trustworthiness variable on brand equity and consumer purchase intention, we can analyse the lack of significance, as their respective p-values are greater than 0.05. This means that hypotheses H6, H1, H7 and H2 are not supported.

Table 2. Structural model assessment.

Direct Effects	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Attractiv -> Br_equity	0.214	0.103	2.073	0.039
Attractiv -> Purch_intention	0.103	0.081	1.270	0.205
Br_equity -> Purch_intention	0.370	0.070	5.285	0.000
Expertise -> Br_equity	0.132	0.097	1.358	0.175
Expertise -> Purch_intention	-0.060	0.073	0.826	0.409
Trust -> Attractiv	0.641	0.046	13.829	0.000
Trust -> Br_equity	-0.033	0.097	0.336	0.737
Trust -> Expertise	0.585	0.054	10.884	0.000
Trust -> Purch_intention	0.103	0.080	1.281	0.201

We can look at Table 3 to observe the indirect effects between the variables. As we can see when we evaluate the results of the p-values of the total indirect effects, the trustworthiness of the social media influencers indirectly affects the brand equity (Beta=0.215, $p < 0.05$). This means that hypotheses H3a and H4a are supported, there is statistically significant evidence. The trustworthiness variable does not directly influence brand equity between variables. However, both the expertise and attractiveness variables are intermediate, so that the trustworthiness of social media influencers ultimately influences brand equity. Regarding the other indirect effects, their p-value is higher than 0.05, but again not statistically significant. This means that hypotheses H8a, H6a and H7a are not supported.

Table 3. Indirect effects.

Indirect Effects	Original Sample (O)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Attractiv -> Purch_intention	0.079	0.043	1.839	0.067
Expertise -> Purch_intention	0.049	0.039	1.252	0.211
Trust -> Br_equity	0.215	0.069	3.124	0.002
Trust -> Purch_intention	0.098	0.068	1.442	0.150

The IPMA is represented in the next figure, i.e., the importance-performance map analysis, which extends the results of PLS-SEM by also taking the performance of each construct into account. Through IPMA we can derive two types of outcome dimensions, both performance and importance. Complementing the previous table, this following map represents the indirect relationships that the constructs have with each other. Thicker arrows show a higher ratio between the variables and as it is represented, the trustworthiness variable can influence brand equity through both the attractiveness and the expertise variables.

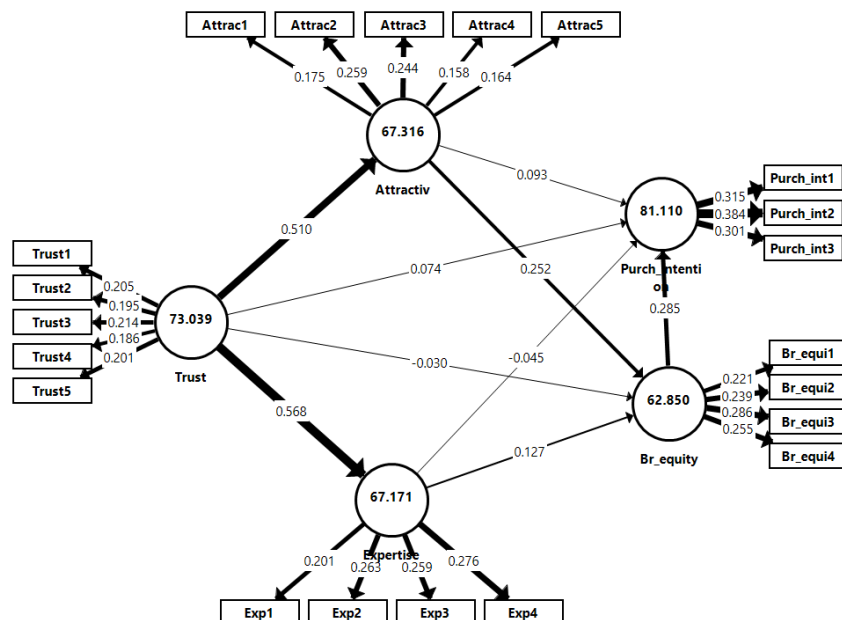


Figure 3. Importance-performance map analysis.

DISCUSSION

The results obtained in this study confirm several positive relationships, which highlight some previous studies. Which consequently provide input to what the study ultimately advances.

Based on a recent article on the three sources of credibility of social media influencers (Jason, Paul, Shasha, & Geoffrey, 2020), the impact that each of them has on consumer purchase intention can be validated. Both Ohanian (1991) and the authors of the referenced article focus on the correlation between a media influencer and the variables of trustworthiness, attractiveness and expertise they convey to the consumer, despite the fact that one article is based more on traditional media (Ohanian, 1991) and the other on online media (Jason, Paul, Shasha, & Geoffrey, 2020). The content of this project confirms the importance of these three constructs, so that brands can use this information to achieve better results.

Nevertheless, a very important variable analysed, brand equity, is also indispensable, not only for the impact it has on the consumer's purchase intention, but also for the relationship it has with the three variables mentioned above. This statement confirms the study conducted by Boonghee, Naveen and Sungho (2000), where brand equity and other related variables such as brand awareness, brand attitude and brand loyalty are positively correlated with consumer purchase intention. Kuang, Yeh and Yang (2009), states the importance of these variables when it comes to consumer intention.

With regard to this study, where a contribution has been captured by successfully support the quantitative results shown, which translates into the fact that there is no direct relationship between the trustworthiness variable of social media influences and brand equity variable. However, paying particular attention to the results of the indirect relationships, the brand equity variable is influenced by the trustworthiness variable through both the attractiveness and expertise variables. This result is a contribution to all companies that are currently developing this type of study in order to improve the way they reach their target.

CONCLUSIONS

Consistent with previous research, an important conclusion of this study is that attractiveness, trustworthiness and expertise are perceived as important elements of social media influencers' credibility. For example, Lim (2017) examined the impact of posts from social media influencers on consumers' purchase intentions. The study found that posts from social media influencers who were not perceived to be directly knowledgeable about a product had no impact on purchase intentions. However, influencers whose public image was congruent with the brands they endorsed significantly influenced consumers' intent to purchase those products.

Not everyone can become an influencer, even if they appear to users to be "one of us". Influencer marketing is primarily a peer endorsement model, which is one of the key differences between celebrity endorsement and influencer marketing in terms of trustworthiness. Peer endorsement also adds elements of word-of-mouth marketing to influencer marketing. It has the potential to reduce negative attitudes towards an influencer's

promotional activities. Influencer marketing is a rapidly growing field that is still evolving (Lou, & Yuan, 2018).

The model used in this study explains the role of source credibility of social media influencers, whose expertise, trustworthiness and attractiveness are implied, on consumer behaviour and redefines the concept of trust in the context of influencers. In addition to credibility, the value of advertising content, in this case influencer-generated content, consisting of informational and entertainment value, can also have positive effects on perceived trust, brand equity and purchase intention.

The results showed that the majority of the respondents believed that the brand equity and the characteristics of trustworthiness, attractiveness and expertise of social media influencers guided and influenced their purchase decision when buying the product related to the brand they had chosen. The results of the correlation analysis showed that the largest contribution in explaining the purchase decision came from the predictor variable trustworthiness, meaning that the majority of respondents felt that trustworthiness towards the current brand they were using guided their purchase decision.

The main contribution of this research, as shown by the results, is that although the trustworthiness variable does not directly influence brand equity, it does indirectly influence it through the attractiveness and expertise variables. This means that since brand equity is a variable based on the "premium value that a company generates from a product with a recognisable name compared to a generic equivalent", the fact that the trustworthiness of social media influencers may not have a direct impact on brand equity, but through their attractiveness and expertise, they convey this type of trust so that brand equity has an impact on consumer purchase intention. This enhancement provided by the study helps companies to focus on how social media influencers can reach their target better and faster, it helps them to focus on what consumers really value.

Despite the theoretical advances, this study has a number of drawbacks. Overcoming them can help and guide future studies. First, a recurring limitation in several studies, including this one, is that the model worked on is based on only a few marketing efforts. For future studies, it is important to evaluate more marketing actions, for example, to further explore the influence of brand equity on consumers' final purchase intention. It will be more enlightening to research which types of advertising create a strong brand when creating a specific advertising strategy (Kalra and Goodstein 1998).

Despite the numerous studies that have been conducted on customer engagement and social media influencers, there is still more analysis and research to be done, as it is a technology-based topic that is constantly evolving. Furthermore, in terms of the three dimensions of source credibility, the findings of this study focus on assessing validity and reliability, and the existing scale can always be expanded and modified. For future studies, one way to assess these variables more prominently, for example, is to use a specific fictitious brand.

An important limitation of the research is that by offering only two gender options, the study may not have accurately captured the gender identities of a significant proportion of the population. This may limit the generalisability of the findings and may not accurately reflect the experiences of those who identify as non-binary.

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Annexes

Variables measured on the questionnaire

Attractiveness

- Attractive/Unattractive
- Classy/Not Classy
- Beautiful/Ugly
- Elegant/Plain
- Sexy/Not sexy

Trustworthiness

- Dependable/Undependable
- Honest/Dishonest
- Reliable/Unreliable
- Sincere/Insincere
- Trustworthy/Untrustworthy

Expertise

- Expert/Not an expert
- Experienced/Inexperienced
- Knowledgeable/Unknowledgeable
- Qualified/Unqualified

Brand Awareness

- I can quickly recall the symbol or logo of the brand.
- Some characteristics of the brand come instantly to my mind.
- I can recognize the brand among other competitive brands.

Brand Attitude

- I have a pleasant idea of the brand.
- I associate positive characteristics with the brand.
- The brand as a good reputation.

Brand Equity

- It makes sense to buy the brand instead of any other brand, even if they are the same.
- Even if another brand has the same characteristics as the brand I preferred, I would prefer to buy the one that I choose.
- If there is another brand as good as the one I preferred, I prefer to buy the one that I choose.
- If another brand is not different from the brand I preferred in any way, it seems smarter to purchase the one that I choose.

Brand Loyalty

- I consider myself loyal to the brand.
- The brand I preferred is going to be my first choice.
- I will not buy another brand if the one that I preferred is available at the store.

Consumer Purchase Intention

- It is possible that I will buy the brand in the future.
- I will seriously consider purchasing the brand.
- It is highly likely that I will buy the brand.

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PAYMENT IMPLANTS AS AN ELEMENT OF HUMAN ENHANCEMENT TECHNOLOGY

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Abstract: *Technology leads to changes that cause the biosphere and the techno-sphere to interpenetrate and co-evolve. This paper is part of a wider research project on the social acceptance of payment implants as an example of Human Enhancement Technology. At this stage, the focus was on identifying the characteristics attributed to users of this form of augmentation in order to assess social attitudes towards them. The study used the method of projection techniques, recognizing that real attitudes towards payment implants may be unconscious or reluctantly verbalized by a person. The research results indicate that the profile of people using payment implants as perceived by society and the set of characteristics attributed to them differs depending on whether the user is a woman or a man. Attention was also drawn to the differences in social and individual attitudes towards this form of augmentation.*

Keywords: *human enhancement technology, microchips implants, payment implants, human, customer.*



INTRODUCTION

Digital technologies, although common in our everyday life, still raise many questions and cause controversies, especially in the context of how far we are willing to push the limits of their acceptance. An undoubtedly inevitable process is leading to the successive popularization and increase in the number of practical applications of Human Enhancement Technologies (HET). Human enhancement and skills development is a co-evolution of nanotechnology, bioengineering, social engineering, and cognitive science, aimed at developing the solutions that allow humans to overcome existing physical and cognitive limitations (Naam, 2005; Meinzer et al., 2014) and gradually exceed them. They improve the body's anatomical, physiological and information processing (Barfield, 2016). Human Enhancement Technologies have become a promise to improve specific aspects of human functioning and/or the human body (Dijkstra, Schuijff, 2016). The desire to reach the next level of human modification – beyond tattoos and body piercings (Thaddeus-Johns, 2017) – has become real. It is based on both practical reasons (the desire to improve current health due to medical conditions, the level of self-esteem, motivation to change the current way of life and increase perceived comfort), as well as the need to have fun or stand out in the group (“I have a given solution before others, I am a pioneer”) (Robertson, 2017; Thaddeus-Johns, 2017). The universality of interaction between human and technology leads to the gradual blurring of a clear boundary between what is typically human and what has resulted from the humanization of technology. Thus, it becomes possible to improve motor skills (e.g., eliminating or minimizing movement limitations, exoskeletons, bionic limbs, etc.), increase cognitive abilities (e.g., sensory perception) and affective abilities (emotions, social interactions), as well as develop abilities that hitherto have not been possessed by human (Greguric, 2014). This applies to both non-invasive (body-worn) and invasive solutions (technological modification of the human body and mind) (Teunisse et al., 2019). This means that technology can coexist with humans in different ways, that is (Warwick, 2016):

- close to the human body, but not integrated with it (e.g., wearables),
- implanted in the body, but not part of the human nervous system,
- implanted into the body and linked to the human nervous system for medical purposes,
- implanted into the body and linked to the human nervous system in order to intensify its capabilities and effectiveness (e.g., the quality and efficiency of the results achieved).

As a result, a person acquires a digital meaning (information collected on how they function, behave, what they feel, etc.), but on the other hand, implanted e.g. nanochips and technological implants replacing some organs and body parts make them partly a cyborg (Greguric, 2014). Body-worn and implantable technology also make it possible to define a person's digital identity and sense of position within a social group (Barfield, Williams, 2017). This leads to the formation of the vision of homo cyber, and even homo augmentus - a human who consciously can use technology to develop and self-improve, and to enter into more and more complex interactions with the environment (Kaczorowska-Spychalska, 2019). “Computationally and technologically advanced” (Trash, 2008) individual that has unlimited possibilities which go beyond the current understanding of the essence of human (Broderick, 2013) and humanism. Smart implants allow chipped users to access smart buildings and rooms without a need for keys or additional authorizations, operate equipment and autonomous

vehicles without access codes and passwords. They also make purchases from a list of perfectly profiled offers, easily and quickly deal with many matters in offices, have an ability to move using urban means of transport, as well as biometric boarding. Technology allows you to see what is invisible, hear what seemingly cannot be heard and feel what ordinary people do not feel. And although there is a debate about the ethics of such solutions and the possibility of using them to manipulate our decisions, leading to the polarization of attitudes towards it, it seems that HET may become something natural in the future. Especially when the user of e.g. nanochips will be able to easily program, update, improve existing functionalities and introduce new ones, individualizing them according to their own needs, and the solutions they use will be comprehensive and understandable. It is not surprising, therefore, that more and more industries and sectors look to Human Enhancement Technologies, in particular nanochips, as controversial, but at the same time promising solutions to intensify the consumer experience. This is due to the fact that human has changed the way he communicates, buys, makes payments, spends his free time and performs daily tasks (Wong, Kim, 2016). What counts more and more for him is the speed, convenience of the solutions used and the accompanying emotions.

The aim of the article is to preliminary diagnose the social attitude towards payment implant, as an example of Human Enhancement Technologies, with particular emphasis on the characteristics attributed to their users.

To achieve the research goals, the following structure of the work was adopted: literature review on the issues of Human Enhancement Technology and microchips/nanochips implants, including payment microchips, with particular emphasis on factors affecting their acceptance, research methodology along with their context based on bibliometric analysis and analysis of published content on the Internet, presentation of the obtained results and discussion. The study also takes into account research and practical implications and indicates the limitations of the conducted research. The article is part of the ongoing discourse on the possible directions of development of digital technologies and their social significance, assuming that people's behavior changes along with the development of technologies and their popularization.

LITERATURE REVIEW

Human Enhancement Technology

The development of technologies and their increasing implication in various spheres of human life have created the opportunity to achieve the desired perfection. This not only fits into the history of its evolution, but at the same time, shapes it for the future in a different way than before, taking into account its cultural, philosophical or religious aspect (Almeida, Rui, 2019). According to Kurzweil, without technology we will not be able to understand and keep up with the changes taking place around us in the long run (Kurzweil, 2005).

