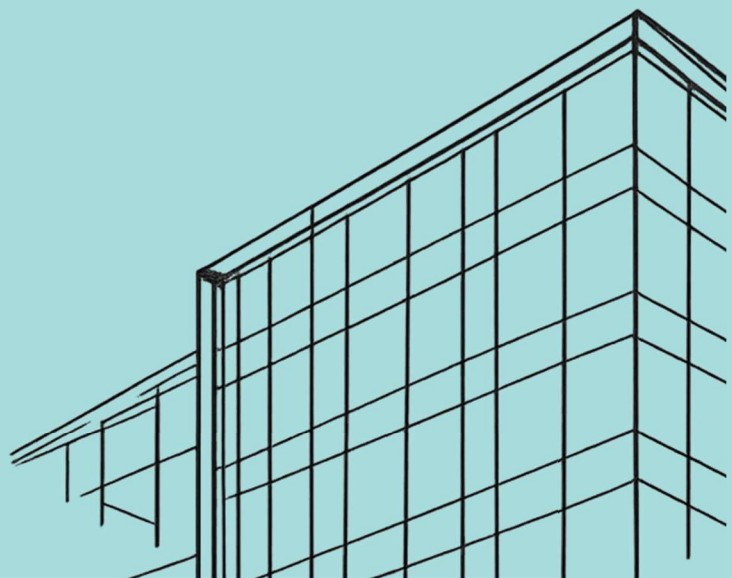




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Editorial: Rethinking real estate markets amid pandemic recovery and digital transformation

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World of Real Estate Journal (WOREJ) is officially back. It has been a while, but after a turbulent period of changes, switching to a biannual frequency of publication and adjustments related to the acquisition of our journal by Krakow University of Economics, we migrated to a brand new Open Journal System platform. I see it as a great improvement and sincerely hope that it will create an opportunity to increase both WOREJ's readership and recognition in the scientific community. More news to come here, as we plan to improve the indexing of the journal.

Meantime the real estate markets have only become more dynamic, and multiple new topics emerged due to an unprecedented series of systemic events that affected the economy and society. Firstly, the Covid-19 pandemic has had a long-lasting effect on the residential, office, retail, and logistics real estate. To a great extent, the impact of pandemics has been covered in many real estate journals, including World of Real Estate Journal, and based on scientometric statistics remained the hot topic in economic publications, conferences and reports (Balemi, Füss, & Weigand, 2021). Secondly, the War in Ukraine initiated a discussion on the linkages between exogenous shocks to the housing markets (Trojanek & Gluszek, 2022), as well as multiple transmission mechanisms. Thirdly, the ongoing Fourth Industrial Revolution and emergence of Artificial Intelligence have only intensified technological changes in construction, real estate management, PropTech and information processing (Starr, Saginor, & Worzala, 2020). Current issue addresses some of the pressing, contemporary topics that has catalyzed discussion on the operation of real markets globally.

Kinga Halama and Agnieszka Telega assess the investment motives of young adults. In their paper entitled *Investment risk propensity among Generation Z - temperament and interest factors*, they try to disentangle two important determinants of attitude toward risk and identify preferred investment assets. The paper offers insight relevant to financial education.

The role of innovation is explored by Wiktoria Serwin and Katarzyna Kania, who investigate the role of new technologies in the operation of the real estate market. The study demonstrates that the use of digital tools significantly enhances property presentation and buyer understanding, thereby accelerating purchase decisions in the residential market.

Young professionals' perspective is further investigated by Malgorzata Uhruska in a paper entitled *Entering the profession from the perspective of young property valuers*. The findings highlight growing barriers and uncertainties faced by early-career specialists, underscoring the need to better understand the factors discouraging new entrants and to develop measures supporting professional succession in the valuation field.

Paulina Stachura and Bartłomiej Marona discuss the consequences of recent technological advancements labelled as Industry 4.0 to demand for office space. In their paper entitled *Changes in the real estate office market in the face of the Fourth Industrial Revolution: A case study of Krakow* they demonstrate that technological innovation has become a decisive factor in office market performance, with advanced, flexible, and sustainable buildings better aligned with evolving tenant expectations in an increasingly hybrid work environment.

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Investment risk propensity among Generation Z - temperament and interest factors

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ABSTRACT

Objective: The study aims to explore the impact of temperament and interest in investment topics on the propensity to take financial risks among Generation Z, and it also seeks to identify which investment assets this generation is most interested in and what factors influence their investment decisions.

Material and methods: A survey was conducted using a research survey, aimed at students aged 19 to 28 from various fields of study. Respondents self-assessed their temperament based on four types (sanguine, choleric, melancholic, and phlegmatic) and their level of interest in investment topics. Chi-square tests were used to analyse the relationship between temperament, investment interest, and risk-taking propensity.

Findings: The results show that sanguine and choleric individuals are more inclined to take financial risks than melancholic and phlegmatic individuals. Furthermore, respondents with a higher interest in investment topics demonstrated a greater willingness to engage in risky investment decisions. Deposits, collectables, real estate and cryptocurrencies were the most preferred investment options.

Research limitations: The study is limited by its sample size and focus on a specific age group (19-28), primarily students, which may affect the generalizability of the results. Future research could explore a more diverse population.

Research implications: The findings provide information on risk-taking behaviour and investment preferences among Generation Z, with potential implications for financial education and investment market strategies.

Keywords: Generation Z; Behavioural economics; Investment decisions; Investment Risk
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INTRODUCTION

The study aims to analyse the factors that influence the investment decision-making process among Generation Z. It also identifies their preferences regarding investment instruments. The objective is to examine how factors such as temperament and interest in the subject of investment influence the willingness to take risks in financial decisions. Another detailed goal was to determine whether young people invest and, if so, in what assets they most commonly invest.

The topic of risk propensity has been an area of research in economic psychology or behavioural economics for years. Today, the easy access to information and its ubiquity contribute to the growing popularity of investing, even among younger people. Numerous factors affect the propensity to risk, including external conditions, psychological mechanisms, internal beliefs, emotions, and material resources. Knowledge of risk-taking tendencies and investment preferences of the younger generation can be valuable to educators and professionals.

The article is structured with a literature review presenting theories on temperament and investment behaviour, followed by a methodology section describing the pilot study design. The results and discussion section analyses how temperament and investment interest influence risk-taking in Generation Z, and the conclusion summarises findings, implications, and future research directions—all clearly outlining what each part covers.

LITERATURE REVIEW

The analysis of financial and investment decisions made by individuals has long been a subject of research and discussion in behavioural economics (Czerwonka & Rzeszutek, 2011). One of the first concepts that distinguished between the two types of perception limitations in decision making defined humans as entities with "bounded rationality" (Sulik-Górecka & Strojek-Filus, 2015). When making decisions under uncertainty, people often exhibit various inaccuracies. One assumption of prospect theory is the thesis that "it is not the absolute level of wealth, but the changes in wealth (gains vs. losses) that carry perceived value" (Tversky & Kahneman, 2015; Zielińska & Ostrowska, 2013). In their individual financial decisions, investors demonstrate what is known as risk aversion, where

people worry more about losses than they rejoice in gains, even though both have the same value (Czerwonka & Rzeszutek, 2011).

The propensity to take risks depends on several factors, such as subjectively assessed probability of winning, subjectively estimated possible benefits and their utility, and how the decision problem is framed. Research shows that a significant portion of the general population is prone to risk. One of the factors that differentiates investors in terms of risk is gender. Women tend to have a lower propensity to take risky decisions than men. However, most of the determinants that influence risk perception are more individual in nature, including character traits, temperament, lived experiences, susceptibility to environmental influence, and the ability to control emotions (Pawlonka, 2021).

Another factor influencing decision making are emotions. Research findings indicate that under the influence of positive emotions, the time spent analysing certain options is shortened. People may overlook certain available information, fail to verify it, or simply ignore it. When decision makers experience negative emotions, they are more prone to cognitive errors and perceive risk as greater. Another reason for risk-taking or risk aversion is the individual's level of desire to make a judgment based on the available information, even if it is incomplete or misunderstood. This mechanism is defined as the need for cognitive closure, which is a type of resistance to ambiguity and uncertainty (Adamczyk, 2018).

Environmental, cultural, economic, and social conditions have a significant impact on risk perception. Among these, culture, in particular, has a profound influence on decision-making, affecting thought processes subconsciously across various life spheres (Majewska-Bielecka, 2012).

According to the theory, behavioural factors are all psychological influences that may affect the decisions made by individuals. A significant determinant of any human decision-making process is individual characteristics, particularly temperament. Temperament can be understood as the type of nervous system combined with an associated physiological mechanism. Among the personality models in behavioural finance, one can distinguish: Myers-Briggs Personality Model, Eysenck's Three-Factor Theory, Keirsey Temperament Model, Five-Factor Model of Personality, HEXACO Six-Factor Model of Personality or Metatheoretic Model of Motivation and Personality (Rao & Lakkol, 2022).

One of the most well-known temperament theories was initially defined by the ancient physician Hippocrates and later developed into a theory of

temperaments by Galen (Strelau, 1996). According to this concept, the four primary temperaments include sanguine, choleric, phlegmatic, and melancholic (Lopez Beltran, 2007; Zdonek, 2023).

A sanguine person is optimistic, energetic, cheerful, and unconcerned with matters of little significance. They don't dwell on emotions for long—feelings like sadness or apathy quickly give way to a cheerful mood. They are sensitive and open to the surrounding world, expressing their emotions strongly and openly. However, their enthusiasm and emotions can sometimes lead to superficial actions, difficulties with concentration, or avoidance of potential difficulties.