Human Enhancement Technology (HET) is defined as any implantable, wearable, invasive or non-invasive technology that can temporarily or permanently change or augment human functioning (Giger J, Rui, 2019, Rui G, Rohde P, Giger, 2019). However, it is emphasized that any improvements should not be mere short-term mechanical or pharmacological alternatives leading to false human expectations. They should enable a deep and complete blurring of the

boundary between the biosphere and the techno-sphere (Anderson and Tollefsen, 2008). Therefore, perceiving technology only as a kind of “prosthesis of human existence” (Giesler and Venkatesh, 2005) seems to be a gross simplification. HET entails the improvement, intensification of human characteristics and abilities to levels that far exceed what is possible as a result of the course of natural - biological processes of human development, including the development of atypical and even supernatural abilities (Agar, 2010; Wood, 2008). As Warwick points out, the dynamics of changes occurring as a result of biological evolution and those resulting from HET take place in different time perspectives (Warwick, 2003). As a result, we can not only look different, but also experience the reality around us in a different way than before. Such improvements should positively affect people as individuals and societies, developing them in a way that recognizes the legitimacy of human existence (Branford, 2017). If we assume that the society of the future will consist of representatives with varying degrees of implemented improvements, including people who, for various reasons, have remained unimproved, then the spectrum of abilities, experiences and capabilities of the entire society/different societies will be diverse. This will allow for shaping new forms and ways of human interaction with increasingly multidimensional and advanced technology, further strengthening the synergy between them and deepening their interdependence (Buchanan-Oliver, Cruz and Schroeder, 2010).

So far, technological solutions used by human were rather external tools that allowed him to better understand the surrounding reality and the processes taking place in it, to understand, modify or create them (Wood, 2008). Currently, they are becoming its "natural" part (Coeckelbergh, 2011) as a result of three potential levels of possible augmentation (Cebo, 2021):

- replication, which recreates typically human features, including organs and body parts (e.g. prosthetic limbs, hearing aids, etc.). Its goal is to reach the level typical for a healthy person;
- supplements (enrichments), especially the intensification of human senses with additional possibilities. This is a specific form of their supplementation, which boils down to increasing their ability to a level exceeding what we are used to considering as typical (e.g. hearing and vision become more acute, we perceive a wider spectrum of colors, we feel additional senses, etc.). As a result, our ability to experience and learn about the world around us, to discover and understand it, increases;
- extraordinary (supernatural), as a result of which we can acquire skills unusual for a typical person, e.g. infrared vision, making payments with the hand, controlling the drone only through thought, etc.

The current types of improvements are most often considered, depending on the specificity of the modified feature, the purpose and method of its modification, as: physical (improvement of motor skills, speed, external appearance - ears, nose, etc.), cognitive (memory, superintelligence, understanding many languages without the need for many years of science (Branford, 2017), etc.), emotional (empathy, happiness, etc.). Some studies also refer to moral improvements (becoming a more moral person) (Coeckelbergh, 2017). The extent to which this modification will progress, both from the point of view of human as an individual, society, and the expected effect of this process, is also significant (Lin, Allhoff, 2008). However, it is pointed out that cognitive and emotional improvements may lead to personality changes, which

raises doubts regarding the future autonomy and moral agency of human (the level of synergy between technology and human) in the light of his further evolution.

The image of an ideal human with a set of features and capabilities at an ideal level, although it would allow for the assessment of the effectiveness and legitimacy of HET (Roduit et al., 2013), is still subjective - it can be interpreted differently by each person, giving him a different level of reference and individual expectations. Pursuing one's own ideal is currently socially accepted (e.g. cosmetic procedures or plastic surgery), allowing me to develop in a direction that reflects who I am and who I want to be. This is a manifestation of the authenticity I declare. Perhaps, therefore, also Human Enhancement Technologies will be morally accepted if they do not lead to damage to third parties (their sense of justice, threat to social position and resulting rights and obligations, level of autonomy, etc.). And even if the ideal we desire is not fully developed (it develops along with the development and change of society and its norms), we can create a set of qualities that we consider perfect, and which are necessary for us to lead an ideal life (Heilinger & Baumann, 2015) embedded in the context of "here and now" - technologies as a tool to achieve excellence (Clark, 2003). And although currently what is reinforced seems to be socially different from the standard, in the long run it may become normal - a new standard, and the lack of improvements which are something unusual, deviating from the accepted social norms at a given moment. The scope and form of HET will therefore change over time, depending on the context in which we consider it.

However, this raises concerns that the features currently unique to a person will become a kind of good that I can buy at any time in order to become physically fitter, more intelligent, closer to certain canons of beauty, or more effective at work. Then, they will become objectified, reduced to the role of an indicator of social status and wealth - they will lose their uniqueness. In addition, Fukuyama suggested that HET may become a relatively simple remedy for eliminating what we as humans are ashamed of, what we consider embarrassing or compromising (Fukuyama, 2002). Moreover, the effort currently put into self-development (study, practice) will lose its importance (Sandel & Michael, 2002), because the opportunity to enhance any desired trait will have a commercial dimension. Thus, by awakening certain abilities or deepening them, we simultaneously impoverish ourselves by others that we currently feel (e.g. satisfaction with our subsequent progress resulting from the perceived relationship between the effort made and the effect achieved) (Kass, 2003), or we will have to redefine their current way of understanding and interpreting them (Bostrom & Roache, 2008). This may lead to the disruption of the current system of social approval and rewards, determined by the individual effort made by human for his self-development (Brey, 2008). In the literature, attention is also drawn to the aspect of the so-called the "fragility" of human combined with the machine (his addiction to technology) (Woodward, 1994), the pain of introducing a foreign body into the human body, and the risk that non-enhanced people may come to see themselves as incomplete and inferior to new standards (Brey, 2008).

By creating new abilities and pushing the boundaries of existing ones, we are creating new realities of life and perceived well-being (Hogle, 2005), which in turn can lead to widening differences in quality of life, social status, education and income. It seems, however, that the existence of huge databases that collect information about us in real time and the resulting knowledge, to which we have more and more unlimited access, makes a person today someone with capabilities and features that go far beyond their typical conditions (Kim, 2017).

Payment implants

Payment implants are a form of microchips implants and as such, are part of the Human Enhancement Technology philosophy. These are electronic devices in a bio housing (biopolymer) that can be implanted into the human body, which leads to the extension of its existing capabilities (Pelegrín-Borondo et al., 2017). Based on NFC (Near Field Communication) technology, they allow you to make a payment when you put your hand with an implanted payment chip to an authorized payment terminal. They do not need batteries, charging, and do not emit their own radio waves (passive device). They also do not track the location of their users and cannot be lost. They are also small in size, and their miniaturization increases the possibilities of their integration with the human body.

An important role in the popularization of payment implants can be played by the level of their functionality and adaptation to the actual expectations of consumers. Contactless payments increase both the speed of transaction execution and the convenience of consumers who use them, especially in comparison to cash. They are perceived as a more competitive alternative to traditional forms of payment (Polasik et al., 2013; Trütsch, 2020). The speed of the transaction and its convenience are therefore crucial in the process of selecting specific payment tools and accepting new ones (Jonker, 2007). The promotion of various innovative forms of payment, in general, over time may lead to a decrease in the popularity of solutions perceived as conventional.

Technology opens up potentially infinite possibilities for human. However, the pace of acceptance of new solutions may depend on the demographic and behavioral characteristics of consumers (Trütsch, 2020; Dias et al., 2023), as well as ethics and individual perception of what is right and wrong in the light of the accepted norms in a given society, as well as in direct reference groups (family friends, acquaintances, colleagues, etc.) (Adams, 2010; Javo & Sørlie, 2010). This will be related to cultural aspects, including e.g. religion, social morality, which may be important when assessing the value of implants, benefits and their ratio compared to costs, as confirmed by research (Žnidaršič et al., 2021; Borut et al. 2022). The more society begins to accept a given innovation, the more the importance of social norms as limitations and barriers in the human decision-making process decreases (Risselada et al., 2014). Social approval then becomes a kind of consent (Pelegrín-Borondo et al., 2016).

More and more often it is also said that the level of acceptance of payment implants may in the future be related to the spectrum of benefits and potential applications they offer (not only a payment tool, but also a tool for identifying and unlocking access to specific rooms, a carrier of information contained in our documents such as ID or passport, a tool facilitating the process of managing smart home and smart devices). It should be assumed that when these benefits outweigh other solutions available on the market, their popularity will increase (Park, 2014).

The attitude towards payment implants may also be affected by the scope and nature of the interests of their potential users. This is confirmed, for example, by research showing that reading science fiction publications has a strong impact on the acceptance of possible human improvements (Laakasuo et al., 2018). This also applies to movies and games. The more often we meet and familiarize ourselves with such controversial solutions in the world of fiction, the more they stop shocking us in the real world. The lifestyle of payment implant users also turns out to be of some importance. Research conducted among people who have opted for this type

of augmentation (Michael et al., 2017) shows that their buyers are mainly men who are active in social media, have experience in contactless payments with smartphones, wearables (smartwatch) and often use online payment services. They are also people who quite often lose various types of identifiers, wallets or payment cards. Moreover, based on the habits of a potential consumer who has a payment chip implanted, it can be assumed that his lifestyle is quite stressful (Borut Werber, 2022). Potential users of this type of Human Enhancement Technology are therefore looking for simple solutions that do not require additional involvement from them, naturally fitting into their everyday habits, while providing them with unusual, as for the moment, skills for a typical person.

The acceptance of payment implants will also be influenced by emotions (Reinares-Lara, 2016), both positive (e.g., they facilitate a payment process, provide new experiences, improve our perceived social status) and negative (e.g. social disapproval, fear of unknown, threats resulting from the presence of a foreign body in the human body (Reinares-Lara, 2018)). The personality traits of payment implant users, which determine their consumer behavior, will be important here (Borut Werber, 2022). It is increasingly difficult to understand the behavior decisions and human attitudes without taking into account their technological perspective.

The conducted research on the factors influencing the acceptance of microchip implants does not provide clear conclusions. On the one hand, they show that perceived ease of use, usability and trust are identified as the most important predictors of the intention to use microchip implants (Žnidaršič et al., 2021). On the other hand, the research by Reinares-Lara et al. from 2016, does not confirm that there is a statistically significant relationship between the ease of use of this type of implants and the decision to use them. Perhaps, this is a result of the adopted methodological assumptions, as well as the purpose for which the chip was introduced into the human body.

METHODOLOGY

Study Context

Issues related to human enhancement technology, including the issue of microchip implants and payment microchips implants, are definitely still a new area of interest for researchers. This can be seen in a relatively small number of publications on these issues. In order to identify the current state of knowledge and the main directions of research in the analyzed area, a systematic literature review was carried out. First, it concerned issues related to human enhancement technology (HET), then microchip implants (MI) and payment microchips. In the process of analysis, a standardized procedure was adopted, taking into account three main areas: 1) identification of key databases and a collection of publications, 2) their selection and development of a full database of publications, and 3) their bibliometric and content analysis. In the first stage, international databases were selected, taking as a criterion their full-text nature. Their analysis allowed for the identification of only 33 publications directly related to HET and 26 related to microchip implants (full-text and peer-reviewed publications). Unfortunately, it was not possible to find publications that would directly address the issue of payment chips. At this stage, the conducted analyzes were not limited to social sciences only,

but also included publications in the field of engineering and technical sciences, medical sciences, humanities, as well as exact and natural sciences.

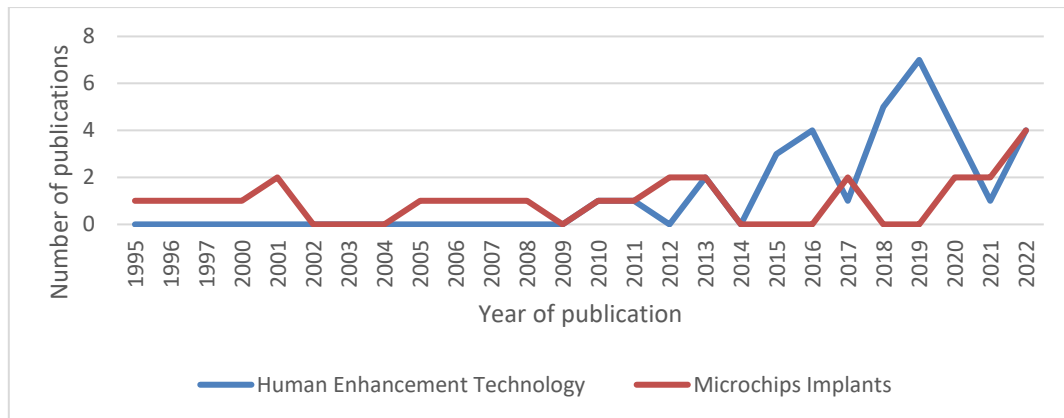


Figure 1. Analysis of the number of publications.

[Source: own study]

Taking into account the dynamics and the scope of observed social and business changes resulting from the development of technology, the period 2010-2022 was adopted for further analyses.

Among the publications in the field of HET, those that were the result of single authorship (42.4%) prevailed. Almost every fourth publication in this field was the result of only institutional collaboration, and slightly more than 18% was created as a result of only national collaboration. Only 15.1% of publications in this field were the result of international collaboration. Interestingly, there were no publications that would have been created as a result of academic - corporate cooperation. In the case of microchips implants, single authorship publications accounted for 15.5%. Almost 1/3 of the publications were those that were created as a result of only national collaboration. Publications resulting from international collaboration and only institutional collaboration accounted for 26.9%, respectively. Only one publication resulted from academic-corporate cooperation.

The list of disciplines that most often refer to HET issues shows a significant share of publications in the field of Arts and Humanities (41.7%), Business, Management and Accounting (33.3%) and Social Sciences (33.3%). However, a parallel analysis of the Field-Weighted Citation Impact indicates that the highest value of this indicator was in the case of publications in the field of Business, Management and Accounting and was at the level of 1.39. In other cases, the value of the FWCI index was lower than 1, which means that publications in this field are cited much less often than would be expected considering the global average for similar publications. In the case of microchips implants, publications in the field of Engineering (31.1%), Biochemistry, Genetics and Molecular Biology (26.7%) and Computer Sciences (11.1%) dominated. However, a parallel analysis of the Field-Weighted Citation Impact indicates that the highest value of this indicator was in the case of publications in the field of Neuroscience (1.32), Computer Sciences (1.16) and Physics and Astronomy (1.11). In the remaining cases, the FWCI was less than 1.

Next, an analysis of the frequency of keywords and research problems for human enhancement technology and microchips implants was performed, and the keywords selected

in this way were subjected to quantitative analysis. The visualization of their frequency was presented in the form of a "word cloud", where the frequency of occurrence was reflected in the size and thickness of the font (Figure 2, Figure 3).



Figure 2. Keyword frequency analysis for human enhancement technology (2010 – 2022)

[Source: own study]

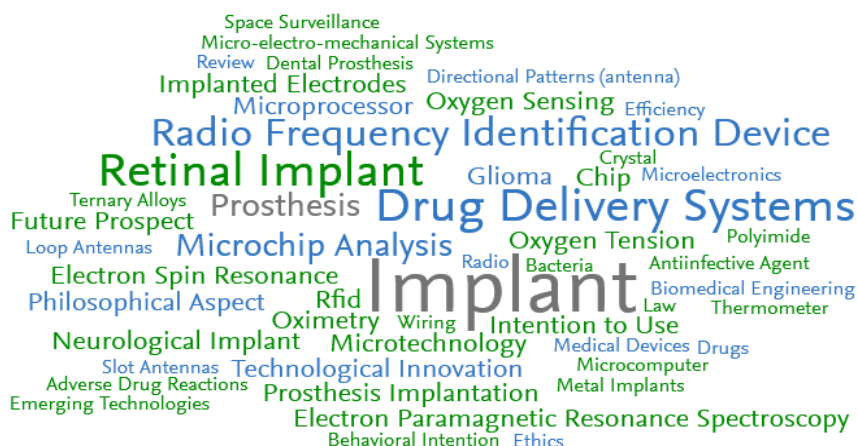


Figure 3. Keyword frequency analysis for: microchips implants (2010 – 2022).

[Source: own study]

Publications in the field of HET were in line with the issues of human-robot interaction (the highest level of prominence measured by the RCSI index), microelectrodes, extended mind, posthuman, methamphetamines. Publications in the field of microchip implants were related to strain and flexible sensors/electronics (the highest level of prominence), transdermal drug, implants and surge capacity. Issues related to management and business practices, which are the main area of interest of the authors, were prominent at the level of 54.822.

The Topics & Topic Clusters analysis showed that publications in the field of Human Enhancement Technology has contributed to 10 topics (Figure 4), of which the dominant was: Science Fiction; Human Enhancement; Posthuman. In the case of microchips implants, publications were more interdisciplinary in nature and they have contributed to 29 Topics & Topic Clusters (Figure 5).

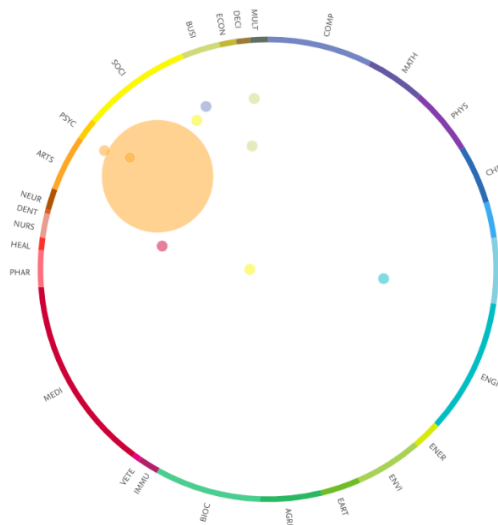


Figure 4. Topics and Topic Clusters for HET.
[Source: own study]

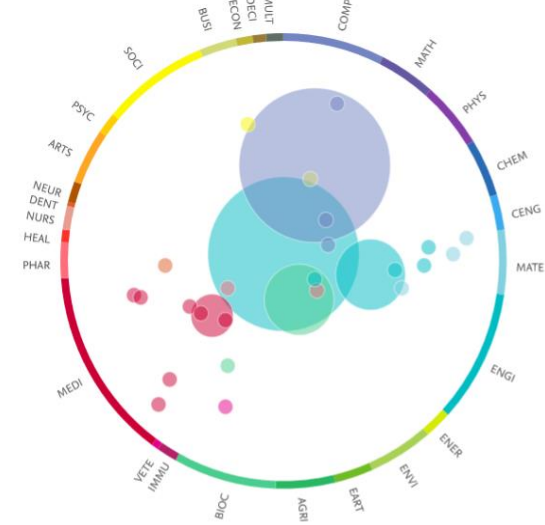


Figure 5. Topics & Topic Clusters for MI.
[Source: own study]

Differences in the number of publications from the point of view of the most active countries and research institutions are small. Therefore, it is difficult to conclude that this is a criterion clearly determining further directions of research on HET and MI. The conducted analysis showed that the largest number of publications on Human Enhancement Technology was created in the United Kingdom. However, the FWCI index was higher than 1 only in the case of publications by German and American research centers. In the case of microchips implants, the most publications came from the United States, Australia and Slovenia, while the highest FWCI was recorded for publications from Belgium, Australia, Italy and Switzerland.

In accordance with the methodology of a systematic literature review, an analysis of citations was also carried out, taking into account the following phrases: human enhancement technology and microchip implants. However, the conducted analysis was limited to substantive areas related to the authors' interests. This made it possible to identify valuable cognitive publications and publications requiring further exploration of research areas, in accordance with the interests of the authors (Table 1).

Table 1. The most frequently cited authors dealing with the issues of human enhancement technology and microchips implants (2010 – 2022).

Author	Article	Publication	Year	Citation Count
HUMAN ENHANCEMENT TECHNOLOGY				
Coeckelbergh, M.	<i>Human development or human enhancement? A methodological reflection on capabilities and the evaluation of information technologies</i>	Ethics and Information Technology vol. 13(2), pp.81-92	2011	40

Grewal, D., Kroschke, M., Mende, M., Roggeveen, A.L., Scott, M.L.	<i>Frontline Cyborgs at Your Service: How Human Enhancement Technologies Affect Customer Experiences in Retail, Sales, and Service Settings</i>	Journal of Interactive Marketing vol.51, pp. 9-25	2020	38
Bloomfield, B., Dale, K.	<i>Fit for work? Redefining 'Normal' and 'Extreme' through human enhancement technologies</i>	Organization vol. 22(4), pp. 552-569	2015	18
Saritas, O.	<i>Human enhancement technologies: Future outlook and challenges</i>	Foresight Russia vol. 7(1), pp. 6-13	2013	7
Caon, M., Menuz, V., Roduit, J.A.R.	<i>We are super-humans: Towards a democratisation of the socio-ethical debate on augmented humanity</i>	ACM International Conference Proceeding Series 25-27-February-2016,a26	2016	3
Woodrow, B.	<i>The Process of Evolution, Human Enhancement Technology, and Cyborgs</i>	Philosophies vol. 4(1), pp.	2019	3
Leung, KH.	<i>The Technologisation of Grace and Theology: Meta-theological Insights from Transhumanism</i>	Studies in Christian Ethics vol.33(4), pp. 479-495	2020	3
Pronin, M., Yudin, B., Sineokaya, J.	<i>Philosophy as expert examination</i>	Filozofskii Zhurnal vo. 10(2), pp. 79-96	2017	3
Lima, V., Belk, R.	<i>Human enhancement technologies and the future of consumer well-being</i>	Journal of Services Marketing vol.36(7), pp. 885-894	2022	1
MICROCHIPS IMPLANTS				
Michael, K.; Michael, M.G.	<i>The future prospects of embedded microchips in humans as unique identifiers: the risks versus the rewards</i>	Media Culture & Society vol.35(1), pp. 78-86	2013	14
Smith, A.D.	<i>Evolution and acceptability of medical applications of RFID implants among early users of technology</i>	Health Marketing Quarterly 24(1-2), pp. 121-155	2008	13
Smith, A.D.	<i>Microchip implants' logistical efficiencies and ethical issues</i>	International Journal of Mobile Communications vol.10(3), pp.281-302	2012	6
Smith, A.D.	<i>Gender preferences of efficiencies and ethical issues: Commercial, personal, and governmental applications of RFID-based implants and technologies</i>	International Journal of Business Information Systems 12(4), pp. 455-492	2013	4
Broudy, D., Arakaki, M.	<i>Who Wants to Be a Slave? The Technocratic Convergence of Humans and Data</i>	Frontiers in Communication vol.5.	2020	1

A review of the literature showed a lack of publications directly related to the subject of payment microchips/payment implants. At the same time, business practice shows that such solutions are becoming available on the market, an excellent example of which are payment

chips from, for example, Walletmor, which are already used by Germans, Dutch, Scandinavians and several dozen Poles (<https://walletmor.com>).

The literature review was supplemented by an analysis of the content published on this topic on the Internet. The overall number concerning the issues of microchips implants, including payment implants, is still relatively low, which suggests a rather limited level of popularity of the discussed issues. This is confirmed by the value of the Presence Score indicator, which allows you to measure the popularity of a given topic on the Internet. In the analyzed case, its value is at the level of 44%, which suggests a moderate level of interest in this issue in relation to other topics. The first comments in this regard appear only in November 2017, and their intensification in subsequent years is periodic and seems to be rather related to specific events related to this issue (e.g. research by Elon Musk, launch of Walletmor payment chips on the market, etc.). The assessment of the range of published mentions indicates a clear advantage of non-social mentions (62%). 1/3 were Web mentions, and almost 18% were video publications. Slightly more than 14% were microblogs and news (12.8%). Almost 11% were mentions on blogs, and 10.3% were publications in the form of podcasts. Among the most influential sites in the analyzed topic were YouTube, Twitter and Yahoo.

The topic of microchip implants was embedded in a broad context, as evidenced by the most frequently appearing trending hashtags. Among them were: #biohacking, #health, #wellness, #mindfulness, #technology, #biotechnology, #regenerativemedicine, #antiaging, #selfhelp #cryprocommunity, #bodybuilding, #futurism. The context of discussions around the phrases: microchip implants and payment implants was also analyzed, and its visualization was presented in the form of a "word cloud", where the frequency of occurrence was reflected in the size and thickness of the font (Figure 6).



Figure 6. Context of a discussion.

[Source: own study]

The analysis indicates the multiplicity of topics discussed, often unrelated and their large dispersion, which is typical for new issues, with an unsystematized conceptual structure, in the initial periods of market commercialization. The most frequently appearing keywords can be entered into two threads: medical and health-promoting applications of microchips implants (e.g. wellness, health, therapy, help) and transformation and reprogramming of the human body (e.g. technology, biohacker, transformation, body). The study of affective states conducted through sentiment analysis allowed for recognizing emotions in published content. And although publications with a positive color prevail (Figure 7), which accounted for 79.9% in the analyzed period, at the same time the analysis of the published content indicates a fairly large polarization of attitudes related to this issue.

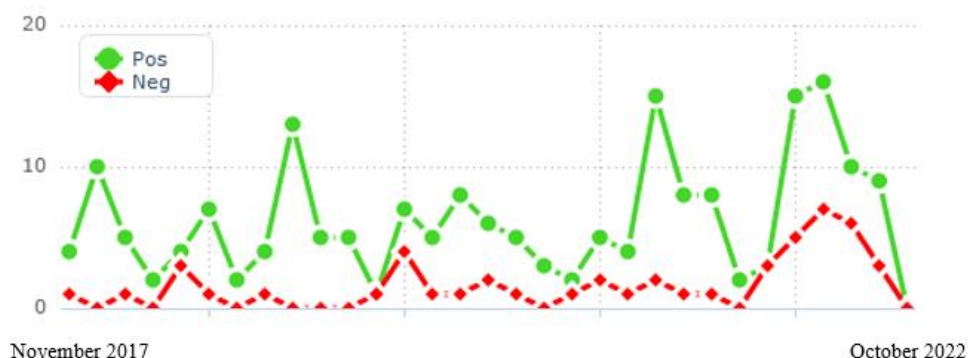


Figure 7. Sentiment analysis.
[Source: own study]

Human evolution, including in the consumer dimension, is undoubtedly driven by technology, while its acceptance and commercialization of digital technologies change their position - technology for humanity (Kotler et.al., 2021). The authors' research focuses on the potential for human-technology synergy and augmentation possibilities. This area is still a novelty, which justifies the need for further research in this area.

METHODS

The completed research is part of a broader research project on the dynamics and factors determining social acceptance of payment implants as an example of Human Enhancement Technology (the scope exceeding typical human skills), and is of the nature of preliminary research. At this stage, the identification of features attributed to users of this form of augmentation was limited to assessing social attitudes towards it.

Due to the fact that research on the social acceptance of payment implants from the perspective of their users has not been conducted on a large scale so far, no hypotheses have been defined regarding the relationship between the analyzed personality traits and attitudes towards payment implants. However, a number of research questions relating to the purpose of the study were considered at this stage:

- What is the future of the co-evolution of technology and human?
- What may determine the popularization of payment implants in the context of the development of HET?
- What concerns and challenges does this entail?
- How is a person who makes a payment via a payment implant perceived socially?
- Does this ratio change depending on the sex of the person who decided to implement and use payment implants?
- Do the values resulting from the declared faith influence the perception of payment implant users?

The authors decided that these answers can be a starting point for in-depth exploration and analysis of the profile of people interested in microchips implants, with particular emphasis on

payment implants and the factors determining this process. It will then allow to assess the effectiveness of existing models of social acceptance of this type of innovation.

The study used the aspect of projective techniques, recognizing that the existing attitudes towards payment implants may be unconscious by a person, or may be conscious, but for various reasons, they are not verbalized (e.g. fear, social stigmatization, potential ostracism) or those that are verbalized differ from the actual attitudes of the individual (human versus society). At the same time, they affect the readiness of a person to make a decision about the implementation and use of this type of microchips implants. This requires identifying and evaluating these motives indirectly, which draws on Haire's research on consumer attitudes (Haire, 1950). On this basis, a 5 x 2 online experiment was designed (different forms of payment x gender of the payers). The various forms of payment currently used on the market include: cash, payment card, watch (smartphone/iPhone), wearable device (smartwatch) and payment microchips. Their selection was preceded by an analysis of consumers' payment habits. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Each participant in the study gave informed consent to participate in it. The experimental stimulus was the pictures presenting various forms of payment made by a woman or a man. Respondents were then asked to rate the indicated personality traits of the person making the payment, selected on the basis of the Big Five Aspects Scale (Struss et al., 2014). Next, the respondents were asked to answer a few questions about their attitude to the technology, including payment chips, along with an indication of the factors that, in their opinion, will determine the process of their popularization in the coming years. Due to the fact that a high polarization of extreme attitudes towards payment chips was observed in social media, including their religious context, it was decided to include a question about the respondents' faith in the research questionnaire. Finally, the questionnaire consisted of 17 questions divided into three blocks of questions. The first one included questions about the respondents' characteristics, the second one included questions measuring selected personality traits of payment chip users. The third part referred to the opinions declared by the respondents regarding the development of payment implants. A five-point Likert scale was used to measure the analyzed attitudes. The authors did not introduce a time limit that would restrict the time needed to complete the research questionnaire. The study was preceded by a pilot study, which allowed to verify the correctness of the adopted methodological assumptions and eliminate possible ambiguities in the formulations. After this validation process, the questionnaire was used in the real research.

Sample

1,017 respondents over 18 years of age took part in the study, 52% of them were women. Representatives of Generation Y dominated, constituting almost 40% of the respondents. The second largest group were representatives of Generation X (slightly over 31%). Respondents had secondary education 44.9% and higher education 41.4%. Almost 46% of the respondents declared their level of technological advancement as high. Almost 60% of respondents assessed their financial situation as average, and every third found it good. Believers accounted for 75.6%, of which 40.4% admitted that they are not only believers, but also practitioners. In the case of the question about faith, slightly more than 9% of respondents refused to give their answer. Detailed characteristics of the community are presented in Table 2.

Table 2. Characteristics of the sample according to the characteristics of the respondents.

Feature	Number	Structure in %
GENDER		
Woman	529	52.0
Man	488	48.0
AGE (according to the Gartner classification)		
1957 – 1964 (Generation Baby Boomers)	104	10.3
1965 – 1979 (Generation X)	324	31.8
1980 – 1994 (Generation Y)	403	39.6
1995 – 2004 (Generation Z)	186	18.3
EDUCATION		
Basic	139	13.7
Medium	457	44.9
Higher	421	41.4
FINANCIAL SITUATION		
Very bad	15	1.5
Bad	93	9.1
Average	582	57.2
Good	305	30.0
Very good	22	2.2
LEVEL OF TECHNOLOGICAL ADVANCED		
Average level of technological advancement	336	33.0
High level of technological advancement	465	45.7
Very high level of technological advancement	216	21.3
ATTITUDE TO FAITH (religion)		
Practicing believers	411	40.4
Non-practicing believers	367	36.1
Atheist	145	14.3
Refusal to answer	94	9.2
TOTAL	1017	100

[Source: own study]

RESULTS

Descriptive analyses

Only less than 6% of the respondents, given the current level of their knowledge about microchips and payment implants, would agree to have them implanted, with men showing a greater tendency in this regard. Despite the high polarization of extreme attitudes towards payment implants in the religious context observed in the media, the study did not find such a relationship.

On the other hand, the respondents do not rule out that payment implants may in the future become as a popular solution as smartwatches they currently own. The perspective of a decade seemed most realistic for the respondents, which was indicated by 1/5 of them and almost 34% claimed that in their opinion, popularization of payment implants is not possible at all.

Respondents were of the opinion that the level of popularization of payment implants may be influenced by their available functionalities and adaptation to the expectations of potential and actual users. Attention was primarily paid to the health dimension of this type of implants, including the possibility of real-time monitoring of basic health parameters (57%), and the fact they could become a carrier of information about our blood type, chronic diseases and/or allergies (54.9%) as well as about drugs taken by the user on a regular basis, along with their

doses (53%). The respondents also indicated that such chips could in the future replace or become an alternative to the current documents, such as ID or a driving license, which was pointed out by every second respondent. It was also mentioned that the dynamics of popularization of payment implants as an alternative payment tool could be directly influenced by banks that would offer them for free (without having to pay for their purchase or use), which was indicated by 53% of the respondents.

They also recognized that the biggest barrier in the process of popularizing payment implants is currently the lack of trust towards them, which is largely due to the nature of the narrative that accompanies them in the media, as well as the lack of reliable knowledge about them. Respondents were primarily concerned that payment chips could in the future become a tool for surveillance of their behavior, which could affect their status and social position (76.4%), as well as their rights and privileges, limiting or extending them (almost 74%). The respondents were also afraid of the possibility of their digital identity being stolen (77.2%), especially when payment implants carry more and more information, including confidential information, about their users. It was also pointed out that it is necessary to intensify works aimed at increasing the miniaturization of microchip implants, so that their introduction into the body does not require systematic skin incision (health and aesthetic aspects). In their opinion, this would eliminate some of the related concerns, especially in the context of the rapid aging of technology. According to the respondents, the level of trust towards payment implants in the near future will be influenced by:

- voluntary level of the decision to implant them (65.5%) - voluntariness is a factor that, in the respondents' opinion, gives them a right to choose payment tools most suited to their needs, and to make decisions in accordance with their preferences (I am the decision maker);
- subjective assessment of the level of ethics of the technologies used and solutions based on them (63.8%) – the more payment implants are contrary to what is socially considered good, moral and proper, the greater the resistance to them may become;
- subjective assessment of the applicable legal legislation from the point of view of the effectiveness of user privacy protection (61.1%) – the lower the level of trust in the existing legislation in this area, the lower the level of interest in payment implants and the lower the willingness to accept them. There is a significant negative relationship between age and the assessment of factors determining the level of trust in payment chips (the older the respondents, the lower their level of trust in this tool).

Main results

The conducted analysis showed that there are significant differences in the perception of people using payment implants, taking into account the gender of their users. The juxtaposition of these features, based on the provided contextual clues (various forms of payment), illustrates the social attitude towards users of this form of augmentation (Table 3).