A choleric person is decisive and dynamic, prone to aggression and anger. They easily experience strong emotions. Cholerics do not fear obstacles on their way to achieving goals; in contrast, they adopt strategies to overcome them. Their determination allows them to achieve goals effectively. They are often impatient, stubborn, and tend to assume leadership roles.

A phlegmatic person is satisfied with their situation, emotionally stable, and is difficult to upset or hurt due to their emotional distance from the surrounding reality. Phlegmatics prefer to be passive rather than active and value peace. They accept all circumstances and dislike changing conditions and new situations. They react to the external environment in a calm, unexpressive way, and their patience and calmness give them better resilience to stress.

A melancholic person may tend toward nostalgia and sadness, often viewing their situation pessimistically. They highly value peace and are characterised by high sensitivity and deep emotional experience. Although they feel emotions strongly, they may not express them outwardly, which can sometimes be misleading to those around them. Melancholics are introspective and reflective, interpreting potential failures as personal and internalising them.

Generation Z consists of individuals born between 1996 and 2015. This generation has been characterised by exposure to technology from a young age, growing up partially in the real world and partially in the virtual world. The internet environment is completely natural to them. Most Generation Z have been raised in material prosperity but also in an unstable socio-economic environment, facing political tensions, migration crises, the COVID-19 pandemic, wars, and issues related to climate change. Their main source of knowledge and education is the internet, where they can easily find information and use it to develop their professional skills through online courses and training. Unfortunately, there has been a noticeable decline in some

communication skills within this group, as seen during job interviews. A characteristic trait of Generation Z is their relatively low loyalty to employers, as they prioritise their personal goals. They prefer to focus on personal development, pursue passions, and live a private life. Financial considerations are a significant factor in choosing a job (Armata, 2023).

In recent years, Generation Z has become a frequently researched group in the context of the labour market, both as future leaders and employees, to better understand their attitudes and career commitment (Yilmaz Kisactutan & Karatepe, 2024; Frunzaru & Cismaru, 2021). Economic research on Generation Z focuses on several threads. First, researchers are trying to identify behavioural patterns in investment markets among young people, who tend to make quick decisions and prefer rapid consumption. Studies conducted in India suggest that Generation Z, compared to Generations X and Y, shows a greater propensity for more risky investment options. There are no significant differences in financial/investment competencies between Generations X, Y, and Z, but Generation Z demonstrated the best knowledge in the study. An interesting conclusion from the research is the correlation between financial knowledge and a greater willingness to take risks, which was similar across all age groups. Regarding investment preferences, Generation Z prefers investment funds, Generation X prefers real estate and bank deposits, while Generation Y prefers gold. The availability of technology plays an important role (Thomas et al., 2024).

The results of studies clearly show that Generation Z varies significantly depending on cultural and educational conditions, making a local analysis necessary. In recent years, there has been a significant increase in the participation of Millennials and Generation Z in the investment market. According to pilot studies conducted in Poland, Generation Z tends to invest mainly in real estate, stocks and cryptocurrencies, as well as alternative forms of investment such as clothing, art, and collectables. The least popular investment instruments were derivatives and cars (Waszczeniuk, 2021).

Real estate is considered a stable form of capital allocation, often becoming the primary component of investment portfolios. The cryptocurrency market is also popular, regarded as futuristic, and with substantial development potential. At the same time, Generation Z is not afraid to invest in cryptocurrencies, unlike older people, for whom cryptocurrencies may still be seen as a new and untested way of allocating capital.

A completely nontraditional investment area involves fashion, primarily clothing and footwear. The current trend in streetwear is especially popular among Generation Z. Many brands have quickly gained popularity, and their products are created in this style. According to research, around 30% of the respondents have invested in clothing. This alternative investment market, due to the lack of knowledge and understanding of the subject of the older generation, has been dominated by Generation Z. Regarding the risk awareness associated with investing, the study showed that most participants were aware of the risks. However, many individuals in this generation are still relatively young, and a large portion of the group does not engage in investment activities due to a lack of knowledge or financial assets.

RESEARCH METHODOLOGY

The main goal of this research was to determine the impact of selected factors (temperament and interest in investment topics) on the willingness to take risks in investment decisions among Generation Z. Furthermore, the study investigated which investment assets are of interest to young people. The hypothesis assumed that individuals with a sanguine or choleric temperament would be more willing to take risks than those with a melancholic or phlegmatic temperament. It was also assumed that Generation Z people who are more interested in investing would be more inclined to take risks.

The study of temperament's influence on economics and investment behaviour employs various methods, including self-report methods (Fisher Temperament Inventory (FTI), the Adult Temperament Questionnaire (ATQ), and the NEO Five-Factor Inventory (NEO-FFI), as well as experimental approaches (Martino et al., 2023). In addition to specialised psychological questionnaires, standard survey questions based on respondents' subjective assessments are also used (Effendi, 2023). Although self-report methods can be susceptible to distortions due to respondent bias or limited self-awareness, they remain quick and easy to manage.

The survey used Hippocrates' classification of temperaments, expanded by Galen, which distinguishes four primary types of temperament:

- Sanguine – sociable, energetic;
 - Choleric – impulsive, decisive;
 - Melancholic – introspective, sensitive;
 - Phlegmatic – emotionally balanced, detached.
-

The respondents self-assessed their temperament type based on the short descriptions provided in the survey. For the purpose of analysing the survey results, the four temperaments were grouped into two categories: sanguine and choleric (group 1) and melancholic and phlegmatic (group 2).

To identify people interested in investing topics, the survey directly asked if the respondent was interested in investing. At the same time, respondents self-assessed their level of investment engagement, answering control questions regarding whether they educate themselves in the field and whether they follow financial market trends. Based on the data obtained, the respondents were divided into two groups: interested (group 3) and not interested (group 4). A chi-square independence test was then conducted separately for groups differing in temperament and investment interest.

The pilot study was conducted through a survey created in Google Forms and distributed on social media (using the snowball method). Generation Z includes individuals born between 1996 and 2015, but for this study, the sample was narrowed to people aged 19-28, primarily students. The research group included people studying financial and economic disciplines, as well as those in other fields such as artistic, technical, medical, and humanities disciplines. Among the 100 respondents, 65 identified as female, 34 as male, and one person selected "other/prefer not to say."

RESULTS & DISCUSSION

The first hypothesis investigated the relationship between temperament and risk-taking propensity. Each type of temperament type is characterised by different traits, which undoubtedly influence how people perceive reality, including financial decision-making. It was hypothesised that sanguine and choleric individuals (54% of respondents) would be more impulsive, which would translate into a higher propensity to take risks, while melancholic and phlegmatic individuals (46% of respondents) would be more risk-averse.

The survey included several questions related to risk-taking in financial decisions. A comparative analysis was conducted for each question, focusing on the two groups: sanguine and choleric (group 1), and melancholic and phlegmatic (group 2). Figure 1. presents the responses to a question about risk propensity in financial decisions and whether respondents believe that their personality traits influence their decision-making. The responses were categorized according to temperament types: group 1 (sanguine and choleric) and group 2 (melancholic and phlegmatic).

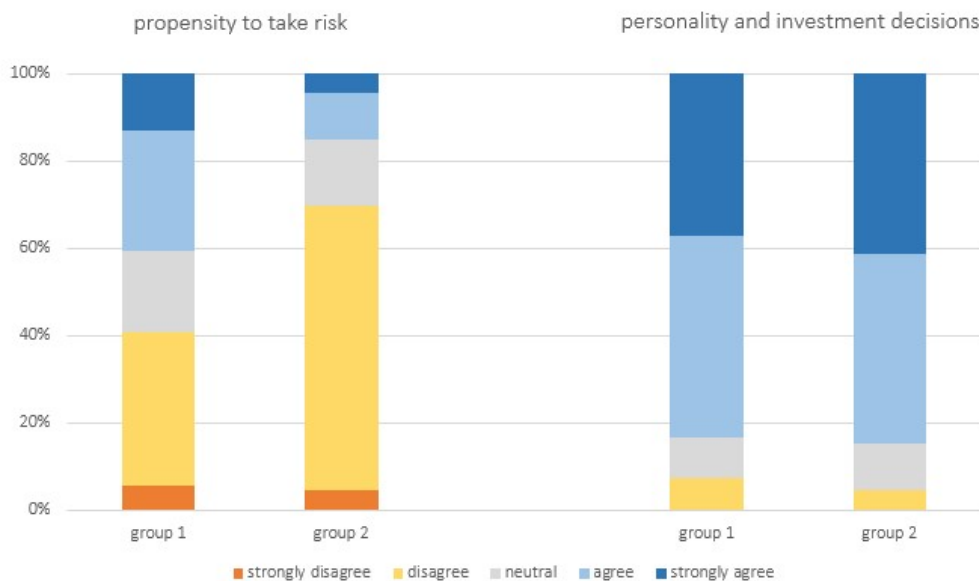


Figure 1. Percentage of respondents with a propensity to investment risk and who believe that personality traits influence investment decisions, by temperament type (group 1 and group 2)

Source: own analysis

The analysis of the responses indicated that the sanguine and choleric individuals were more inclined to take financial risks. Differences were particularly noticeable in the following response options:

- "Disagree": The majority of votes for this option came from group 2.
- "Agree": The majority of votes for this option came from group 1 (sanguine and choleric).
- "Strongly agree": Most of the respondents who chose this option were from group 1.

In summary, based on the responses to this question, we can draw a general conclusion that sanguine and choleric individuals are more inclined to take risks in financial decisions compared to melancholic and phlegmatic individuals. The study used several control questions, asking respondents from both group 1 and group 2 whether they preferred low-risk investments, even if that meant lower potential returns (Question 1). Additionally, both groups were asked whether they had ever made a risky investment decision (Question 2) and whether they preferred less secure investments to potentially achieve higher

returns (Question 3). The results for group 1 (sanguine and choleric) and group 2 (melancholic and phlegmatic) are presented in Figure 2.

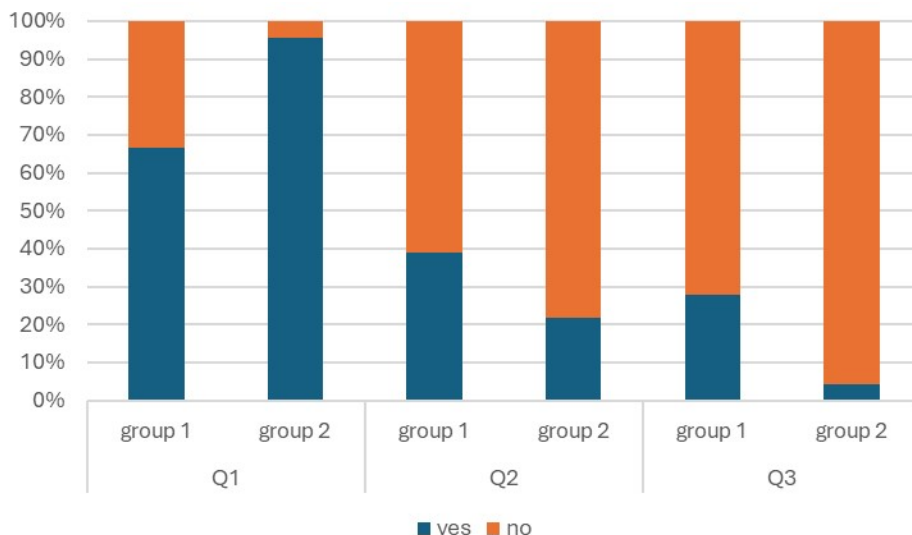


Figure 2. Responses to the control questions on risk propensity in relation to investment decisions, by temperaments

Source: own analysis

Most of the melancholic and phlegmatic respondents answered affirmatively to Question 1, indicating that they prefer low-risk investments even if it means lower returns. Differences in responses to Questions 1 and Question 3 between groups 1 and 2 were statistically significant ($\chi^2 = 11.29$, p-value = 0.000078 and $\chi^2 = 8.08$, p-value = 0.0045, respectively). However, there were no statistically significant differences between the groups in their responses to Question 2 ($\chi^2 = 2.66$, p-value = 0.103).

In summary, the analysis of the responses to the five questions related to risk propensity suggests that people with a sanguine or choleric temperament were more likely to take risks than those with a melancholic or phlegmatic temperament. The differences between groups are subtle.

The second part of the study aimed to determine whether people who are more interested in investing are more likely to take risks in their investment decisions. Respondents' interest in investing was assessed based on their self-reported level of engagement and responses to control questions regarding whether they educate themselves in the field of investments and whether they follow financial market trends. The respondents were then divided into two groups: those interested in investing (group 3) and those not interested (group 4). Figure 3 shows the distribution of responses related to risk propensity in financial decisions.

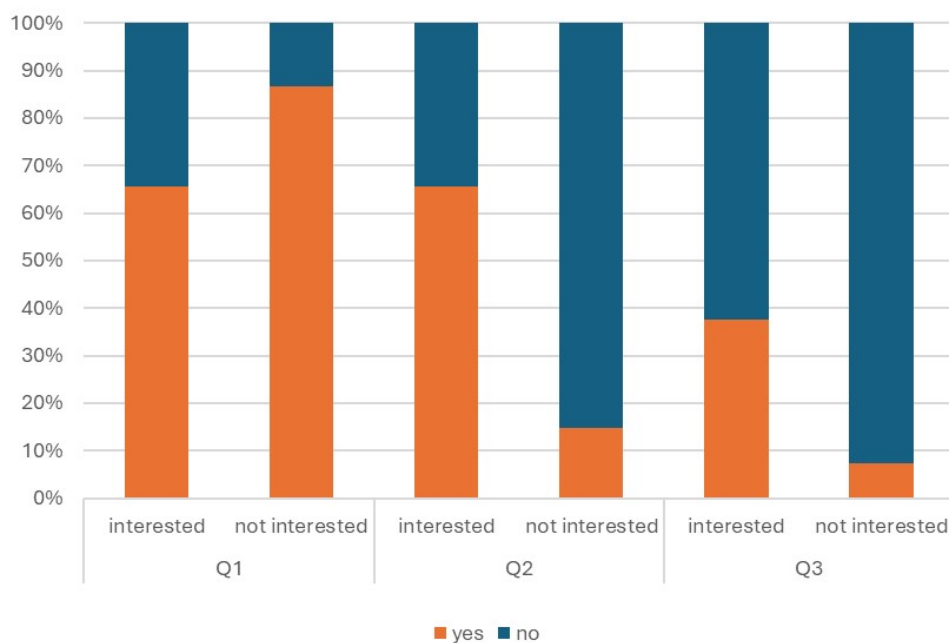


Figure 3. Percentage of respondents willing to take risk in investment decisions

Source: own analysis

The graph illustrates that individuals interested in investing were more likely to select the "strongly agree" and "agree" options compared to those not interested in the topic. As with temperament, the differences between the groups were analysed in the control questions. The distribution of responses is shown in Figure 4.

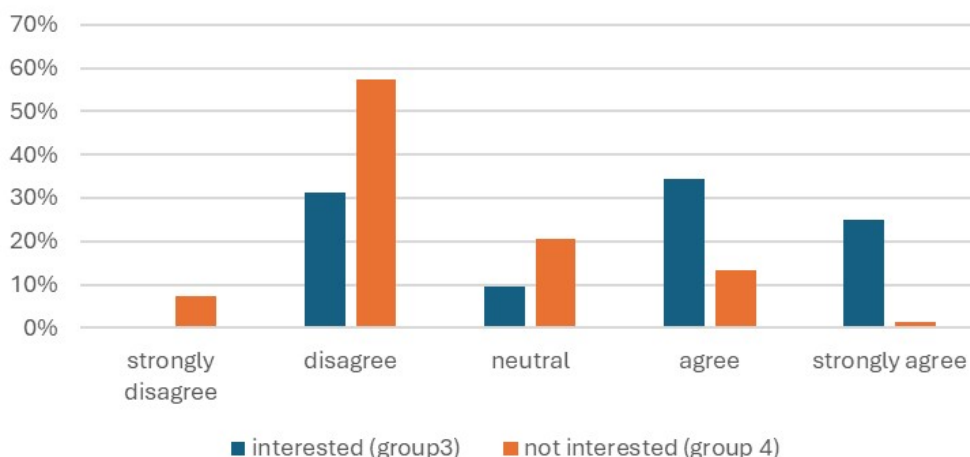


Figure 4. Responses to the control questions on risk propensity in relation to investment decisions, by interests

Source: own analysis

Compared with the groups related to temperament, in this case, the relationships are much stronger and more significant. The group interested in investing was more inclined to make risky investment decisions compared to the group not interested in investing. Additionally, a significant majority of the people in group 3 had previously made risky investment decisions compared to group 4 (those who are not interested in the topic of investment). In all three cases, the differences between the responses of groups 3 and 4 were statistically significant. This means that for each question, the distribution of "yes" and "no" answers was not the same between the two groups. The largest difference occurred in Question 2, suggesting that the responses to this question were particularly divergent between the two groups. The chi-square values for Question 1 were 4.83 (p-value = 0.028), for Question 2 $\chi^2 = 24.05$ (p-value = 9.39×10^{-7}), and for Question 3 $\chi^2 = 11.96$ (p-value = 0.00054).

The final part of the study examined the types of investments preferred by Generation Z. The most frequently chosen investment instruments among the respondents who invested were savings deposits (27%), followed by collectables (15%), real estate (11%), and cryptocurrencies (11%). Clothing (10%), bonds (6%) and stock (9%) ranked next in popularity. The least chosen investment options included works of art, investment funds, and commodities (2%). The respondents selected traditional and alternative forms of investment. In particular, a significant number of respondents selected collectables as an

investment option, which might not typically be considered a common investment vehicle.

CONCLUSIONS

The main objective of the research was to determine the impact of selected factors, such as temperament and interest in investment topics, on the willingness to take risks in investment decisions among students of Generation Z. Furthermore, the preferences regarding financial instruments among the research group were identified. After verifying the hypotheses, it was concluded that sanguine and choleric individuals are more inclined to take risks. Interest in the topic of investing was also positively correlated with a higher propensity to take risks. A much stronger correlation was found in the case of respondents interested in the topic of investment than in the case of temperament type.

Regarding the structure of investment instruments among the research group, the most popular were savings deposits, followed by collectables, real estate, and cryptocurrencies. Young people chose traditional and alternative forms of investment, although there was no significant dominance of one over the other. The research indicated that some of the selected factors significantly influence the willingness to take risks in investment decisions.