The higher the age of the respondent, the more sociable a man using a payment implant was perceived ($H=11.832$; $df=5$; $p=0.037$), and a woman more dutiful ($H=12.696$; $df=5$; $p=0.026$). At the same time, with the increase in the level of education, a man who used a payment implant on a daily basis was considered a very active person ($H=6.640$; $df=2d$;

$p=0.036$), and interestingly, in the same situation, the woman appeared to be a very active person, but focused only on her own convenience ($H=11.677$; $df=2$; $p=0.003$).

It was also found that the higher the declared level of technological advancement, the higher was both the perceived level of creativity of a man using the payment implant ($H=10.290$; $df=2$; $p=0.006$) and their regularity in actions ($H=8.627$; $df=2$; $p=0.013$) and reliability in their implementation ($H=6.482$; $df=2$; $p=0.039$). In the case of women, they were considered more intelligent ($H=6.931$; $df=2$; $p=0.031$) and bolder ($H=7.577$; $df=2$; $p=0.023$), but at the same time, they were once again defined as people who put a lot of emphasis on their comfort ($H=13.911$; $df=2$; $p=0.001$).

The declared level of religiosity also influenced the perception of payment implant users. The higher it was, the more a man was perceived as a man prone to irritation and anger ($H=10.336$; $df=2$; $p=0.006$). Interestingly, in this case, the traits attributed to women were positive. They were considered as dutiful ($H = 9.281$; $df = 2$; $p = 0.010$), responsible ($H = 10.221$; $df = 2$; $p = 0.006$) and cognitively open ($H = 9.698$; $df = 2$; $p = 0.008$). The higher the declared level of religiosity, the more the woman was assessed as more creative ($H=9.987$; $df=2$; $p=0.008$).

Gender also turned out to be a factor having a significant impact on the differences in the perception of payment implant users. Women, more than men, perceived a man using this form of payment as better organized ($U=019.00$, $Z=-2.365$, $p=0.018$), reliable in achieving the assumed goals ($U=2095.50$, $Z=-2.025$; $p=0.043$), and conscientious 2.455; $p=0.014$) and a person of great imagination ($U=1933$; $Z=-3.193$, $p=0.001$). In the case of women using payment implants, they were perceived by other women, only as active ($U=2090.50$; $Z=-2.053$; $p=0.040$).

Importantly, no other relationships or interactions between variables turned out to be significant.

Table 3. Main characteristics attributed to people using payment implants.

MAN	WOMAN
Conscientious	Conscientious
Active	Active
Creative	Creative
Systematic	Intelligent
Sociable	Bold
Reliable in achieving the assumed goals	Responsible
Well-organized	Cognitively open
Endowed with great imagination	Focused on her own comfort
Prone to irritation and anger	

[Source: own study]

DISCUSSION

The research shows that the profile of people using payment implants perceived by the society differs depending on whether their user is a woman or a man, which will be important for market practice in the process of popularizing this tool, both in the narrow sense (a new form of payment) and the wider one (HET). The way in which people using payment implants are currently perceived, as well as the further nature of changes taking place in the arrangement of

these features (e.g. new features, change in the intensity of already identified features, disappearance of some currently indicated features) will be important for the dynamics of the implementation of this form of augmentation and its social acceptance. Demographic and behavioral characteristics of consumers (including both, those who use payment implants, and those who have not yet decided to do so), as shown by some earlier research (Trütsch, 2020; Schönthaler et al., 2022), will be crucial. This also applies to their perception as individuals functioning in a given society and the moral standards recognized by them.

It was noted, however, that although negative opinions about payment implants and their users are quite often verbalized in the social sphere, the features attributed to them in the study turned out to be basically positive (which was also confirmed by the sentiment analysis). The narrative currently conducted in the media is undoubtedly highly emotional and set primarily in the context of the negation of humanism, however, the individual assessment of such solutions may not be so strong and focus more on their pragmatic aspects. This will lead to a gradual weakening of the importance of the applicable norms, as mentioned, for example, by Risselada et al., 2014; Žnidaršič et al., 2021. However, it may suggest that the gradual, deepening synergy between a human and technology does not have to ultimately lead to a real denial of what at the current level of human evolution we consider to be the paradigm of our being, and which will indicate further directions of their mutual coevolution.

The list of features currently attributed to women and men using payment implants shows that those identified with the conscientiousness, intellect and extroversion of their users predominate, while in the case of women using payment implants, attention was drawn to the fact that they may be more than men focused on their own convenience. It seems reasonable to further deepen research in this area. However, when comparing the characteristics attributed to women and men using payment implants, it is difficult to conclude that there are currently arbitrary rules that would allow for an unambiguous assessment of their decisions on augmentation at a generalizing level for all users. Discrepancies in the juxtaposition of the discussed features will undoubtedly be even more pronounced when taking into account cultural differences, at the next stage of the research conducted by the authors.

The prerequisites and limitations identified in the study regarding the decision to implement payment implants are in line with previous research on the issue of HET (e.g. Franks & Smith, 2021).

LIMITATIONS

The publication is not free from cognitive and methodological limitations. However, it takes up new issues both from the point of view of science and market practice. The obtained results are declarative in terms of identifying the potential dynamics and directions of further development of payment implants, including the identification of its barriers and reasons (respondents did not have such chips implanted). In this respect, they are idiographic in nature, which means that the obtained results concern only the surveyed group of respondents and require the inclusion of current users of payment implants in further research. The study did not take into account the binary division of respondents' gender. However, this category will be introduced at subsequent stages of the research, which, in the authors' opinion, will create a

natural space for self-determination about the respondent's identity and will broaden the cognitive perspective of the analyzes conducted. Additionally, at this stage of the research, the analysis of the basic relationships between variables was limited, which constitutes a basis for further exploration of the analyzed issues and the starting point for critical reception, reflection and further considerations in this area. It would also be advisable to include qualitative methods, allowing for a deeper understanding of the motives and predictors behind the decision on this form of augmentation, including taking into account cultural differences (e.g. moral, religious).

CONCLUSIONS

Technology not only leads to changes in who we are today, but also in what direction we will continue to develop. The human is an inseparable part of the surrounding world, which is a complex system that is constantly evolving (Gladden, 2018). It is a system that as a whole determines its behavior (holistic approach) and at the same time is influenced by each of its parts (reductionist approach). As a consequence, in order to understand the interdependencies between human and technology and their social connotations, we must look not only at the dynamics and nature of changes taking place on each side of this interaction in a fragmentary way, but also at their interdependencies and connections in a comprehensive way, taking into account including the possibility of their mutual adaptation and co-evolution. The biosphere and the technosphere not only interpenetrate, but also co-create each other. The tightening of the process of integration between human and technology is a complex, multidimensional and multi-stage process. This may lead to a situation where gradual augmentation will equip a human with advanced technological devices that are not the result of natural evolution, as a result of which the human will become a form of non-biological technology (Woodrow, 2019). This is important both from the point of view of the individual and the whole society.

Payment implants, regardless of whether they are perceived in a broad perspective (HET element), or in a narrow perspective (another alternative form of payment), create the possibility of going beyond what we currently know and morally accept. Human still seems to be a kind of "work in progress", still requiring work, modification and improvement in the direction desired by them (Bostrom, 2003). However, it is important to realize the importance of technology in the process of human evolution, including through the process of its technological augmentation, the factors determining it, including those that stimulate or weaken it as well as the resulting consequences.

IMPLICATIONS FOR RESEARCH, APPLICATION, OR POLICY

Research implications

Payment implants are definitely a new area of research, exploration and market applications, which causes many extreme opinions and attitudes towards them. The conducted research is part of the ongoing discussion on the scope of the gradual blurring of the boundary between

the biosphere and the technosphere, and the mutual co-evolution of human and technology. They provide knowledge about the social perception of payment implant users, taking into account their gender, while looking for predictors of the basis of our attitude towards them. The research results allow to create a profile of payment implant user, which is a kind of photograph of current attitudes towards this form of augmentation. Further research on the issue of payment implants, or more broadly HET, conducted by the authors, will be focused on the analysis of the level of social acceptance of such solutions, including a comparative analysis of the most frequently used models and their constructs. Linking them further with the analysis of personality traits attributed to people who use various forms of augmentation, including payment implants, may allow for the identification of differences in the profile of people interested in it, including individual levels of HET. Further research should be carried out in two parallel perspectives. On the one hand, it should take into account common social opinions and attitudes as the context in which the phenomenon is embedded, and on the other hand, should deepen the analysis of individual attitudes, with particular emphasis on the group of people who have already undergone augmentation (current users of payment implants), including cultural differences.

Practical implications

The conducted research provides information that may be an indication as to why certain forms of augmentation, including payment implants, may be socially accepted or negated. The obtained results may turn out to be an interesting material for the creators of various solutions that fit into the idea of HET, including the creators of the next generation of payment implants (e.g. in terms of miniaturization of the device, looking for ways to slow down the pace of technology aging, creating new functionalities), as well as organizations offering services, including banking institutions (e.g. gradual expansion of payment methods available to their clients, building awareness, knowledge and trust towards this form of payment, creating positive emotions around it). At the same time, indicating the spectrum of features attributed to people using payment implants (taking into account their gender distinction) may be important from the point of view of building a narrative augmentation around this form, referring to socially recognized ethical norms and values, including moral and religious ones, which may become more and more important as the analyzed solution becomes popular.

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FACTORS INFLUENCING ACCEPTANCE OF INDONESIAN CONTACT TRACING APP: DEVELOPMENT OF THE TECHNOLOGY ACCEPTANCE MODEL

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Abstract: *Contact tracing apps for the COVID-19 have been broadly developed worldwide and Indonesia is no exception. The Indonesian application is called PeduliLindungi. This study aimed to provide a comprehensive understanding of the public's intention to use such applications by incorporating trust, trust in government, privacy concerns, and social influence variables as an extension to the technology acceptance model (TAM). A questionnaire was distributed online through social media to attain 371 participants among Indonesian inhabitants based on the convenience sampling method. Descriptive analysis and covariance-based structural equation modeling were used to analyze the data. The results indicated that intention was predicted well by trust, attitude, and social influence. Furthermore, trust in government played a role in predicting the application's trustworthiness. The government and decision-makers should consider this observation in promoting the PeduliLindungi application, as it could increase its effectiveness.*

Keywords: *COVID-19, Indonesia, technology acceptance model, mHealth, contact tracing app, structural equation modeling.*



INTRODUCTION

Health technologies have played an influential role in preventing and controlling the spread of Covid-19 (Ye, 2020) and supporting healthcare organizations in making important decisions (Vaishya et al., 2020). For example, artificial intelligence has contributed to discovering COVID-19 clusters (Vaishya et al., 2020), while mobile technology has provided an easier way to spread awareness about virus transmission with its ability to map the spread of COVID-19 (Verma & Mishra, 2020). In particular, mobile health apps have become increasingly necessary, as they help to organize patient-generated health data crucial for tracing and tracking the diffusion of the virus (Ye, 2020). Due to such critical role of mobile health apps, numerous countries have been developing and publishing them officially (Criddle & Kelion, 2020). However, any application's success in suppressing the number of cases depends on the number of its users (Altmann et al., 2020).

In Singapore, the mobile application uses short-distance Bluetooth signals that automatically detect individuals close in proximity; through this, the government can detect the individuals an infected person has contacted (Whitelaw et al., 2020). In Switzerland, SwissCovid – their application's official name – adopted the decentralized privacy-preserving proximity tracing (DP-3T) protocol; this application has been downloaded by almost half the population (von Wyl et al., 2021). Similar to SwissCovid, the NZ Covid Tracer App developed by New Zealand's Ministry of Health has been downloaded by more than 2 million people, although less than 400 people use it daily (Tretiakov & Hunter, 2021). In Germany, the number of installed applications accounted for 20% of the population (Blom et al., 2021).

Along with optimizing the vaccination program, the Indonesian government developed a Covid-19 tracing application called PeduliLindungi to help control the spread of COVID-19. The application was officially launched in April 2020. Using the application, users can obtain information about the risk level in their area. On the other hand, the app assists the government in tracing and tracking new cases (Lin et al., 2020). On July 1, 2021, the Indonesian Ministry of Health published new developments in the application, enabling users to obtain digital vaccine certificates. They also mandated the public to scan QR Codes provided in public places with the built-in scanner in the apps whenever they enter them. These developments helped in intensifying tracking and contact tracing. As a result, proper login through the apps has become the main requirement for entering public places such as Ancol Beach Park and supermarkets.

Some studies have been conducted to investigate the role of the application in combating the transmission of COVID-19 in Indonesia (Kurniawati et al., 2020; Suryaatmadja & Maulani, 2020). Moreover, one study used the technology acceptance model (TAM) approach—using the first model introduced by Davis (1989)—to measure public acceptance of the application (Kurniawati et al., 2020). Another study extended the TAM further by incorporating two variables: privacy concerns and trust (Velicia-Martin et al., 2021). Despite not utilizing the TAM, another study has examined the role of trust, trust in government, and social influence in public acceptance of Covid-19 tracing apps (Oldeweme et al., 2021). In the many developments of the TAM by many researchers (Lee et al., 2003), we found that no researcher has studied it more deeply by incorporating other seemingly important variables (trust, trust in government, privacy concerns, and social influence) simultaneously from the TAM perspective. Therefore, this study endeavors to address the existing research gap through the examination of the influence of perceived usefulness, perceived ease of use, attitude towards

the app, trust, trust in government, privacy concern, and social influence on the apps' adoption. In the context of PeduliLindungi, we included the new application updates (integration with 15 other apps, QR-Code scanner, etc.) to capture the ground reality better (in previous research projects about the app, these updates were not present yet). Thus, we hope the findings of this study can support the government and its stakeholders in their need to enforce application use further (Antara, 2021).

The Core Constructs of the TAM

Davis (1989) proposed that user acceptance of technology depended on its perceived usefulness and ease of use. Perceived usefulness is the level of an individual's belief that the technology can enhance their job performance. As for perceived ease of use, it's the level of an individual's belief that the technology does not require much effort to use (Davis, 1989). Both constructs influence the individual's attitude towards acceptance behavior (Aggelidis & Chatzoglou, 2009; Cheung & Vogel, 2013; Kim & Park, 2012; Lim & Ting, 2012). Attitude is described as the level of an individual's evaluation of whether a behavior is deemed advantageous or not (Ajzen, 1991). Perceived ease of use also influences perceived usefulness (Aggelidis & Chatzoglou, 2009; Cheung & Vogel, 2013; Ha & Stoel, 2008; J. Joo & Sang, 2013; Y. J. Joo et al., 2018; Kim & Park, 2012; Lim & Ting, 2012; Venkatesh & Davis, 2000). Afterward, the attitude leads to the intention to perform the behavior (or motivation [Ajzen, 1991]) and ends with the performing of the actual behavior (Legris et al., 2001).

H1: Perceived usefulness positively influences attitude towards PeduliLindungi Application.

H2: Perceived ease of use positively influences perceived usefulness.

H3: Perceived ease of use positively influences attitude towards PeduliLindungi Application.

Although TAM did not originate from a health-related context, a study (Holden & Karsh, 2010) found dozens of health care studies using and mentioning the model. However, these studies didn't focus on Covid-19 tracing apps but other technologies such as telemedicine, internet-based health applications, and mobile health care systems. Although, studies that utilized the TAM to investigate the adoption of COVID-19 contact tracing apps were also found (Kurniawati et al., 2020; Velicia-Martin et al., 2021; Walrave et al., 2021).

Ancillary Constructs of the TAM

TAM's objective is to examine the effect of external variables on internal beliefs, attitudes, and intentions toward accepting a technology (Legris et al., 2001). In telehealth, attitude is defined as positive or negative feelings toward telehealth service usage (An et al., 2021). Therefore, in this case, attitude is defined as the positive or negative feelings toward using a COVID-19 tracing app. Derived from the TAM, attitude affects intention to use (Aggelidis & Chatzoglou, 2009; Davis, 1989; Ha & Stoel, 2008; P. J. Hu et al., 1999; Kim & Park, 2012). Davis (1989) also found an unmediated relationship between perceived usefulness and intention. Other studies have proved this relationship in the context of health technologies (Aggelidis & Chatzoglou, 2009; P. J. Hu et al., 1999; Kim & Park, 2012), fitness application (Beldad & Hegner, 2018), and even Covid-19 contact tracing applications (Tomczyk et al., 2021).

H4: Attitude towards PeduliLindungi positively influences intention to use.

H5: Perceived usefulness positively influences intention to use.