Given the pilot nature of the study, the authors acknowledge its limitations, such as the small sample size and the reliance on the self-assessment of the respondents to classify their type of temperament. Since the tendency toward risk in this study is influenced by temperament, future research could incorporate a standardised questionnaire to assess personality traits and temperament, rather than relying on the self-assessment of the respondents.

The analysis of the results may serve as a basis for further research and considerations of educational initiatives that could support young people starting their investment journey.

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The impact of new technologies on facilitating the real estate purchase process

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ABSTRACT

Objective: The purpose of this study is to identify the impact of new technological tools on the real estate purchase process.

Material and Methods: The tool of this research was a survey conducted among individuals who are part of the Krakow residential market. The survey allowed authors to analyse the impact of new technological tools in the process of buying a house.

Findings: Thanks to this research, it can be concluded that new technological tools have a great impact on the residential market. These tools increase the attractiveness of the presentation and help to better understand the layout of the property. Additionally, the presence of new technological tools makes it easier for customers to make the decision to buy the property faster.

Research limitations: The rapid development of technology means that the study should be continually updated. In addition, the results presented relate to the local residential market in Krakow. This means that the research was limited, as it did not include other cities in Poland.

Research implications: The results of this study can be used by developers operating in the primary market as a source of information on which new technological tools are preferred by potential clients. This insight can help developers improve the promotion of their offers in the primary market and, consequently, contribute to increasing property sales.

Keywords: Residential market; New technologies; Property purchasing process; Developer's website; Presentation tools

JEL codes: R3, M2, M3

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INTRODUCTION

Modern technologies are increasingly impacting the property market, particularly in how customers perceive offers and how they are presented by developers. Online information sources, such as developers' websites and property portals, are becoming crucial in the housing search process (Bartkowiak et al., 2023). More and more people are searching for properties online, reflecting the growing popularity of modern technological tools. As a result, developers' websites play a key role in attracting the attention of potential buyers.

Research into the impact of new technological tools on the property search process is essential, as it helps to understand how these tools support customers in their decision-making process. This knowledge enables developers to better adapt their marketing strategies, making them more competitive and effective in the marketplace.

This research aims to examine the impact of modern technological tools on the customer experience during the search and purchase process. For the study, the main hypothesis was established: the presence of modern technological tools facilitates potential buyers in making a property purchase decision. To support this main hypothesis, two specific hypotheses were identified:

- Modern technological tools are more prevalent in the primary market.
- The presence of modern technological tools increases the attractiveness of properties.

To thoroughly investigate the impact of modern technological tools on the property purchase process, the remainder of the paper is structured as follows: a literature review, a description of the research methodology, a presentation and analysis of the results. The literature review discusses key studies and theories on the application of modern technology in the property market. The methodological section details the research tools, methods of data collection, and the research group. The final section presents the research results and provides a discussion of the findings.

LITERATURE REVIEW

Nowadays, the Internet is an important source of information, providing easy access to a huge number of resources on a wide range of topics. It is typically the first place people turn to when seeking information on subjects of interest (Gorzeń-Mitka, 2016). According to a survey conducted (in 2021) by the National Association of Realtors, the Internet plays a crucial role in the property search process, with 97% of home buyers using it as a key resource to gather information (National Association of REALTORS Research Group, 2021). Furthermore, the most common place where buyers found the home they purchased was also the Internet (indicated by 52% of respondents), with the following less recognised: real estate agent, family/friends and magazines (National Association of Realtors, 2024). This dependence demonstrates that the Internet plays a significant role in the real estate market, serving as the most frequently chosen source of information for potential clients (Bartkowiak et al., 2023). The development of technology, especially computers and the Internet, has significantly facilitated the operations of real estate companies by enabling the rapid flow of information. The Internet has become a key marketing platform for these companies, as the quality and accuracy of the information provided directly influence the efficiency of the real estate market (Azlie & Hamzah, 2020).

According to the literature, the residential market is one of the most advanced sectors due to the standardisation of transaction processes. For this reason, both primary and secondary market activities are increasingly based on the Internet. Many processes, such as applications, valuations, and lending, are now conducted online (Vandell & Green, 2000).

Today, having a website is a fundamental element of developers' online strategies. These websites are increasingly adopting modern technologies, such as 3D models, chatbots, and virtual tours, to help customers better understand and visualise properties. This, in turn, significantly influences their purchasing decisions (Martyniak, 2015). Companies that implement such technologies gain a competitive advantage in the rapidly evolving property market (Lizam, 2019).

An important concept related to modern technology in the real estate sector is PropTech. This term encompasses advanced real estate technologies that streamline the processes involved in buying, selling, and financing properties (Siniak et al., 2020). The primary objective of PropTech is to increase the efficiency of the real estate market, which has historically been perceived as resistant to technological change (Górska, Mazurczak & Strączkowski, 2022). The

fourth industrial revolution, closely related to PropTech's development, is characterised by automated processes and the use of artificial intelligence, virtual reality, mobile applications, and more (Furmanek, 2018; Bartkowiak et al., 2023).

The COVID-19 pandemic further accelerated the digitisation of the real estate industry, compelling developers and real estate agents to adopt more sophisticated online tools (Moro, Souza Mendonça and Andrade, 2023). Studies indicate that more than 70% of agents and brokers reported a significant impact of the pandemic on the adoption of modern technologies in the real estate sector (Kania & Kmiec, 2022). These findings align with previous research that highlighted the critical role of technology in driving innovation and meeting customer expectations within the industry (Grant & Cherif, 2016). In response to these challenges, companies in the real estate sector have increasingly focused on digital solutions, upgrading their websites, and implementing advanced tools to better meet customer needs during the pandemic.

Thus, the use of modern technological tools has become essential for developers to remain competitive and adapt to the demands of the modern market (Maududy & Gamal, 2019). A detailed overview of these modern technological tools is presented below (Tab.1).

Table 1. New technological tools in property presentation

Modern technological tools	Description
VR glasses	Based on virtual reality, they allow potential customers to view properties that are not built yet. They give the opportunity to see visuals on the outside and inside of the building (Molga & Plachta, 2020).
AR projects	Computer-generated content (3D objects, images) in a real environment (Kołodziejczyk, 2013). Presentation via an electronic device (e.g. tablet).
3D models	A three-dimensional image showing the property using tools such as 3D scanning and computer modelling (Naeem, Rana, & Nasir, 2023).
Virtual walk	A collection made up of a series of high-quality photographs. It gives the ability to see the property by interactively clicking on the marked points in the photographs (Palonka & Sroka, 2013).
Visualisation of the flat	Presentation of the interior with images or computer graphics (PWN dictionary, 2024).

Virtual assistant to buy a flat	A computer program that interacts with potential clients. It learns the user's preferences to personalise the property offer. Present from the beginning of the search to the real estate transaction (Kuligowska & Lasek, 2007).
QR codes to navigate to selected parts of the offers	Square digital code, read by built-in cameras (Kuligowska & Lasek, 2007). It redirects, for example, to photo galleries, virtual walks, etc.
Chatbots	A computer program based on artificial intelligence (Jaskowska & Wójcik, 2017). It provides the necessary information about the offered properties.
Mobile application	A computer program for viewing offers, communicating with developers, and managing transactions (Bac, 2014).
Online meeting with the seller	Real-time interaction with a given communicator. Provides the ability to get information about real estate (Gackowska, 2013).
Flat search engine	A computer program that allows the search for a flat according to the client's preferences (PWN dictionary, 2024).

Source: own study

Technologies have a significant impact on the property sales process. Innovations such as VR, AR, and virtual tours enable interactive property viewings without the need for physical presence, saving time and resources for both parties involved in the transaction. Realistic visualisations allow customers to better assess property interiors and surroundings, increasing engagement and accelerating purchase decisions. Additionally, VR facilitates the presentation of properties under construction, reducing the likelihood of subsequent modifications (Miljkovic, Shlyakhetko and Fedushko, 2023). These technologies also shorten the property search process, leading to faster decision-making. Consequently, their implementation contributes to more efficient and automated transaction processes (Naeem, Rana and Nasir, 2023). Other technological tools, such as chatbots and virtual assistants, enhance communication and streamline transactions by providing instant access to information and assisting with the preselection of offers. They also collect data on customer preferences, enabling the creation of more tailored and personalised offers (Gackowska, 2023). Furthermore, mobile apps, property search engines, and QR codes facilitate the search process by helping customers quickly find properties that meet their requirements. These tools improve the efficiency of transactions, making it easier and faster for customers to complete their property purchases (Bac, 2014).

RESEARCH METHODOLOGY

The research on customer interaction with modern technological tools in the context of the real estate market involved gathering information from individuals (potential buyers) planning to purchase property in the future. The primary objectives of the study were the following:

- to identify the impact of modern technology on the property buying process;
- to determine in which market modern technological tools are most prevalent;
- to assess whether modern technological tools increase the attractiveness of the presented properties.

The study used a questionnaire composed of closed-ended questions. The purpose of these questions was to collect information about customers' preferences and opinions regarding modern technological tools used in property presentations and purchases. The questionnaire included topics such as sources of property information, frequency of tool use, and an evaluation of their usefulness and influence on the buying process.

The use of closed-ended questions made the survey easier to complete, thus increasing the number of respondents and improving the representativeness of the results. The survey was conducted in June 2024 using the Microsoft Forms platform and was distributed through social media.

The research focused on Krakow, chosen because the researcher was familiar with the local residential market and the city's growing importance as one of the fastest-developing property markets in Poland. A total of 100 respondents participated in the survey. A detailed analysis of the results concerning customer interaction with modern technologies is presented in the subsequent sections.

RESULTS & DISCUSSION

The study provided valuable information on the most common sources of information used by potential property buyers. This question allowed respondents to select up to three options, offering a clearer picture of their preferred sources of information (Figure 1). Websites were the most frequently chosen source of property information (selected by 88 respondents), followed by social media (44 respondents), real estate agencies (22 respondents), magazines (3 respondents), billboards (18 respondents), and family/friends (27 respondents).

The results suggest that developers should focus their marketing efforts on improving their online presence. While social media is less popular compared to websites, it should not be overlooked, as it provides unique opportunities, such as engaging with younger audiences.

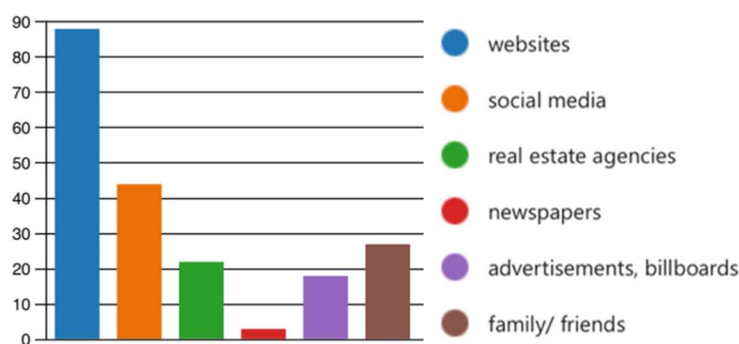


Figure 1. Sources of information on real estate offers

Source: own study.

In the question regarding the frequency of modern technological tools on websites (Figure 2), there was considerable diversity in their presence. The property search engine was the most common tool, with 94% of respondents stating that it appears 'very often' or 'often.' This indicates that the search engine is the most frequently used modern tool on developers' websites.

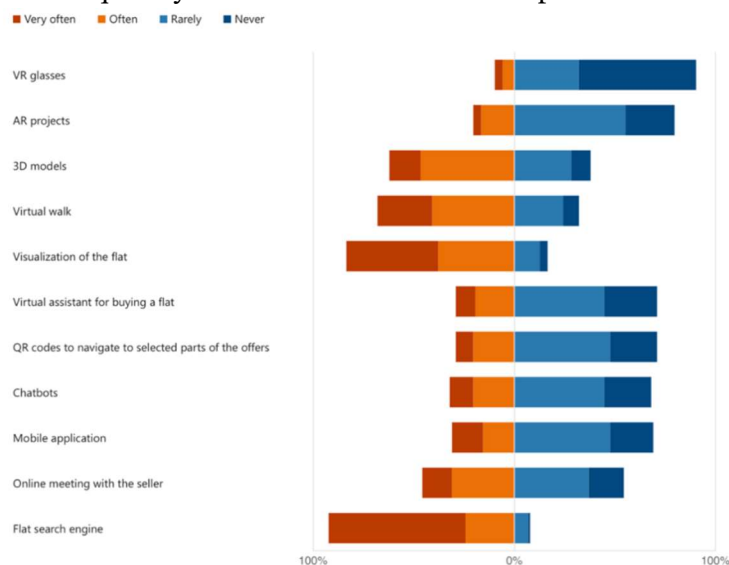


Figure 2. Frequency of modern technological tools in property presentations in the primary real estate market

Source: own study.

The next most common tools, according to respondents, are housing visualisations (86%), virtual tours (68%), and 3D models (64%). Among the less frequent tools are online meetings, mobile applications, chatbots, virtual assistants for property purchases, and QR codes. The survey found that tools such as augmented reality (AR) projects and VR glasses are the least common. The limited availability of VR glasses may be attributed to their novelty and mainly stationary use. Furthermore, augmented reality technologies are not yet widely adopted in the real estate sector (Bartkowiak et al., 2023).



Figure 3. Availability of modern technological tools as reported by respondents

Source: own study.

As stated by most respondents (62%), modern tools are most commonly found on websites offering primary market properties (Fig. 3). This suggests that developers dealing with newly built properties are more likely to invest in advanced digital tools to enhance the presentation of their offers. The second largest group (17%) found it difficult to determine where modern tools were the most prevalent. Another 14% of the respondents felt that modern tools were equally available in both markets. The smallest group (7%) indicated that modern tools are found more frequently on the secondary market.

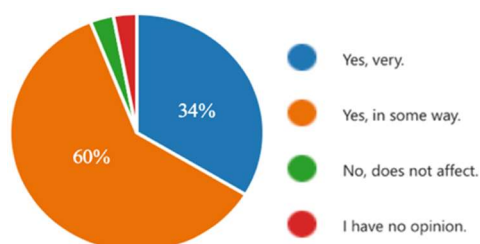


Figure 4. Assistance provided by modern solutions in the decision-making process for property purchase

Source: own study.

In response to the question about the impact of modern technological tools on property purchase decisions (Figure 4), many respondents (94%) felt that these tools influence the decision-making process. Tools such as virtual tours, 3D models, and augmented reality provide potential buyers with a more immersive and detailed understanding of a property. This can help them make a more informed decision, especially when a physical visit is not possible. Only 3% of the respondents felt that the presence of these tools does not affect real estate purchase decisions, while the remaining respondents had no opinion on the matter.

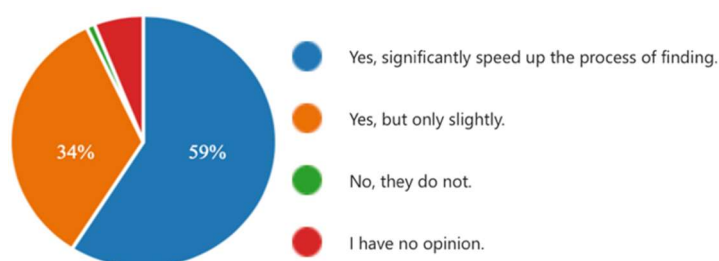


Figure 5. Do modern technological tools shorten the time needed to identify a suitable property?

Source: own study.

In a survey on the impact of modern tools on property search time (Figure 5), many respondents felt that these technologies effectively speed up the process. Up to 93% of the respondents believed that these tools accelerate the process of finding a suitable property. Only 1% of the respondents felt that modern tools had no impact, while 6% had no opinion on the matter.

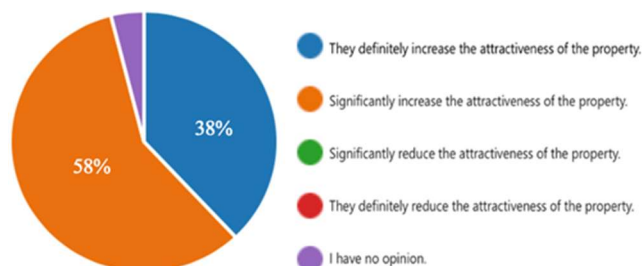


Figure 6. The impact of new technological tools on the attractiveness of presented properties, according to the opinions of the respondents

Source: own study.

The next part of the survey examined whether modern technological tools speed up the property search process (Figure 6). Many respondents, 96%, agreed that these tools improve the attractiveness of properties. The remaining 4% of the respondents had no opinion on the subject. It demonstrates that modern technological tools not only speed up the property search process but also play a crucial role in enhancing property attractiveness.

As can be seen (Figure 7), the dominant group of respondents (97%) felt that modern technological tools helped understand the layout and appearance of the property. A small percentage (2%) felt that these tools were not useful, and 1% of respondents stated that they had no opinion.

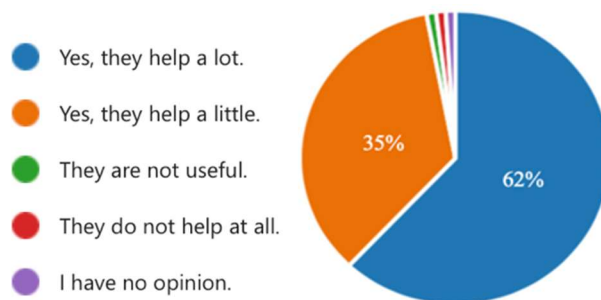


Figure 7. Perceptions of the respondents of modern technological tools to understand the layout and appearance of the property

Source: own study.

As shown in Figure 8, when asked about the usefulness of modern tools in property purchases, respondents indicated that the most valued tools were 3D models (99%), property visualizations (97%), virtual tours (96%), AR projects (96%), and property search engines (95%). Respondents also found online meetings (73%) and virtual assistants (67%) useful. QR codes (56%) and chatbots (54%) were rated less useful. This trend may be due to the fact that these tools are less frequently present on websites (see Figure 2).