Several studies found a positive relationship between trust and intention to use (Kamal et al., 2020; Oldeweme et al., 2021; Velicia-Martin et al., 2021). Other studies are more specific by incorporating the “trust in government” variable –which also affects trust in general (Oldeweme et al., 2021; von Wyl et al., 2021). Although, we also found a study (Beldad & Hegner, 2018; Tretiakov & Hunter, 2021) that discovered an insignificant relationship between trust and intention. In the technology acceptance context, trust is faith in a technology’s ability to provide good services (Kamal et al., 2020). Additionally, a study on e-shopping revealed that trust also significantly affects perceived usefulness and attitude (Ha & Stoel, 2008).

H6: Trust in PeduliLindungi positively influences intention to use.

H7: Trust in government positively influences trust in PeduliLindungi.

H8: Trust in PeduliLindungi positively influences perceived usefulness.

H9: Trust in PeduliLindungi positively influences attitude toward using.

One study argued that trust in government correlates with the perception of privacy security (von Wyl et al., 2021). It’s foreseeable since the policymakers are responsible for designing privacy regulations (Trang et al., 2020). Privacy concerns have become a primary barrier to using Covid-19 tracing apps (Altmann et al., 2020; von Wyl et al., 2021). It has been described as an individual’s concern about the leak of personal information when using a Covid-19 tracing application (Kamal et al., 2020). A study has confirmed a negative relationship between privacy concerns and attitude (An et al., 2021). However, another study didn’t find any relationship between the two (Tretiakov & Hunter, 2021). Although a study discovered a direct effect on intention (Walrave et al., 2021), two other studies did not find it significant (Kamal et al., 2020; Velicia-Martin et al., 2021).

H10: Privacy concern within PeduliLindungi negatively influences trust in government.

H11: Privacy concern within PeduliLindungi negatively influences attitude toward using.

Furthermore, a study found that social influence is positively associated with the usage number of COVID-19 tracing applications (Seto et al., 2021). A study (Oldeweme et al., 2021) has discovered an effect of social influence on trust and intention (Kamal et al., 2020), while another study found a connection between social influence and perceived usefulness (Aggelidis & Chatzoglou, 2009). In their extension of the TAM, Venkatesh and Davis (2000) mentioned a connection between social influence with intention and perceived usefulness. Social influence (the extent to which significant others are perceived as encouraging the use of the app) provides information by which an individual can reduce uncertainty about the application through interactions and the environment, including workplaces that require it (Tretiakov & Hunter, 2021). In addition, people tend to utilize technology if their families or relatives advocate it (Kamal et al., 2020). One study has confirmed all the above directions (Beldad & Hegner, 2018).

H12: Social influence positively influences perceived usefulness.

H13: Social influence positively influences trust in PeduliLindungi.

H14: Social influence positively influences intention to use.

Figure 1 describes the proposed research model based on the hypotheses. This study attempts to find a more comprehensive picture of the drivers of acceptance of the PeduliLindungi application by incorporating privacy, trust, trust in government, and social

influence variables. The results could then aid the Indonesian government and its stakeholders in optimizing the app's further developments.

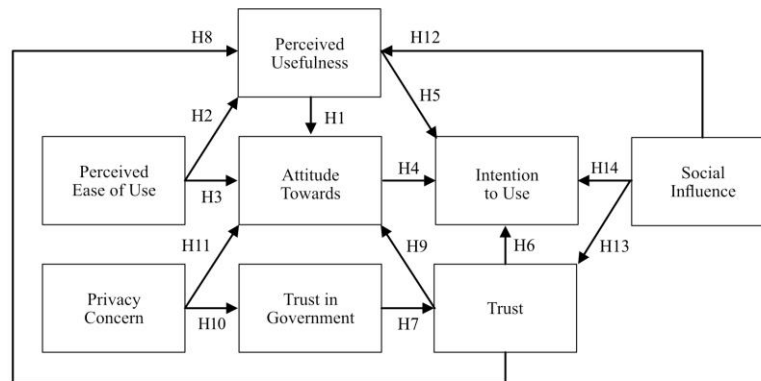


Figure 1. Proposed Research Model.

METHODS

Procedure and Data Collection

A minimum sample size was determined based on Soper's A-priori Sample Size Calculator for Structural Equation Models (2023) which generated 177 samples (effect size of .30 (Doulani, 2018; Feng et al., 2021); statistical power level of .80 (Wolf et al., 2013); alpha level of .05). It is also recommended to gather more than 200 samples in conducting structural equation modeling (Kyriazos, 2018). Therefore, we gathered 402 participants to fill out a questionnaire. The survey was conducted from October 26, 2021, to November 12, 2021. Because of the similarity of all answers and some missing answers, 31 participants were excluded. The link to the questionnaire was shared through social media using the convenience sampling method. Before answering the questions, the participants were asked for informed consent adopted from the Research Ethics Committee of Padjadjaran University (KEP Unpad). In measuring the constructs, 34 items were compiled.

Measurement

We measured the original TAM variables with a questionnaire developed by Tomczyk et al. (2021) as the basis. As for intention, we used three items (e.g., "I intend to use this app in the future.") built from a model developed by Velicia-Martin et al. (2021) to measure it. Perceived usefulness was assessed using six items (e.g., "PeduliLindungi can improve the tracing of infection chains."). As for perceived ease of use, four items (e.g., "The features of PeduliLindungi are clear and easy to operate.") were used. For the additional variables: trust (4 items), trust in government (4 items), and privacy concerns (5 items), we adopted the items from a study by Oldeweme et al. (2021). Finally, social influence was measured using four items (e.g., "Other people expect me to use such an app.") developed by Tomczyk et al. (2021). All variables were assessed based on a 5-point Likert scale from "strongly disagree" to "strongly agree," except for attitude, which was assessed

on a 5-point semantic differential (e.g., “bad” to “good”). Each item used in the construct is presented in Appendix.

Explanatory factor analysis (EFA) was conducted to ascertain that the questions measured each variable separately. We excluded items with poor factor loadings ($<.40$) considering that items with loadings under $.40$ are not good enough to represent the measured variable significantly as it opens the possibility of representing other variable (Maskey, 2018); high loadings indicate good correlations between the items and its measured variables (Watkins, 2018). We conducted confirmatory factor analysis (CFA) afterward. The reliability was assessed by Cronbach’s alpha, in which each variable is required to fall between the interval of $.70$ – $.95$ (Tavakol & Dennick, 2011).

Data Analysis

Descriptive analysis was carried out to discover the means and standard deviations of each item and describe the participants’ characteristics. We also defined the mean intention across the groups. Before the hypotheses test, we assessed the correlation and fit of the model by measuring the ratio of chi-square (χ^2) to degrees of freedom (df), comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of affirmation (RMSEA). Then we used JASP software to evaluate the research hypotheses based on the lavaan package. Finally, we utilized maximum likelihood estimation to test the path regression using the Satorra-Bentler method because it has been reported to be more accurate than other methods (Marcoulides et al., 2020).

RESULTS

Participants Characteristics

After exclusion, 371 participants were included in this study. Table 1 presents the demographic information. The sex distributions of the participants were nearly equal. Regarding age groups, the participants were well distributed except for those aged 55 until 70, which amounts to just 19 (nearly 5%). The data were centralized in Java with 328 participants. The remaining participants were distributed across six islands, with less than 10% of the participants for each island. Most participants (48.5%) hold a bachelor’s degree, and 66 have a master’s degree. Regarding occupations, most participants were employees or civil servants. In addition, we also collected health workers (2 participants), pensioners (2 participants), and an architect (1 participant).

Table 1. Characteristics of Participants.

Characteristics	Participant, n (%)	Mean Intention (SD)
Gender		
Female	173 (46.6)	3.726 (.885)
Male	198 (53.4)	3.645 (1.041)
Age		
18 – 24 years old	97 (26.15)	3.814 (.919)
25 – 34 years old	88 (23.72)	3.496 (.964)
35 – 44 years old	92 (24.80)	3.402 (.993)
45 – 54 years old	75 (20.22)	4.009 (.894)
Above 54 years old	19 (5.12)	3.947 (.964)
Domicile		
Non Java	43 (11.6)	3.969 (.908)
Sumatera	26 (7.0)	
Riau Islands	6 (1.6)	
Kalimantan	5 (1.3)	
Lesser Sunda Islands	1 (.3)	
Sulawesi	4 (1.1)	
Maluku Islands	1 (0.3)	
Java	328 (88.4)	3.645 (.974)
Educational Level		
High school or lower	97 (26.2)	3.718 (1.021)
Associate's degree	28 (7.5)	3.369 (.970)
Bachelor's degree	180 (48.5)	3.565 (.894)
Master's degree	60 (16.2)	4.111 (.966)
Doctoral degree	6 (1.6)	3.833 (1.329)
Occupation		
Housewife	32 (8.6)	3.365 (.852)
Civil servant	97 (26.1)	4.055 (.940)
Employee	121 (32.6)	3.477 (.923)
Student	66 (17.8)	3.995 (.832)
Entrepreneur	29 (7.8)	3.379 (1.064)
Teacher	11 (3)	3.273 (1.104)
Others	15 (4)	3.133 (.966)

The intention to use the application exceeded 3.00 across all groups. As the overall median of participants' intention was 4.00, a score above that was considered as high intention. Low intention was presented by a score under 2.00 while medium intention was presented by a score of 2-4, as explained by Coyer with her colleagues (2019). We did not find any low intention between the groups because the minimum mean was only 3.133. Therefore, all participants can at least be classified as having a moderate intention, according to Table 2. For gender groups, we detected similarity levels of intention between females and males, contradicted a previous study (Grill et al., 2021). Interestingly, people aged above 54 years still have a high intention to use PeduliLindungi (which counts as new technology). This finding aligns with a survey (Vogels, 2019) conducted in the US that found a significant escalation in technology adoption among "baby boomers." The survey also found that nearly seven out of ten baby boomers own a smartphone (Vogels, 2019). In particular, positive evaluations regarding a contact tracing app were found higher in older people in Germany (Grill et al., 2021). Thus, age is not a barrier to the adoption of new technologies, in contrast to prior studies (Ross, 2021; Walrave et al., 2020). Islands outside Java were reported to nearly have a high intention with score of 3.969. Location has been determined to be a significant factor in app acceptability (Abuhammad et al., 2020; Grill et al., 2021). The highest mean was for those who had completed master's degrees,

reaching 4.111. Students and doctors also almost had a high intention to use the app. Regarding occupation, the mean intention of teachers (including lecturers) was moderate, although it reached only 3.273. This finding has to be considered because teachers and similar professions have regular contact with many people. Students and civil servants had strong intentions. This finding confirmed that civil servants are loyal to the government.

Table 2. Classification Criteria.

Classification	Interval
Low	<2
Moderate	2-4
High	>4

Measurement Model

Explanatory factor analysis was performed. We used the maximum likelihood factor analytic method as it's more suitable for the structural equation modeling approach (Howard, 2016) rotated by the oblique (oblimin) method. Following the test, we excluded two items under privacy concerns and 1 item under trust because of poor factor loadings (they did not exceed .40) (Watkins, 2018). After that, confirmatory factor analysis from the lavaan package (Rosseel, 2012) reported high factor loadings which exceeded .60 for each item (Arifin & Yusoff, 2016). Regarding the AVE, our items had good convergent validity since the value exceeded .50 (Sakib et al., 2022). The model fit was also sufficient (see Table 3) in terms of χ^2 / df ratio (<3) (Aggelidis & Chatzoglou, 2009; Oldeweme et al., 2021), CFI (>.90), RMSEA (<.080), and TLI (>.90) (Sakib et al., 2022),

Table 3. Model Fit Criteria.

Model	χ^2/df	CFI	TLI	RMSEA
CFA	912.56 / 405	.951	.944	.058
Path Model	1157.03 / 417	.929	.921	.069

Note. CFI = Comparative Fit Index. TLI = Tucker-Lewis Index. RMSEA = Root Mean Square Error of Affirmation. **Model:** CFA = Confirmatory Factor Analysis.

Cronbach's alpha and composite reliability were applied to test reliability. All constructs showed good results, with a value of more than .90 except for privacy concerns and trust. In conclusion, the reliability of the constructs was adequate, exceeding .70 (Bujang et al., 2018) for Cronbach's alpha and .60 for composite reliability (Sakib et al., 2022). Table 4 shows the results of the measurement model.

Table 4. Validity and Reliability Score.

Construct and Item	Mean (SD)	EFA	CFA	AVE	CR	CA
Perceived usefulness (PU)	3.702 (.864)			.655	.919	.917
pu1	3.819 (1.001)	.484	.780			
pu2	3.358 (1.138)	.686	.809			
pu3	3.806 (.995)	.467	.720			
pu4	3.987 (.934)	.568	.834			
pu5	3.666 (1.035)	.829	.869			
pu6	3.577 (1.035)	.723	.835			
Perceived ease of use (PEASE)	4.019 (.825)			.728	.914	.910
pease1	3.871 (.997)	.708	.799			
pease2	3.962 (.932)	.788	.900			
pease3	4.038 (.915)	.968	.920			
pease4	4.208 (.871)	.783	.785			
Privacy concern (PRIVAT)	3.230 (.774)			.624	.830	.819
privat1	3.695 (.979)	.351	Excluded			
privat2	3.571 (1.140)	.613	.636			
privat3	2.757 (1.030)	.253	Excluded			
privat4	3.151 (1.077)	.834	.835			
privat5	2.973 (1.110)	.839	.877			
Attitude towards (ATT)	3.635 (.825)			.742	.920	.919
att1	3.792 (.926)	.628	.893			
att2	3.348 (.936)	.477	.800			
att3	3.598 (.881)	.678	.833			
att4	3.803 (.934)	.793	.915			
Trust in government (GOV)	3.498 (.922)			.788	.937	.936
gov1	3.499 (.996)	.849	.888			
gov2	3.515 (.979)	.864	.924			
gov3	3.496 (1.033)	.826	.843			
gov4	3.482 (1.020)	.901	.893			
Trust (TRU)	3.641 (.878)			.725	.888	.884
tru1	3.639 (1.067)	.471	.802			
tru2	3.566 (1.007)	.533	.883			
tru3	3.582 (.939)	.464	.868			
tru4	3.779 (.947)	.371	Excluded			
Social influence (SOCIAL)	3.678 (.871)			.747	.922	.919
sosial1	3.714 (.961)	.913	.893			
sosial2	3.650 (.965)	.827	.897			
sosial3	3.682 (.945)	.537	.759			
sosial4	3.674 (1.013)	.859	.900			
Intention to use (INTENT)	3.683 (.971)			.842	.941	.941
intent1	3.749 (1.008)	.795	.896			
intent2	3.682 (1.030)	.880	.938			
intent3	3.617 (1.042)	.796	.919			

Note. EFA = Explanatory Factor Analysis. CFA = Confirmatory Factor Analysis. AVE = Average Variance Extracted. CR = Composite Reliability. CA = Cronbach's alpha.

Hypotheses Testing

All constructs were reported to correlate ($p < .001$). Privacy concerns also was detected to negatively correlate with the other variables (see Table 5). However, users could possibly use the app despite concerning their privacy in order to prioritize their health (Nguyen et al., 2023), as found in Malaysia (Alshami et al., 2022). The proposed path model was reported to have an adequate fit considering the same cutoff as before, as summarized in Table 3. Therefore, all

paths from the hypotheses were accepted except for H5 ($\beta=.047$; $p=.514$) and H12 ($\beta=.097$; $p=.096$).

Table 5. Correlation Matrix.

Constructs	pu	pease	att	tru	privat	social	gov	intent
pu	1.000							
pease	.622*	1.000						
att	.770*	.664*	1.000					
tru	.829*	.730*	.817*	1.000				
privat	-.375*	-.349*	-.455*	-.456*	1.000			
social	.631*	.599*	.703*	.652*	-.254*	1.000		
gov	.597*	.493*	.667*	.655*	-.304*	.549*	1.000	
intent	.677*	.615*	.767*	.725*	-.288*	.734*	.566*	1.000

Note. Pu = perceived usefulness. Pease = perceived ease of use. Att = attitude towards. Tru = trust. Privat = privacy concern. Social = social influence. Gov = trust in government. Intent = intention to use.

* $p < .001$; Correlation coefficients are standardized.

Table 6 shows a positive effect of perceived ease of use ($\beta = .170$; $p < .001$) and trust ($\beta = .664$; $p < .001$) on perceived usefulness, but not for social influence ($\beta = .097$; $p < .096$), although the p-value did not exceed .10. Hence, only H2 and H8 were accepted. Attitude was significantly influenced by perceived usefulness ($\beta = .206$; $p < .01$), perceived ease of use ($\beta = .150$; $p < .001$), trust ($\beta = .522$; $p < .001$), and privacy concern ($\beta = -.130$; $p < .01$). Therefore, H1, H3, H9, and H11 were supported. Furthermore, intention had 3 out of 4 predictors, which we accepted. Perceived usefulness did not significantly affect intention ($\beta = .047$; $p = .514$) showing that the effect had to be mediated by attitude which is not only affected by perceived usefulness. Attitude ($\beta = .329$; $p < .001$), trust ($\beta = .170$; $p < .05$), and social influence ($\beta = .380$; $p < .001$) were found to have significant effects on intention. Thus, H4, H6, and H14 were supported.