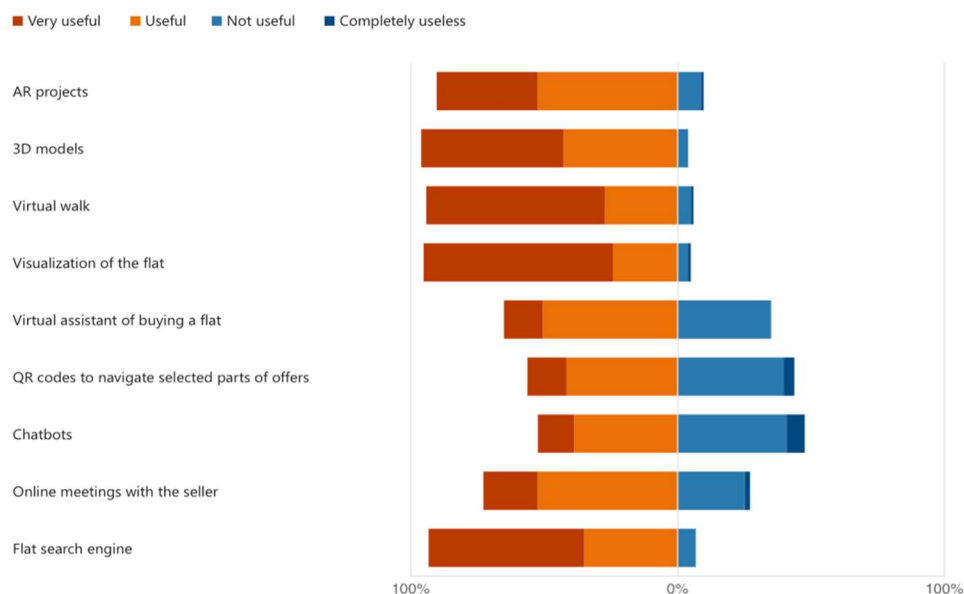


Figure 8. Assessment of the usefulness of modern technological tools according to the respondents' opinions

Source: own study.

CONCLUSIONS

The analysis carried out in this study provides valuable information on the impact of modern technological tools on user experience in the property market. The results indicate that the Internet is the dominant source of property information, which is consistent with previous research (Bartkowiak et al., 2023). This finding highlights the need for developers to improve their efforts to develop and use modern technological tools online.

The research shows that modern tools significantly facilitate the property search process and accelerate the purchase decision. The respondents indicated that these tools improve their search efficiency and reduce the time required to select the right property. It has been confirmed that the availability of these technological tools greatly enhances the user experience and can attract potential buyers. Furthermore, the study revealed that the respondents identified key tools such as AR projects, property visualisations, property search engines, 3D models, and virtual tours as essential to enhance their experience. However, comparing these findings with Mazurczak's research, which focused on developers' perspectives, reveals a significant gap. Although highly valued by potential buyers in this study, virtual tours remain one of the least implemented tools, appearing

in only 25% of investments (Mazurczak, 2021). Another study found that only two out of four developers offer virtual tours on their websites, and only one in four provides apartment visualisations (Tomasik & Marona, 2023). This discrepancy emphasises the need for developers to adapt their strategies to meet client expectations, enhancing the appeal of their offers and improving the effectiveness of their marketing efforts.

The main hypothesis was confirmed, that the presence of modern technological tools facilitates potential buyers in making property purchase decisions. Respondents noted that modern technological tools are frequently used and significantly assist in property searches. Specific hypotheses about the more frequent use of modern tools in the primary market and their influence on the attractiveness of properties were also confirmed. Furthermore, research by Górska, Mazurczak, and Strączkowski highlights that over 90% of developers recognise the potential of using tools such as virtual tours, interactive location maps, 3D models, and QR codes in real estate marketing (Górska, Mazurczak & Strączkowski, 2022). This suggests an opportunity for increased adoption of these solutions by developers in the future. Such actions can not only enhance client satisfaction but also improve the overall customer experience and support decision-making.

Although this study provides valuable information, it also has some limitations. One of these is its pilot nature, which allows for the identification of key findings and serves as a foundation for future, more detailed research. Additionally, the rapid development of technology and shifting customer preferences may impact the results' validity, necessitating continuous updates to the study. The research was conducted with participants from the Krakow residential market, so future studies could focus on other real estate markets in Poland.

Furthermore, modern technologies are present not only in property presentations but also in other aspects of the property market, such as property management, market data analysis, and transaction processes. Future research could also analyse the impact of modern technologies in these areas of real estate as well.

In conclusion, modern technologies are crucial in shaping the real estate market, transforming how offers are presented and improving transaction processes. Future research, which is essential for future development, should focus on technological advances and their impact on various areas of the real estate market.

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Entering the profession from the perspective of young property valuers

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ABSTRACT

Objective: For several years, there has been a decline in interest in the profession of property valuation. This is clearly seen in the declining number of professional licenses issued. So far, no studies have addressed this problem. The main objective of this research was to find out how the profession is perceived by young real estate appraisers who have recently entered the profession.

Material and methods: A survey was conducted to find out what challenges they face at the beginning of their career, what their strengths and weaknesses are, to identify the relative difficulties of young professionals and to assess what might discourage young people from choosing this profession.

Findings: For almost ten years, there has been a gradual decline in the number of new professional licenses issued, and consequently a decline in the number of new valuers entering the profession. At present, the reasons for this decline are not known, so it is worth examining the problem more closely to propose possible solutions.

Research limitations: The importance of this issue confirms the need for further research in this area. To obtain reliable results and formulate general conclusions, follow-up studies should be conducted with a significantly larger sample size and supplemented with additional research methods, such as in-depth interviews and case studies.

Research implications: For almost ten years, there has been a gradual decline in the number of new professional licenses issued, and consequently a decline in the number of new valuers entering the profession. At present, the reasons for this decline are not known, so it is worth examining the problem more closely to propose possible solutions.

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Preparation for the profession; Property valuation business

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INTRODUCTION

Real estate valuers are an important professional group supporting the real estate market. In Poland, the profession is regulated by legal and professional restrictions. Candidates must meet formal requirements and demonstrate knowledge and skills in real estate valuation. They are required to complete postgraduate studies, undertake professional practice, and ultimately pass a state exam. The preparation process itself takes about two years from graduation and involves significant time and financial commitments at each stage of training.

Practising the profession poses many challenges for appraisers. In their work, they often encounter various issues which, especially at the beginning of their careers, can be challenging and even lead to disappointment. Appraisers point to a range of problems in the profession, such as inadequate preparation of candidates, growing competition, price dumping, ease of questioning valuation results, non-transparent market data, lack of formal specialisation among appraisers, client pressure on valuation outcomes, and professional liability (Małkowska et al., 2019). Nevertheless, appraisers report satisfaction with their work, emphasising their professional independence, the professionalism of their services, and the benefits associated with their established market position (Małkowska et al., 2021).

The primary aim of this study was to understand how the profession is perceived by young real estate appraisers who have recently entered the field and to learn about the challenges they face at the start of their careers. This is preliminary research intended to assess the advisability of further in-depth study and to help determine its future direction and scope.

LITERATURE REVIEW

Starting or changing a career is undoubtedly one of the most important moments in everyone's life. It is a time to take stock and evaluate one's own professional competencies and skills against expectations and dreams for one's career and future life in general. As many researchers point out (Li and Yeo, 2011; Waworuntu et al., 2022; Mruk, 2022), the quality of professional life is closely related to the quality of life, which is why it is so important that work is a source of satisfaction and provides a sense of security and fulfilment.

The profession of a property valuer is characterised by certain features. It is a so-called public trust profession, which performs a kind of social mission, satisfying the public interest, where the profit criterion is not always a priority (Klusek, 2015). It is an activity that requires specialised, interdisciplinary knowledge and experience.

There are many threads in the literature on real estate valuation. These are mainly methodological publications explaining general principles of property valuation (Gabrielli and French, 2021; Pagourtzi et al., 2003), local guidelines applicable in different countries (Abidoye et al., 2019; Schnaidt and Sebastian, 2012), comparative studies comparing valuation methodologies in selected markets (Adair et al., 2005; Mansfield and Royston, 2007), or real estate valuation principles with special considerations, such as a specific type of property and its components (Lisi, 2019; Majumdar, 2019; Grande-Ortiz et al., 2012) or specific valuation purposes (Mangioni, 2015). Issues of training and preparation for the profession of young appraisers are also raised (Baxter, 2007; D'Arcy and Taltavull, 2009; Poon, 2014; Mooya, 2015), referring to study programs and professional development principles.

In addition to the valuation principles themselves, authors also refer to the business side of real estate valuation, describing the conditions for conducting professional business (Seagar, 2003; Warren and Elliot, 2005; Oloyede et al., 2011; Wilkinson et al., 2018; Lee et al., 2024), often pointing out various issues that can affect the way the profession is practiced.

Similar publications apply to Polish valuers. In addition to legislation (Ustawa, 1997; Rozporządzenie, 2023) and professional standards (PF SRM), there are many publications on general valuation principles (Dydenko, 2020; Cymerman and Cymerman, 2021), as well as on the application of selected methods and techniques used for specific purposes (Konowalczyk, 2014; Trojanowski, 2019; Nowak, 2020). There are also publications on the profession's performance in Poland, considering the conduct of the valuation business itself (Małkowska and Uhruska, 2018b; Kania et al., 2020; Małkowska and Uhruska, 2022), the relationship with the client (Żróbek et al., 2018), or the direction of further development (Małkowska and Uhruska, 2019).

In the context of this article, publications on student education and preparation for the profession are relevant (Żróbek and Grzesik, 2013; Żróbek et al., 2016; Żróbek et al., 2020). As the authors point out, the education system for Polish valuers seems to be insufficient, especially in the perspective of global changes in valuation conditions (Lee et al., 2024).

In Poland, it is possible to become a property valuer at different ages and stages of one's career. The choice of such a professional path is challenging, as it requires long-term substantive and practical preparation. This is because candidates for the profession must meet a number of formal requirements. Typically, the path to the profession includes the following stages: graduation from a university of any profile, completion of post-graduate studies in real estate appraisal, implementation of an apprenticeship and passing the state exam (Ustawa, 1997; Rozporządzenie, 2014). After passing the exam, the candidate acquires a professional license and officially becomes a property valuer.

Young valuers entering the profession can rarely find employment with appraisal companies. In Poland, the vast majority of valuers operate as sole proprietors without employees. Most often, young people with little to no professional experience start their own independent businesses and conduct valuations on their own account. They often view real estate appraisal as supplementary work that complements their primary profession (Małkowska and Uhruska, 2018b).

Currently, due to the lack of research in this area, it is difficult to determine whether the property valuer profession is favourable for young people. We do not yet know the specific challenges they face, where difficulties arise, or where they see advantages over more experienced colleagues. This article presents the results of a preliminary survey that outlines the situation of young property valuers in Poland and offers recommendations for further research.

RESEARCH METHODOLOGY

The research presented in the article is preliminary. For several years, we have been observing a decline in interest in the profession of property valuation in Poland. This can be seen in the statistics of the number of licenses issued, but also in the number of applicants for postgraduate studies. At this point, there is a lack of research on the detailed reasons for this situation, but it can be assumed that candidates may be discouraged by the difficulty of preparing for the profession and by the problem of starting a new business on their own (insufficient preparation, little experience, limited employment opportunities), which may be disproportionate to the expected income from the work performed.

As the research is preliminary, it will not be used to verify hypotheses. Their main purpose is to pre-screen the problem of people entering the profession and to clarify the scope of further research in this area. An important conclusion of this preliminary study is the indication of directions for further analysis, which is presented in the summary at the end of the paper.

The preliminary study is based on information obtained from a survey of property valuers who became members of the Malopolska Association of Property Valuers (MSRM – Małopolskie Stowarzyszenie Rzecznawców Majątkowych) in Krakow since 2021. The group of respondents was quite small, numbering only 47 valuers, but intentionally, the survey was addressed only to young appraisers in their early years of experience. It was considered that new members of the MSRM are most likely to be appraisers who have recently entered the profession and will be able to comment on their problems and challenges they face. Typically, young professionals are looking for colleagues and institutional support, so they also choose to become members of a local professional organisation as they begin their business operations. Finally, responses were received from 10 appraisers, representing more than 21% of the survey recipients. The survey was compiled in an electronic version and was distributed by email. The responses were fully anonymous.

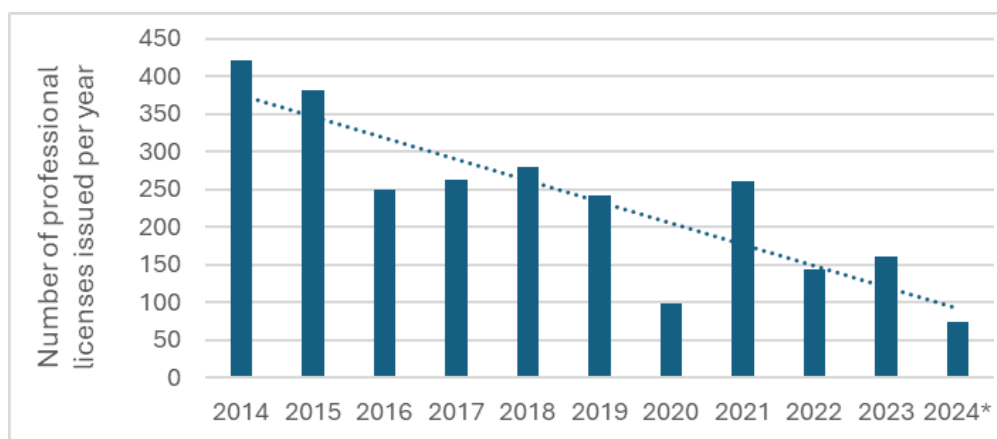
The survey contained a total of 12 multiple-choice questions and four open-ended questions. The questionnaire consisted of two main parts. The first part included questions about the stage of preparation for the profession, specifically the evaluation of the theoretical and practical knowledge gained during the preparation, as well as the adequacy of the price for the different stages of training. In turn, the second part concerned the performance of professional work. In this part, respondents indicated what favours and what hinders work in the profession of property valuer. For each question, respondents had the opportunity to leave a comment. In addition, the questionnaire included follow-up questions on the gender, age and years of work experience of the respondents.

RESULTS & DISCUSSION

Currently, nearly 8,500 professional licenses have been issued in Poland (Central Register). Looking at detailed data on the number of professional authorisations issued annually (Kania et al., 2020; Central Registry), it can be observed that interest in the profession varied at different times, which was

mainly due to changes in legal regulations regarding formal requirements for candidates.

The largest number of authorisations (a total of 3262 or about 652 per year) was granted during the initial, so-called "transitional" period, i.e. 1992-1997 (Kania et al., 2020). Starting in 1998, unified rules for obtaining professional licenses were introduced (Ustawa 1997), which were subsequently modified several times. While in the initial period of the legislation the requirements for candidates were systematically raised, eventually in 2014, as a result of the general deregulation of the real estate professions (Ustawa 2013), the guidelines were lowered by reducing the duration of professional practice (from 12 months to 6 months), reducing the number of valuations performed at practice (from 15 to 6), and by lowering the state exam requirements. Then there was the biggest boom in the number of licenses issued, and so in 2014, 420 licenses were issued, and in 2015, 381 licenses were issued, respectively. This boom, however, quickly came to an end, and since 2016, despite the lowered requirements for applicants still in force, we have seen a consistent decline in the number of newly granted professional authorisations, which continues to this day.



* Data for 2024 are incomplete. In the first half of the year (January-June), 75 licenses were issued

Figure 1. Number of professional licenses issued per year.

Source: own study, based on the Central Register of Real Estate Valuers (Central Register).

Figure 1 shows a reduction in the number of professional licenses issued. In 2020, examinations were partially suspended due to sanitary restrictions related to the Covid19 pandemic, and only 98 appraisers obtained professional licenses, but those who did not participate in the 2020 examinations were tested later,

which explains the large increase in 2021. However, this was an exceptional situation. After the pandemic period ended, the number of new appraisers decreased further. Only 143 licenses were issued in 2022, 161 in 2023, respectively, and in the first half of 2024, there were only 75 new appraisers.

So far, the reasons for the reduction in the number of new appraisers are not known. It is worth analysing whether the decline in the number of new appraisers is due to the difficulty of preparing for the profession and the examination procedure, which perhaps discourages candidates while they are still preparing for the exam, or whether they are discouraged by the difficulty and responsibility of the work itself or by unsatisfactory salaries at the beginning of their careers. In the following section, the results of the survey on the beginnings of property valuers' careers are presented.

The survey was conducted among valuers between the ages of 30 and 49, only two of whom were over 40 years old. They obtained their professional licenses between 2018 and 2024, which confirms that the newly enrolled MSRM members are appraisers with less professional experience. For those surveyed, the time to obtain professional credentials counted from completion of postgraduate studies to passing the state exam varied widely, i.e. from 3 to 15 years, but in most cases it was 4-5 years. The reasons for extending the time to complete the practice and prepare for the exam are not known. This could be due to other professional work undertaken, lack of adequate motivation or any other personal reasons. 40% of those surveyed had worked with appraisals before becoming licensed, while the rest entered the profession without any prior experience. Interestingly, most of those who previously engaged in appraisal often treat appraisal as their sole or predominant activity after becoming licensed. Most likely, these individuals consciously entered the profession and pinned their hopes for future career development on it. -On the other hand, people who had no previous experience with real estate appraisal tend to treat the profession as an additional, complementary one to their main profession.

The purpose of the preliminary research was to identify the situation of young appraisers shortly after obtaining their licenses. The survey was intended to provide preliminary information on the state of young appraisers' preparation for the profession, as well as to find out what makes valuation work easier and what makes it more difficult. The survey was divided into two main parts - the first concerned preparation for the profession, and the second included questions about professional performance.

As mentioned earlier, the profession of property valuers in Poland is strictly regulated. In fact, there are detailed guidelines on how to prepare for the profession, how to obtain a license, and even what methodology to use in your professional work. Everything is regulated in the relevant legislation (Ustawa 1997; Rozporządzenie 2014; Rozporządzenie 2023).

Candidates, as part of their preparation for the profession, must complete postgraduate studies, complete an internship and pass an exam (in exceptional situations, exceptions to these rules are possible). The minimum curriculum for postgraduate studies and internships, as well as the rules for the exam, are fully prescribed by law, but are not necessarily confirmed by the actual market requirements and the needs of those entering the profession. As it turns out, on the basis of preliminary surveys conducted, young property valuers assessed that their level of preparation for professional activities at the time of obtaining their licenses was below average. On a scale of 0 to 10, where "0" meant completely unprepared and "10" meant fully prepared for the profession, respondents indicated answers from 2 to 6 and, on average, rated their skills at 4.5.

Young appraisers emphasise good theoretical preparation, with insufficient practical skills. As for assessing the degree of usefulness of the various stages of preparation for the profession, they gave the best ratings to apprenticeships and self-study before the exam. Respondents' opinions are shown in Figure 2.