Table 6. Hypothesis results.

Code	Hypotheses		R ²	β^a (SE)	p value	Evaluation of hypotheses
	Predictor	Outcome				
H2	pease			.170 (.047)	<.001	Approved
H8	tru	pu	.656	.664 (.059)	<.001	Approved
H12	social			.097 (.049)	.096	Rejected
H10	privat	gov	.124	-.352 (.073)	<.001	Approved
H7	gov	tru	.541	.483 (.043)	<.001	Approved
H13	social			.506 (.045)	<.001	Approved
H1	pu			.206 (.077)	.005	Approved
H3	pease	att	.686	.150 (.043)	<.001	Approved
H9	tru			.522 (.073)	<.001	Approved
H11	privat			-.130 (.044)	.002	Approved

H4	att			.329 (.080)	<.001	Approved
H5	pu			.047 (.085)	.514	Rejected
H6	tru	intent	.636	.170 (.090)	.040	Approved
H14	social			.380 (.048)	<.001	Approved

Note. Pu = perceived usefulness. Pease = perceived ease of use. Att = attitude towards. Tru = trust. Privat = privacy concern. Social = social influence. Gov = trust in government. Intent = intention to use.

^aStandardized path coefficients.

The remaining hypotheses were also supported. Trust was significantly influenced by trust in government ($\beta=.483$; $p<.001$), which supported H7, and social influence ($\beta=.506$; $p<.001$), which supported H13. Lastly, we also found support for H10, as privacy concerns negatively impacted trust in government ($\beta=-.352$; $p<.001$). The results are also illustrated in Figure 2.

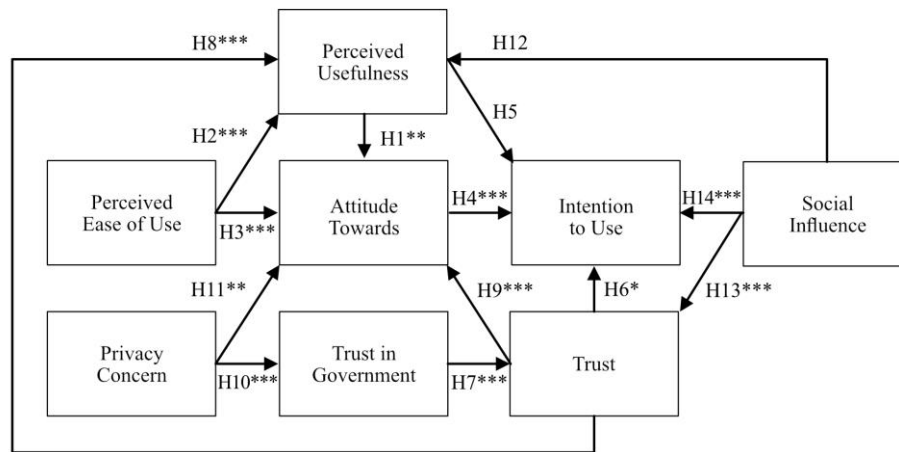


Figure 2. Research Model Results

Note. * $p<.05$; ** $p<.01$; *** $p<.001$

DISCUSSION

Regarding the core variables of TAM, perceived usefulness had a more significant effect on predicting attitude than perceived ease of use. Interestingly, a previous study on the acceptance of COVID-19 contact tracing apps (Velicia-Martin et al., 2021) found that ease of being safe from virus transmission matters more to the respondents than the ease of using the app. Nevertheless, this previous study mentioned above found an effect of perceived usefulness on attitude, in contrast to a prior study (Kurniawati et al., 2020). Perceived usefulness was reported to have a more significant effect on intention than perceived ease of use. This finding corresponded with the results of a previous study (Velicia-Martin et al., 2021). Our results also reported a less influential role of attitude in predicting intention than prior studies (Kurniawati et al., 2020; Kwarteng et al., 2023; Velicia-Martin et al., 2021). Another hypothesis of genuine TAM was the connection between perceived ease of use and usefulness. Our results confirmed

the findings of previous studies (Aggelidis & Chatzoglou, 2009; Cheung & Vogel, 2013; Ha & Stoel, 2008; J. Joo & Sang, 2013; Y. J. Joo et al., 2018; Lim & Ting, 2012; Venkatesh & Davis, 2000) which detected a significant effect. It explained that the ease of using the application (including the information and support the app could provide) could impact the public's perception of its ability to overcome infection risks.

Conversely, our results showed that perceived usefulness did not influence intention (to use), unlike attitude. Hence, the respondents who hold a higher evaluation of the application's usefulness do not necessarily have a greater intention to use the application. Despite contradicting previous studies (Aggelidis & Chatzoglou, 2009; Alshami et al., 2022; Kamal et al., 2020; Kim & Park, 2012; Kurniawati et al., 2020; Tomczyk et al., 2021; Velicia-Martin et al., 2021) and meta-analysis (Holden & Karsh, 2010), the results are the same with those from a study in the context of mobile learning (Park et al., 2012). They argued that the convenience of using the mobile device results in an indirect effect. Similarly, Indonesian perceptions of ease of use had the highest mean ($M=4.019$; $SD=.825$). In addition, public perceptions that the app can reduce COVID-19 transmissions did not predict the acceptance of the app in China (Kostka & Habich-Sobiegalla, 2022). Indonesia and China have the same policy regarding the obligation to use the app that could be a factor in the impact of perceived usefulness. According to our results, the public intention was affected more by other constructs like social influence and trust. Presumably, when people don't receive any influence from their surroundings, they will not use the application despite realizing its benefits.

Additionally, social influence played a crucial role since it affected trust and intention with the highest effect compared to other predictors. This result was in line with previous studies in the context of trust (Beldad & Hegner, 2018; Oldeweme et al., 2021) and intention as an outcome (Aggelidis & Chatzoglou, 2009; Alshami et al., 2022; Huang et al., 2022; Oldeweme et al., 2021). Therefore, the surrounding encouragement influences the public's willingness to use the application. Thus, when the app's use is not required in many public places, public acceptance of the app will also be lower (Nurita, 2021). The item about family influence was reported to have the highest mean, although the differences between the items were not significant. From this finding, we can also see that influence from people with no relationship with an individual still had an important role in predicting the individual's intention.

The role of social influence became more crucial because it also affected trust, which was the critical predictor of attitude. Trust in the application should be considered because it influences perceived usefulness, attitude (Ha & Stoel, 2008), and intention (Kamal et al., 2020; Oldeweme et al., 2021; Ukpabi et al., 2021; Velicia-Martin et al., 2021). The relationship between trust and perceived usefulness showed that the public hoped this application could solve the contagion of the virus. They also hoped that the application could aid the quarantine implementation. Furthermore, trust predicted attitude with the highest effect compared to others. By integrating trust and social influence, attitude still had a high impact on intention despite not exceeding social influence. Therefore, it showed that public trust and willingness to use the application depended on their social surroundings. Despite these findings, we detected no significant effect of social influence on intention, which differed from previous studies (Aggelidis & Chatzoglou, 2009; Beldad & Hegner, 2018). This discovery explained that social influence does not affect users' perception of the application's ability to lessen the infection risk and control the virus's diffusion.

Privacy concerns were found to negatively affect attitude, as in the previous study (An et al., 2021). This finding indicates that privacy has become a barrier to the acceptance of the application. A study in Singapore (Huang et al., 2022), Australia (Sun et al., 2021), China, Germany, and the United States (Kostka & Habich-Sobiegalla, 2022) also showed that people who are sure about their data security are more willing to use their contact-tracing app. However, we did not explore the direct effect of privacy on intention. Since some studies found no significant effect of privacy on intention (Abuhammad et al., 2020; Alshami et al., 2022; Kwarteng et al., 2023), the effect might be mediated by attitude, as our study showed. On the other hand, perceived usefulness and perceived ease of use did not strongly impact attitude compared to trust after incorporating them with privacy concerns. In addition, privacy concerns also affected trust in government, corresponding to a prior qualitative study (von Wyl et al., 2021). Privacy concern and trust in government had been detected to greatly detain the adoption of contact-tracing apps in several countries (Nurgalieva et al., 2021). Thus, the government should perfect the app's safety so that the adoption of the application can increase, as a prior study suggested (Kostka & Habich-Sobiegalla, 2022). Trust in government has also been confirmed to affect trust, in line with the prior works (Oldeweme et al., 2021; von Wyl et al., 2021). Accordingly, the public's trust in the government's online services and that they're keeping the public interest in mind can enhance their reliance on the application. Nevertheless, the involvement of privacy concerns in predicting attitude was not as crucial as others due to the effect size. But privacy concerns serve as a good predictor factor in predicting trust to government.

CONCLUSIONS

The PeduliLindungi as a COVID-19 contact tracing application is a vital tool in controlling the spread of the virus in Indonesia. The government has also made significant efforts to develop the app to make it easier to use. This study revealed the factors affecting the acceptance of the application in a broader picture. First, our results have confirmed the role of trust, social influence, and privacy in extending the technology acceptance model. Furthermore, the findings of this study also confirmed the necessity to include the trust in government variable in describing an app's acceptance. The trust in government variable becomes necessary because it affects trust in the application. Encouragement from families and other social aspects was also found as critical. To address the degradation of the number of application uses (Adyatama, 2021), the government and its stakeholders should strengthen public trust in the application or the government themselves. They also should drive social influence further by implementing communication programs and policies that will help influence the population's utilization of PeduliLindungi.

There are several limitations to this study. First, we conducted the study using the convenience sampling method, so it could not represent the total population. Hence, we recommend that future research projects employ probability sampling, particularly for traditional market populations, which were said to be not ready to use the application (Pebrianto, 2021). Second, this study did not examine the direct connection between privacy concerns and trust in government with intention. Nevertheless, these findings can help ascertain a relationship between those constructs. Third, other constructs such as self-efficacy, perceived

convenience, exposure to health messages, perceived transmission risk, or perceived mandatory should be incorporated to examine their effect on intention or other constructs of the TAM.

IMPLICATIONS FOR RESEARCH, APPLICATION, OR POLICY

Theoretically, this study has examined the impact of trust, social influence, and privacy on the technology acceptance model. Moreover, our results confirmed the necessity of the trust in government variable in describing the acceptance of a Covid-19 tracing app. However, perceived usefulness did not significantly affect intention to use; thus, our findings rejected the principal theory. By integrating trust and social influence, attitude toward still had a substantial impact on intention to use despite not exceeding social influence. Astonishingly, perceived usefulness and ease of use did not strongly impact attitude compared to trust. Overall, the technology acceptance model has been validated in the context of the PeduliLindungi, which shows the model's effectiveness.

For practical purposes, the government and its stakeholders should strengthen the public's trust in the application or the government. Trust in government becomes necessary because it affects trust in the application. To attain such an objective, it is crucial for the government to exercise transparent and consistent communication (Zimmermann et al., 2021). Therefore, it is also recommended that healthcare professionals, media practitioners, and analysts be involved in promoting and campaigning for the adoption of the app. The combination of digital (such as social media) and traditional media (especially television) have to be arranged properly to reach wider audiences. Furthermore, privacy security, which leads to trust in government, must be strongly considered. Fortunately, the government sufficiently handled it when integrating PeduliLindungi with 15 other apps (Riana, 2021). Nevertheless, the government should perfect its safety to increase the adoption of the application.

Regarding social influence, campaigns, such as news, advertisement, socialization, etc., presumably can be considered an essential factor in public acceptance of PeduliLindungi. Besides that, encouragement to use the app from families and relatives is also crucial. App developers should amplify the protection of data users and simplify the user experience more. Although, the participants were recorded to report having a comfortable experience using the application, as shown by their questionnaire answers pointing to a high level of perceived ease of use.

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Appendix

Measurements of Constructs

Construct and Item	Measurement	Scale	Reference
Perceived Usefulness (PU)		5-point Likert Scale	Tomczyk et al. (2021)
pu1	Pedulilindungi can improve the tracing of infection chains.		
pu2	Pedulilindungi is a good opportunity to reduce my personal infection risk.		
pu3	Pedulilindungi helps the implementation of quarantine.		
pu4	Pedulilindungi can reduce the infection risk of other people.		
pu5	Pedulilindungi is effective in informing the public about potential infections.		
pu6	Pedulilindungi is effective in protecting me against potential infections		
Perceived Ease of Use (PEase)		5-point Likert Scale	Tomczyk et al. (2021)
pease1	Feature of Pedulilindungi is clear and easy to operate.		
pease2	It would be easy for me to become competent in using the app.		
pease3	Using the app would be easy for me.		
pease4	Learning to use the app would be easy for me.		
Attitude Towards (ATT)	<i>(rate Pedulilindungi from)</i>	5-point semantic differential	Tomczyk et al. (2021)
att1	Highly useless to highly useful		
att2	Highly unsafe to highly safe		
att3	Awful to excellent		
att4	Highly unobliging to highly helpful		
Intention to Use (Intent)		5-point Likert Scale	Velicia-Martin et al. (2021)
intent1	I intend to use this App in the future.		
intent2	I will try to use this App in my daily life		
intent3	I intend to use this App frequently		
Trust (TRU)		5-point Likert Scale	Oldeweme et al. (2021)
tru1	Pedulilindungi is trustworthy.		
tru2	I trust Pedulilindungi keeps my best interests in mind.		
tru3	Pedulilindungi will keep promises it makes to me.		
tru4	I believe in the information that Pedulilindungi provides me.		

Trust in Government (GOV)		5-point Likert Scale	Oldeweme et al. (2021)
gov1	I think I can trust state government agencies.		
gov2	State government agencies can be trusted to carry out online offerings faithfully.		
gov3	I trust state government agencies keep my best interests in mind.		
gov4	In my opinion, state government agencies are trustworthy.		
Privacy Concern (PRIVAT)		5-point Likert Scale	Oldeweme et al. (2021)
privat1	Pedulilindungi would collect too much information about a user.		
privat2	I would be concerned about my privacy when using Pedulilindungi.		
privat3	I have doubts as to how well my privacy is protected while using Pedulilindungi.		
privat4	My personal information would be misused when Pedulilindungi is running.		
privat5	My personal information would be accessed by unknown parties when using Pedulilindungi in my everyday life.		
Social Influence (SOCIAL)		5-point Likert Scale	Tomczyk et al. (2021)
social1	Most people who are important to me (e.g. family) think that I should use such an app.		
social2	Many people close to me think that I should use such an app.		
social3	Other people expect me to use such an app.		
social4	My family expects me to use such an app.		

SEXTING, FEAR OF MISSING OUT (FOMO), AND PROBLEMATIC SOCIAL NETWORK USE AMONG ADOLESCENTS

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Abstract: *The article is part of the current discussion on the scale and mechanisms of selected threats of the digital world to which adolescents are exposed. The text presents data on three e-risks: FOMO, Problematic Use of Social Networks, and sexting. The study covered adolescents aged 13-17 in Poland (N=1053) in 2020. Based on analyses of the quantitative data, it was noted that: 1) Almost half of the adolescents use SNS daily just before going to sleep; 2) Every fourth respondent has multiple features of problematic Internet use (PUI); 3) The majority of adolescents use the Internet in ways not classified as PUI; 4) The age and gender (female) of the respondents is associated with higher levels of PUI; 5) The vast majority of adolescents have no experience of sexting; 6) Adolescents are much more often recipients of materials classified as sexting than creators; 7) Girls receive erotic messages, much more often than boys.*

Keywords: *FOMO, problematic social network use, problematic internet use, sexting, youths, Poland.*



INTRODUCTION

Undoubtedly, more and more is known about risk behaviours mediated by new media among young people. This is the result of research conducted worldwide by psychologists, sociologists, and media educators (Smahel et al., 2020; Pyżalski et al., 2019; Velicu et al., 2019). Emerging research findings reveal not only the scale of the phenomenon of selected risk behaviours, but also the mechanisms hidden behind typical e-risks, such as cyberbullying, cyberaggression (Del Rey et al., 2015; Dvoryanchikov et al., 2020), online image protection, digital piracy (Ciesielska & Jemielniak, 2021), and problematic use of smartphones (Kopecký et al., 2021). The analysis of individual phenomena usually takes place within the framework of diagnostic research assigned to the risk paradigm of media pedagogy, where individual e-risks constitute a separate pool of risk behaviours. Each of the negative phenomena is subjected to very detailed measurements, carried out by specialists in the given area. Such research is usually aimed at showing how often a given e-risk occurs and at the same time provides a basis for designing prevention activities among children and young people (Zych et al., 2019). Other research related to cyber risks can be seen in the longitudinal studies carried out in many countries using standardised research tools (e.g. EU KIDS Online, Global Kids Online, PEW Research) (Livingstone, 2019; Velicu & Marinescu, 2019; Kachingwe et al., 2020), studies aimed at showing the co-occurrence of e-risks (Romera et al., 2021), and universal protective factors against particular groups of risk behaviours mediated by new media (Zych et al., 2018). Nevertheless, given the number of studies conducted to date on the co-occurrence of individual e-risks, the differentiation in the scale of the phenomena, and the variability of e-risks due to cultural conditions, it seems particularly valuable and justified to conduct further research to understand to what extent risk behaviours in cyberspace interact. This type of research has not been sufficiently carried out so far in selected countries.

Both risk behaviours mediated by new media are typical of the information society, in which ICTs play a significant role in shaping different types of behaviour (Korjonen-Kuusipuro & Wojciechowski, 2023). It is ICTs that are the main channel for the transmission of information, being the main source for shaping behaviours associated with diverse forms of PUI. In the case of sexting, on the other hand, it is the rapid and apparently secure transmission of intimate material that is also made possible by digital technologies. It is therefore not surprising that many of the risk behaviours typical of the information society are identified with the dynamic development of IT hardware and software capabilities (Siegle, 2010; Sánchez Vega et al., 2016). However, it is important to be aware that the technological layer relating to the increasingly fast and almost unlimited Internet, as well as profiled software (e.g. Snapchat), is only one of many determinants of risk behaviour among young people (Gregg et al., 2018). Technological stratification is an insufficient factor to explain the scale of this type of behaviour, however, it becomes a starting point for high-speed data phenomena.

This text attempts to fill the gap in revealing to what extent two forms of problematic Internet use - FOMO and inappropriate use of social networks - are related to sexting. The first two risk behaviours associated with problematic Internet use are currently heavily debated in terms of diagnostic criteria (Atroszko et al., 2022; Marengo et al., 2022), while the third behaviour, sexting, is a phenomenon fraught with many stereotypes and

overinterpretations (Ng et al., 2022; Maes et al., 2022). Both groups of e-violence are closely linked to the psychosocial functioning of adolescents. Therefore, the basic analyses that relate to the co-occurrence of e-risks in this text are extended to include well-being issues. This study fills a gap in this type of research on risky behaviours among adolescents in Poland.

RESEARCH OVERVIEW

The digital safety of children and young people has of late become an important area of research into the psychosocial functioning of young people. Among the various e-risks, issues related to problematic Internet use (PUI) occupy a special position. This phenomenon is manifested by the loss of control over time spent on the Internet, and the constant consumption of content, photos, and videos, all of which have a bearing on the relationship with loved ones, school and home responsibilities, and psychosocial functioning more broadly (Spada, 2014; Donati et al., 2022). PUI is combined with loss of control over the use of phones and the internet, and is classified as a behavioural addiction (Talis, 2022). Due to the fact that addiction is a negative diagnostic term that carries many medical and preventive connotations, and is characterised by clear diagnostic criteria, the term problematic internet use has become more and more appropriate. The category of PUI encompasses many different types of challenges related to the uncontrolled use of smartphones and social networks, and the redundant and uncontrolled consumption of information (FOMO) (Arrivillaga et al., 2022; Franchina et al., 2018). The issue of PUI is also an increasingly important one due to the social changes associated with the pandemic period, which increase the involuntary time spent using ICTs across age and occupational groups (Adamec & Šimáně, 2021). PUI and other negative phenomena related to cyberspace are characterised by a discrepancy in terms of diagnosing the scale of the phenomenon. The lack of consensus on a single definition of PUI, along with the wealth of measurement tools, has meant that researchers disagree on the scale of PUI among different groups, including young people. For example, in Poland in recent years it has been noted that PUI involving only social media (SNS) counts just 2.2% of young people as characterised by the highest level of this type of "addiction" (Tomczyk, 2019). On the other hand, researchers gathered around the EU KIDS Online research network have found that all of the diagnostic criteria used for the diagnosis of PUI occurring in maximum intensity concern only 0.1% of the sample studied in Poland (Pyżalski et al., 2019). Research conducted within the EU NET ADB, in turn, brings the information that only 1.3% of young people were characterized by a high level of Internet addiction (Makaruk & Wójcik, 2013). In turn, analyses conducted using K. Young among high school students in the vicinity of Rzeszów showed that 11% of young people have problems with the appropriate (intentional) use of the Internet (Rębisz et al., 2016). Polish research on PUI is characterised by the use of a wide range of research methods. Longitudinal analyses are extremely rare. There are also many discrepancies among Polish media educators and psychologists in defining PUI, as well as in defining a closed selection of diagnostic criteria. Therefore, there is a need for an expert debate, involving the use of international tools, which would allow the scale of PUI in Poland to be related to other countries that are more advanced in research in this key area.

Sexting, like problematic Internet use, raises many questions of interpretation. Sexting, defined as sharing one's own intimate photos, videos or text messages, is a phenomenon

considered by many experts in digital safety as extremely dangerous and harmful. Currently, a debate is still visible in the literature: to what extent does sexting among adolescents result from developmental needs? Is it a harmful activity (assuming the materials will not be made available to a wider audience)? Is it an activity associated with breaking the law? (Jenkins & Stamp, 2018). Sexting is a relatively well understood phenomenon. Much is now known about the reasons for sharing one's own intimate photos with others (Baiden et al., 2020); however, the scale of the phenomenon is still a matter of debate. Research on sexting also brings different reports related to the different forms of involvement in sharing and receiving intimate photos, as well as the differentiation of the phenomenon in terms of sociodemographic strata depending on the country in which the research is conducted (Lucić et al., 2019; Van Ouytsel et al., 2021; Holt et al., 2021). Existing data on sexting also offer knowledge about mechanisms related to peer pressure, how to deal with this threat, and how to conduct effective preventive actions to reduce sexting (Vandoninck et al., 2013). The phenomenon itself, despite the fact that it has been examined repeatedly in the context of different countries, still arouses interest due to the ambiguities regarding the scale of the phenomenon in selected countries (in this case Poland) and the link between the activities of sharing and receiving this type of content and the well-being of young people (Barrense-Dias et al., 2017; Strohmaie et al., 2014; Van Ouytsel et al., 2018). Of course, the issue of well-being in crisis situations resulting from the abuse of sharing intimate material is obvious, and also forms a central argument in the prevention of this type of behaviour (Van Royen et al., 2015; Ojeda & Del Rey, 2021). Nevertheless, taking into account the state of knowledge to date, it seems reasonable to ask whether the phenomenon of sexting has an impact on well-being. Moreover, is this type of behaviour linked to other e-risks, such as, for example, problematic Internet use?

RESEARCH METHODOLOGY

Objective, research focus and research problems

The aim of the study is to reveal the extent of sexting and two forms of problematic Internet use (FOMO and SNS abuse) among young people in Poland. The indirect aim is to show the mutual co-occurrence of the aforementioned e-risks and also to predict the well-being of young people depending on changes in the scale of the two selected forms of problematic Internet use and sexting. The subject of the study takes the form of survey responses of young people aged 13-17. The following research problems were assumed in this study:

- RQ1: What is the scale of FOMO, SNS abuse, and sexting among Polish adolescents?
- RQ2: To what extent is FOMO, SNS abuse, and sexting conditioned by sociodemographic variables?
- RQ3: Do FOMO, SNS abuse, and sexting co-occur?
- RQ4: To what extent is wellbeing linked to FOMO, SNS misuse, and sexting?

Selection of the research sample and characteristics of the respondents

The study was conducted in Poland in 2020. Adolescents aged 13-17 participated in voluntary surveys. The research was carried out using an online questionnaire, which was

prepared by a Polish-Czech research team. The research was conducted in three provinces bordering the Czech Republic: Śląskie, Dolnośląskie, and Opolskie. The data were collected by interviewers (K12 teachers and university teachers) cooperating with the Centre for the prevention of risky virtual communication in the Palacký University. The interviewers had expertise in social research among adolescents due to their pedagogical education and their work in educational institutions.

A total of 1053 young people participated in the study. The mean metric age of the subjects was 14.97 (median=15, with a standard deviation of 1.31). The sample was divided between 35.99% boys and 64.01% girls. More than half of the respondents (52.99%) came from the Dolnośląskie voivodeship, while the remaining part came from the Śląskie (27.16%) and Opolskie (19.85%) voivodeships. The respondents most often lived in rural areas (60.49%), towns up to 50 thousand inhabitants (22.89%), and cities over 50 thousand inhabitants (16.62%). The respondents attended the following schools: secondary school (55.37%), primary school (39.41%), technical secondary school (4.27%), and vocational secondary school (0.95%).

Research tool

The study used a triangulation of four stand-alone survey instruments. The triangulation of the tests allowed for the creation of an appropriate length of test battery, which was merged and made available as an online form. The tool also had a standard sociometric section containing questions regarding metric age, gender, place of residence, and type of school attended by the respondents. The entire online survey consisted of:

- Summary of social media use (Hetz, Dawson, & Cullen, 2015) consisting of 5 questions measuring SNS use during meals and just before and after waking up. Scale responses were constructed using a 5-point Likert scale from 1- never to 5 - daily. Internal consistency for the Cronbach alpha tool was 0.860.
- FOMO scale - a shortened version of an earlier instrument (Abel et al., 2016) consisting of four questions that could be answered on a 5-point Likert scale from 1 - never to 5 - daily. The internal consistency for the tool was 0.809.
- A sexting scale developed by a team of researchers from Palacký University consisting of 6 questions, 3 of which were related to sending intimate photos and videos, and 3 related to receiving this type of material. Scale responses were given on a 5-point Likert scale ranging from 1 - never to 5 - very often. The internal consistency for this measurement tool was 0.873.

The internal consistency (Cronbach's alpha) for the whole tool was 0.849.

Research ethics

The research project was approved by experts from the PRVOK, who have been conducting diagnostic research on the risky behaviour of children and adolescents for more than a decade in the three Visegrad countries - Czech Republic, Slovakia, and Poland. The present research is therefore a continuation of the long-term projects carried out so far in the field of the diagnosis and prevention of risk behaviours mediated by digital media. The present text, in addition to the typical procedures of tool acceptance by the PRVOK, required several levels

of approval from the stakeholders participating in the study to be obtained. The data collection was preceded by the approval being obtained of the subjects managing the educational institution (school directors), who were shown the research tool. The tool was then handed over to the guardians of the individual classes, who also verified the survey questions in digital form. The interviewers, who obtained permission from both the headmasters and the teachers, presented the purpose of the research to the students, provided a link to the survey, and asked them to answer the questions. The completion of the survey was voluntary. Each student was able to opt out of completing the questionnaire at any time. No questions were included in the tool to identify individual students, classes, or schools.

RESULTS

The scale of problematic SNS, FOMO, and sexting

Less than half of the respondents use SNS daily just before bedtime (49%). Almost one in four (23%) launches SNS every day just after waking up. Every tenth young person also browses SNS resources while eating breakfast. From the data collected, it was also noted that over half (58%) check what is happening on the internet when they are alone. One in three very often or often check online resources for no reason at all. Detailed data - descriptive statistics for the indicators of the two types of problematic Internet use - are included in Table 1.

Table 1. Descriptive statistics for problematic use of SNS and FOMO.

Factors of Problematic Internet Use	Mean	Std. Deviation
SNS1: How often do you use social media 15 minutes after waking up?	3.101	1.439
SNS2: How often do you use social media during lunch?	2.396	1.325
SNS3: How often do you use social media during dinner?	2.573	1.384
SNS4: How often do you use social media 15 minutes before bedtime?	3.916	1.382
SNS5: How often do you use social media during breakfast?	2.291	1.306
FOMO1: I impulsively check electronic media when I am with other people.	2.315	1.148
FOMO2: I check what is going on in electronic portals whenever I can log on, for example, for no reason at all.	2.449	1.296
FOMO3: I check social media when I have school activities.	2.188	1.240
FOMO4: I check what is happening on the Internet when I am lonely.	3.453	1.464

Using the k-means cluster analysis technique, three groups of young people were identified. The first group (Cluster 1; N=237; 22.50%) are those with low levels of FOMO and problematic SNS use. Cluster 1 confirms that the majority of young people use new media in an appropriate manner and are not burdened by the need to constantly consume information. The second group (Cluster 2, N=528; 50.15%) consists of young users with mostly low PUI values. In this group, only two activities occur frequently - this is using SNS just before going to bed and checking Internet resources when alone. For Cluster 2, the occurrence of selected PUI factors is only the form taken by a certain habit, or a desire to use cyberspace resources in leisure time. The last group (Cluster 3, N=288; 27.35%) are those

with elevated levels of PUI, in particular problematic SNS use. In Cluster 3, it was also noted that the first activity that is performed during the absence of contact with other people is the use of Internet resources. The detailed distribution of the indicators in each group is shown in Figure 1.

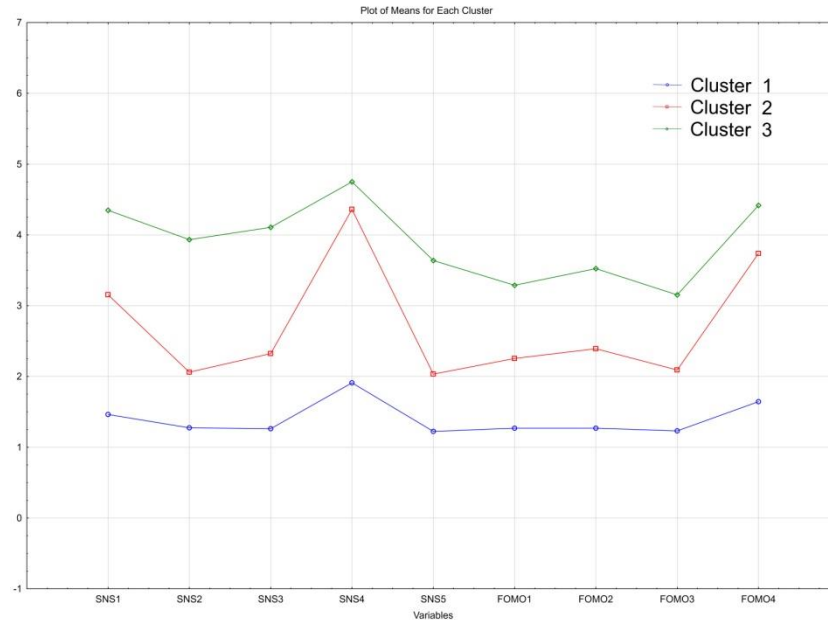


Figure 1. Problematic Internet Use - Cluster Analysis.

The vast majority of respondents have no experience with sexting. Among Polish adolescents, over 95% have never sent a video in which they are naked or partially naked. Almost 90% have never sent a photo of themselves that was erotic in nature. More than two-thirds of the respondents have never sent an erotic text message either. It is clearly the case that adolescents are more often the recipients than the creators of various forms of messages classified as sexting. The frequent phenomenon of sexting in the form of sending sexual content (e.g. SMS messages or instant messaging) has affected less than 6% of respondents, while photographs account for 3%, and videos less than 2%. Therefore, the phenomenon of sexting among Polish adolescents should be considered in the category of risky behaviours atypical for the whole population. As mentioned earlier, young people are much more often the recipients than the creators of this type of content. Detailed data on the scale of the phenomenon can be found in Figure 2, while descriptive statistics for individual components of the phenomenon are presented in Table 2.

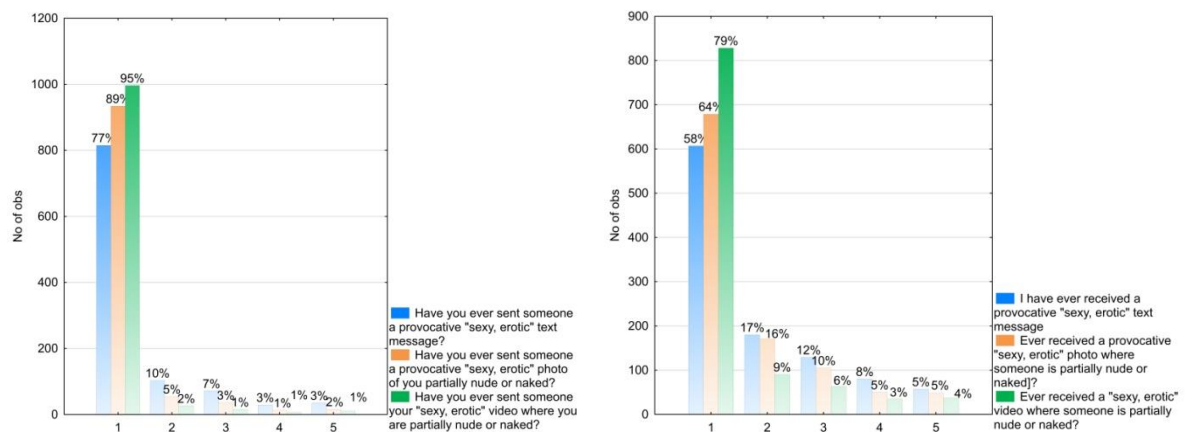


Figure 2. The scale of the phenomenon of sexting among Polish adolescents (on the left sending content, on the right receiving content).

Table 2. Descriptive statistics for sexting.

Factors	Mean	Std. Deviation
Have you ever sent someone a provocative "sexy, erotic" text message?	1.448	0.973
Have you ever sent someone a provocative "sexy, erotic" photo of you partially nude or naked?	1.217	0.704
Have you ever sent someone your "sexy, erotic" video where you are partially nude or naked?	1.108	0.523
Ever received a provocative "sexy, erotic" text message?	1.860	1.213
Ever received a provocative "sexy, erotic" photo where someone is partially nude or naked?	1.687	1.117
Ever received a "sexy, erotic" video where someone is partially nude or naked?	1.445	0.994

Problematic SNS, FOMO, and sexting, and sociodemographic variables

On the basis of the Mann-Whitney U test, it was noted that all almost the problematic SNS and FOMO factors were slightly more frequent among girls than among boys. In particular, a significant gender difference can be observed for the factors SNS checking before going to bed (SNS 4) and FOMO checking alone (FOMO 4). Detailed differences are presented in Table 3.

Table 2. Problematic SNS, FOMO, and gender.

	Group	N	Mean	SD	W	p
SNS1	Boys	379	2.828	1.485	106603.500	< .001
	Girls	674	3.254	1.390		
SNS2	Boys	379	2.245	1.328	113372.500	0.002
	Girls	674	2.481	1.316		
SNS3	Boys	379	2.409	1.376	113735.000	0.002
	Girls	674	2.665	1.380		
SNS4	Boys	379	3.501	1.579	99859.500	< .001
	Girls	674	4.150	1.197		
SNS5	Boys	379	2.211	1.300	119722.000	0.079
	Girls	674	2.335	1.307		
FOMO1	Boys	379	2.084	1.112	104503.500	< .001
	Girls	674	2.445	1.148		
FOMO2	Boys	379	2.127	1.228	98879.000	< .001
	Girls	674	2.631	1.299		
FOMO3	Boys	379	1.992	1.158	110521.500	< .001
	Girls	674	2.298	1.272		
FOMO4	Boys	379	2.887	1.510	84869.000	< .001
	Girls	674	3.772	1.337		

The Mann-Whitney U test provides interesting results, showing that girls are much more likely to receive sexually explicit messages and images than boys. This is the only element that distinguishes the two genders. The detailed discrepancy due to gender for the variable sexting is presented in Table 4.

Table 3. Sexting and gender.

	Group	N	Mean	SD	W	p
Have you ever sent someone a provocative "sexy, erotic" text message?	Boys	379	1.472	1.027	128327.000	0.862
	Girls	674	1.435	0.942		
Have you ever sent someone a provocative "sexy, erotic" photo of you partially nude or naked?	Boys	379	1.245	0.794	128072.500	0.893
	Girls	674	1.202	0.648		
Have you ever sent someone your "sexy, erotic" video where you are partially nude or naked?	Boys	379	1.132	0.603	129073.000	0.467
	Girls	674	1.095	0.472		
Ever received a provocative "sexy, erotic" text message?	Boys	379	1.734	1.164	115875.000	0.005
	Girls	674	1.932	1.235		
Ever received a provocative "sexy, erotic" photo where someone is partially nude or naked?	Boys	379	1.615	1.096	120362.500	0.068
	Girls	674	1.727	1.128		
Ever received a "sexy, erotic" video where someone is partially nude or naked?	Boys	379	1.441	1.012	126702.500	0.764
	Girls	674	1.448	0.985		

Co-occurrence of Problematic SNS, FOMO, and Sexting

On the basis of calculations using Spearman's correlation coefficient, it was noted that all Internet-mediated risk behaviours are in a positive relationship with each other. The co-occurrence of individual behaviours differs only in the strength of the correlation. Taking into account the type of risk behaviour, it was noted that the phenomenon of sexting shows strong interrelationships. Receiving and sending pictures is characterised by a strong to medium strength of relationship. This means that it is highly likely that people who send or receive one type of erotic material (e.g. a photo) will also receive and send other types of material (e.g. videos, text messages). Furthermore, it was noted that the factors of problematic Internet use are strongly interrelated. All the factors of problematic use of SNS and FOMO are correlate to a medium or large degree. Thus, the occurrence of one phenomenon, e.g. eating meals in the "company" of SNS, may cause that person to also use SNS very often in inappropriate situations. Analyses with a correlation coefficient also showed that the relationship between PUI and sexting does not exceed low correlation strength, which means that there is no regularity associated with sexting automatically co-occurring with intensive and uncontrolled Internet use. Details related to the correlation coefficients among the studied phenomena are presented in Table 3 (Appendix).

DISCUSSION

The idea of internet addiction among young people is controversial among experts in media pedagogy and psychology. In this group, there are both researchers claiming that it is a serious problem involving a large group of adolescents (Tran et al., 2017; Seabra et al., 2017) as well as those who emphasise that with careful analysis and the use of incisive and appropriate measurement items and scales, it turns out that the problem is typical of a very small group (Pyżalski et al., 2019). Therefore, when conducting analyses on the scale of problematic Internet use, also often controversially referred to as Internet addiction (Yellowlees & Marks, 2007; Kuss & Lopez-Fernandez, 2016), it is important to bear in mind the differences that can be observed in the literature, which is mainly due to different measurement concepts. The scale of PUI is related to the complexity and diversity of the phenomenon. For example, this text presents only two forms of PUI, namely FOMO and problematic use of SNS (Tomczyk, 2019). Nevertheless, this phenomenon encompasses many more different processes (e.g. problematic use of smartphones, addiction to e-gambling and gaming etc.). The collected data and analyses (descriptive statistics and cluster analysis) make it clear that the issue of inappropriate and uncontrolled use of digital media covers only a narrow group of adolescents who use digital resources very intensively. One should also be aware that depending on the adopted criteria, measurement scales, means of analysing and compiling data or the setting of thresholds (borders), the scale of the PUI phenomenon may be interpreted in a wide variety of ways.

It seems somewhat easier to determine the scale of sexting among young respondents. Generally, this group of studies is characterised by low levels of sexting. The data collected in this study are consistent with previous reports from Poland, e.g. within the EU KIDS Online study (Pyżalski et al., 2019). Sexting is a phenomenon that occurs sporadically.

Young people are much more often the recipients of sexual content than the creators. However, the following facts are interesting: boys are much more likely to send erotic content. In addition, text messages with this type of content are the most common form of sexting. The first phenomenon – the gender difference – is difficult to explain from a pedagogical perspective without having additional variables. Nevertheless, as reported by Polish and Czech researchers, these situations may be due to the specifics of adolescence, peer pressure, and the eroticisation of public space (Morelli et al., 2021; Kopecký et al., 2012; Wojtasik, 2014). The data collected are also interesting in the context of the scale of the analysed phenomenon in Poland in relation to other countries (Ng et al., 2022; Kim et al., 2020), as it appears that the phenomenon is less of an issue in Poland than it is elsewhere. Interpretations of the scale of the phenomenon may slightly differ from the actual state of the phenomenon, e.g. due to the fact that young people do not want to share their own experiences in this respect with anonymous interviewers. This may be due to the fact that they fear legal consequences or treat sexting as a shameful phenomenon that should not be reported to anyone in any way (Holoyda et al., 2018).

This text offers new insights into the intersection of phenomena mediated by digital media. Firstly, not all Internet-related risk behaviours are interrelated. This means that the occurrence of one phenomenon in high intensity, e.g. sexting, will not be positively correlated with another, e.g. FOMO. When designing further research on the negative aspects of cyberspace, one should be aware that each of the e-threats is characterised by different mechanisms and may also concern a different group of users according to their sociodemographic variables. This is very important in the context not only of research, but also of prevention. When implementing pre-emptive or protective actions, the diversity of techniques, methods, content, and forms should be taken into account, depending on the type of e-threat. However, the co-occurrence of phenomena is visible in the context of the correlation of indicators within a given phenomenon. The present study is in line with previous analyses conducted in this area in Poland, which noted that particular types of behaviour e.g. those related to PUI, co-occur with each other (eating meals in the company of SNS, lack of self-control in various inappropriate situations). Also, an internal correlation is noticeable for sexting. People who frequently send erotic material of their own authorship also very often receive other types of content of the same nature. This text also notes that age is related to the intensity of particular phenomena, e.g. PUI and sexting. This is a regularity that has also been confirmed in previous studies (Ioannidis et al., 2018; Englander & McCoy, 2018; Nakayama et al., 2020). This condition is most often due to an increase in the amount of time spent using digital media, developmental needs, or stronger peer influence that results in the acceleration of undesirable behaviours. When analysing individual risky behaviours, one should also be aware that narrowing the presented phenomena only to their negative aspects may, in a broader perspective, be unfavourable as stereotypes might easily be generated about young people, leading to the creation of ineffective preventive actions (Pyżalski, 2016; Pyżalski, 2017).

An important aspect of the present research was to reveal not only the scale of two selected forms of PUI and sexting, but also to present how the phenomena may constitute the basis for predicting the level of well-being among young people. Assuming that risky behaviours have a negative impact on social relationships in the near and distant environment (PUI) or may lead to violation of the law (sexting), it automatically follows that they must

have an impact on wellbeing. That assumption is undermined by the present research, as the results demonstrate that no such relationship exists. It is therefore important to distinguish between several issues. In a situation with high levels of PUI, in which a young person is solely focused on Internet-related activities, neglects household chores, comes into conflict with parents due to lower school grades, neglects sleep, etc. then automatically lower well-being is associated with higher levels of PUI. However, this is an extreme phenomenon. FOMO or intensive SNS use becomes a certain component in how young people use new media rather than a predictor of reduced well-being.

A similarly low level of correlation was noted between well-being and sexting. In this case, the issue seems more straightforward to interpret. In the course of receiving and sending this type of material (with consent), teenagers' needs are realised. The realisation of needs, unless these are extreme cases e.g. related to forcing the sharing of photos, videos can be linked to building an intimate relationship with a boyfriend or girlfriend. Therefore, the present data do not support statistical significance between a change in the level of well-being and sexting (a phenomenon that is not widespread and not linked to the developmental needs of all adolescents). The problematic nature of sexting leading to reduced well-being may emerge in extreme cases when intimate material is shared on the Internet, violates the law, or leads to the stigmatization of the young person in the immediate environment (Anastassiou, 2017; Galovan et al., 2018; Burić et al., 2021; Dodaj et al., 2023). When analysing the relationship between sexting and well-being, a range of contexts should be taken into account, as well as the fact that not all actions lead to extreme situations.

RESEARCH LIMITATIONS AND NEW ORIENTATIONS

The present research is part of an attempt to reveal the interdependence between two phenomena assigned to the risk paradigm of media pedagogy (Tomczyk, 2021). The study considers only two phenomena that are subtypes of problematic Internet use. However, one should be aware that currently, among the phenomena classified as PUI, one can distinguish, for example, e-gambling, phubbing, and nomophobia (Davey et al., 2018), which should be included in a broader research model to show the relationship between well-being and intensive and unsupervised use of SNS, the Internet, and smartphones.

Another research limitation in this text is the research sample, which does not include every province in Poland. The research was limited to three voivodeships in the south-western area. Therefore, it is necessary to collect data that considers a greater part of the country as a whole.

The data collected are also limited in terms of diagnosing the scale of the phenomena and linking it to well-being. It seems reasonable to extend the research model to include the consequences resulting from individual risky phenomena. For example, subsequent studies should include information on the negative consequences that result from PUI (conflicts in the family, lowering of school grades, neglect of interests in the offline sphere) or sexting (dissemination personal material, fear of sharing material). These issues should be mediating variables between the scale of the phenomenon and adolescent well-being. The issue of the contexts of occurrence of specific phenomena should be particularly considered for the phenomenon of sexting, which is characterised by many complex individual and social determinants (Van Ouytsel et al., 2017).

Another aspect that may affect the results of the research is the quality of the activities undertaken through SNS. When conducting research on PUI, a broader emphasis should also be placed not so much on the frequency of use of e-services, but also on the type of activities undertaken in this space (Pyżalski, 2017). When analysing the scale of PUI phenomena, attempts should be made to develop more precise measurement scales that define screen time and standby time in the context of popular e-services (Woo et al., 2021).

Given the specificity of the two risk behaviours analysed, new areas related to the technological layer are also emerging. It is therefore interesting to conduct further research relating to the technological dimension. To be more specific, it seems reasonable to look for an answer to the question - how the type of software installed, as well as the type of equipment owned and the means of accessing the Internet determine both risk behaviours. We know more and more about sexting and PUI, but there are still empirical gaps (relating to technological determinism) that call for increased research efforts in order to holistically understand selected e-risks.

CONCLUSIONS

The present research is an attempt to understand the psychosocial functioning of adolescents in the new media space. The text refers to a group of Polish adolescents who were studied within the scope of the interpenetration of three phenomena: problematic Internet use (limited to SNS and FOMO), sexting. The conclusions that emerge from the quantitative research presented here refute the circulating stereotypes that all young people are at risk of "Internet addiction" (Fineberg et al., 2018). Moreover, the available data make it clear that sexting occurs sporadically in the study group and is not typical for all adolescents (Maraganski, 2017).

This text provides an empirically validated voice in the discussion, highlighting that risky behaviour is not typical of the entire adolescent population. It is also worth reiterating explicitly that behaviours in cyberspace are not always interrelated. This means that the occurrence of one e-threat does not automatically generate other e-threats. In addition, most seemingly problematic situations do not have a real impact on the level of well-being among adolescents when they occur.

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Appendix

Table 3. Co-occurrence of sexting, problematic SNS use, and FOMO.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Have you ever sent someone a provocative 'sexy, erotic' text message?															
2 Have you ever sent someone a provocative "sexy, erotic" photo of you partially nude or naked?	0.597**														
3 Have you ever sent someone your "sexy, erotic" video where you are partially naked or nude?	0.422**	0.621**													
4 Ever received a provocative 'sexy, erotic' text message?	0.622**	0.405**	0.271**												
5 Ever received a provocative "sexy, erotic" photo where someone is partially naked or nude?	0.521**	0.472**	0.322**	0.765**											
6 Ever received a "sexy, erotic" video where someone is partially naked or nude?	0.441**	0.381**	0.375**	0.631**	0.721**										
7 How often do you use social media 15 minutes after waking up?	0.152**	0.111**	0.032	0.246**	0.235**	0.165**									
8 How often do you use social media during lunch?	0.135**	0.091*	0.041	0.255**	0.251**	0.202**	0.491**								
9 How often do you use social media during dinner?	0.155**	0.091*	0.036	0.255**	0.265**	0.195**	0.482**	0.805**							
10 How often do you use social media 15 minutes before bedtime?	0.145**	0.095*	0.032	0.295**	0.265**	0.171**	0.605**	0.445**	0.485**						
11 How often do you use social media during breakfast?	0.142**	0.122**	0.076	0.245**	0.265**	0.205**	0.525**	0.631**	0.645**	0.395**					

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12 I impulsively check electronic media when I am with other people.															
13 I check what is going on in electronic portals whenever I can log on, for example for no reason at all.	0.15 ^(**)	0.13 ^(**)	0.11 ^(**)	0.19 ^(**)	0.21 ^(**)	0.16 ^(**)	0.48 ^(**)	0.38 ^(**)	0.43 ^(**)	0.45 ^(**)	0.41 ^(**)				
14 I check social media when I have school activities.	0.14 ^(**)	0.12 ^(**)	0.14 ^(**)	0.20 ^(**)	0.21 ^(**)	0.18 ^(**)	0.48 ^(**)	0.39 ^(**)	0.40 ^(**)	0.43 ^(**)	0.40 ^(**)	0.63 ^(**)			
15 I check what is happening on the Internet when I am lonely.	0.24 ^(**)	0.20 ^(**)	0.16 ^(**)	0.30 ^(**)	0.30 ^(**)	0.22 ^(**)	0.40 ^(**)	0.37 ^(**)	0.38 ^(**)	0.37 ^(**)	0.39 ^(**)	0.51 ^(**)	0.51 ^(**)		
	0.16 ^(**)	0.12 ^(**)	0.08 ^(*)	0.28 ^(**)	0.25 ^(**)	0.18 ^(**)	0.51 ^(**)	0.38 ^(**)	0.40 ^(**)	0.60 ^(**)	0.36 ^(**)	0.49 ^(**)	0.54 ^(**)	0.42 ^(**)	

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