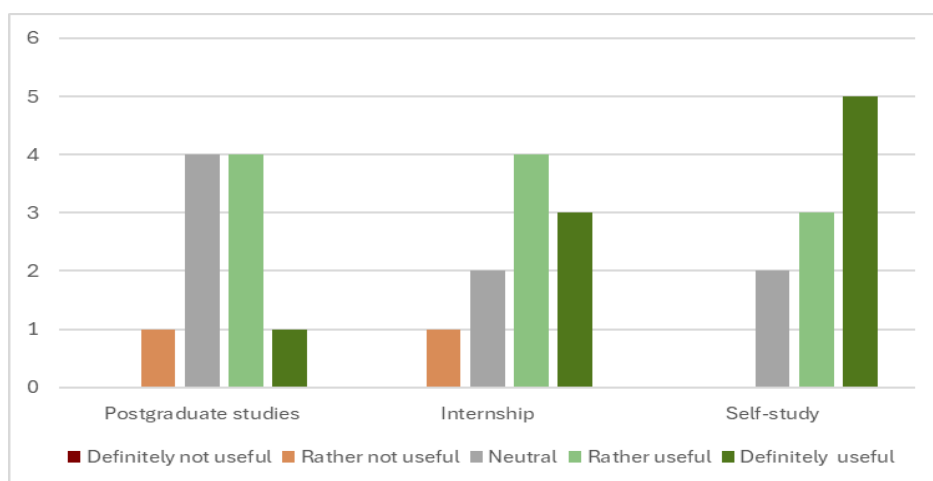


Figure 2. Assessment of different stages of preparation for the profession

Source: own study, based on the survey conducted.

At this point, it is worth quoting one respondent who stressed the importance of apprenticeships, provided they are of high quality. Good practical preparation of young appraisers is the key to success in their future work, while poor practical preparation, despite good theoretical knowledge, can be a barrier to entry into this specialised service market. Unfortunately, the preparation stage of the profession in Poland is based mainly on theoretical knowledge.

Respondents also addressed the cost of preparation for the profession. Their opinions were sharply divided, but in general, they expressed acceptance of the level of cost of postgraduate studies and apprenticeships; however, in the case of the examination procedure, respondents clearly assessed that its price is too high.

To summarise the above, preparation for the profession is formalised, time-consuming (a minimum of 2 years after graduation from university), costly, and, according to the surveys conducted, unfortunately, does not give a sense of complete preparation for the profession. Young appraisers have to improve their skills on their own by taking supplementary courses to prepare for the exam or participating in professional training.

Polish valuers experience several problems in their professional work. These include declining service quality, lack of specialisation, high competition, and price dumping (Małkowska and Uhruska 2018a). Young people seeking their place in this service market have to face these challenges, as well as deal with the impediments arising from their unstable professional position. Thus, the surveyed appraisers point to insufficient practical training, unsatisfactory earnings and, at the same time, high business costs, as well as high competition and lack of cooperation with other more experienced valuers and limited opportunities for full-time work as the most important impediments. In contrast, they do not perceive the difficulty of reaching clients or the lack of theoretical knowledge as an obstacle. Details are shown in Figure 3.

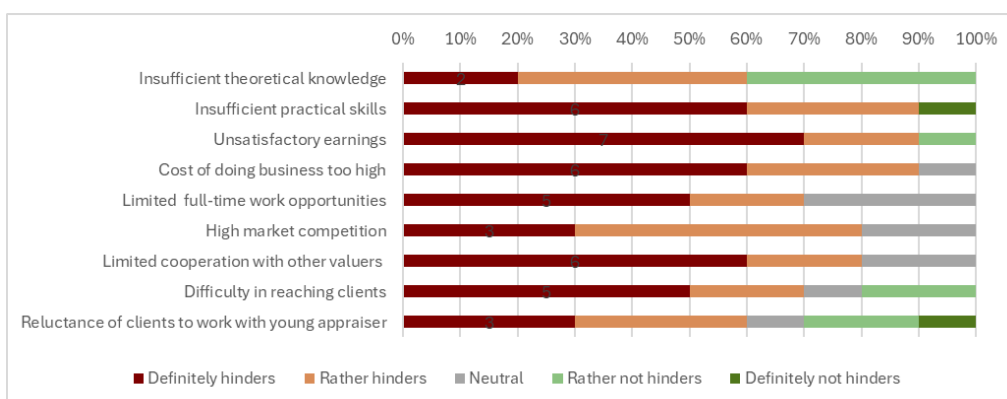


Figure 3. Assessment of potential impediments for valuers entering the profession

Source: own study, based on the survey conducted.

It can be considered that young valuers with little professional experience initially gain their market position by performing easier, more routine assignments, for which they receive correspondingly lower salaries. The lower remuneration received at the beginning of a career with relatively high professional requirements is an unfavourable situation and may discourage young people from choosing this career path. Additionally, the limited opportunity to work with an experienced valuer is certainly an impediment. In Poland, the dominant business model among valuers (Malkowska and Uhruska 2018b) is a sole proprietorship without hiring employees, so opportunities to find full-time work are very limited. Young people starting are unlikely to find employment with an experienced valuer. Often, despite their lack of experience, they go into business on their own. For young people expecting support and professional guidance (Waworuntu et al., 2022), this can be a highly uncomfortable situation.

Young valuer also recognise their strengths and find many facilitations they are eager to use. Such facilitators are: electronic access to real estate and real estate market data, as well as analytical tools used in the valuation process, a wide range of nationwide remote training courses, access to literature and research, and the ability to promote their services on the Internet, through multimedia and social networks. See Figure 4.

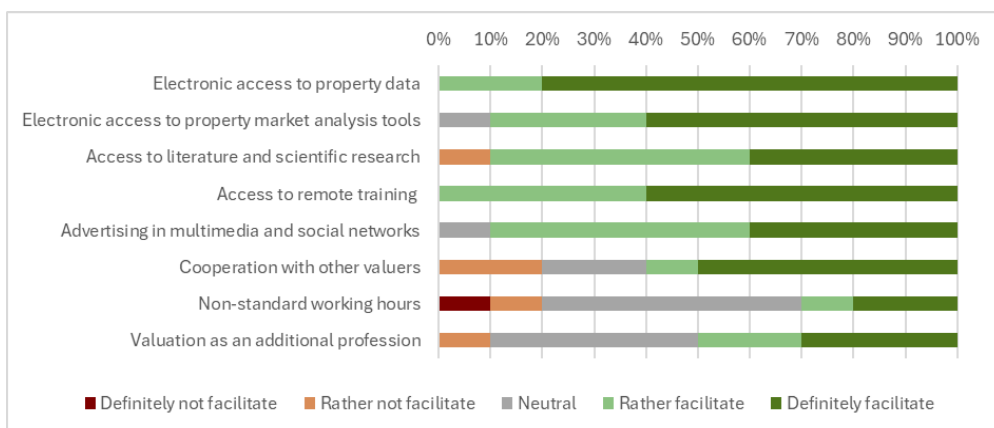


Figure 4. Assessment of potential facilitations for valuers entering the profession

Source: own study, based on the survey conducted.

Irregular working hours and the possibility of combining valuation with other areas of professional activity were assessed negatively by young valuers, that is, as an element that does not facilitate work. Both of these elements make it more difficult to achieve the so-called work-life balance when working two jobs and with irregular working hours.

Young valuers also indicated which directions are effective in starting their professional activities. As the most effective strategy for entering the profession, they indicated enhancing their professional skills through participation in specialised training (e.g., valuation for banks, business valuation, etc.) and further specialisation of services. They hope to gain a competitive advantage in selected areas of valuation along with specialised knowledge. In addition, they highly appreciate advertising their services in electronic media and establishing cooperation with other experienced valuers. A big surprise was the assessment of the possibility of joining analytical teams that obtain market data for valuation. Here, "neutral" responses predominated, which may confirm that survey participants are not part of such teams and do not yet appreciate the benefits of this form of cooperation (Bieliński 2015). The responses are shown in Figure 5.

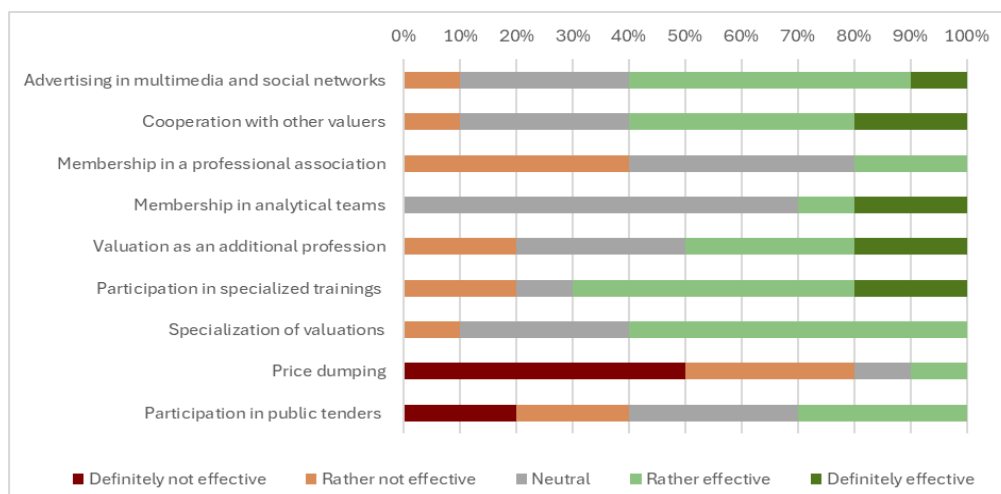


Figure 5. Assessment of potential strategies for entering the profession

Source: own study, based on the survey conducted.

Young valuers expressed negative opinions about price dumping. They do not rate the price-dumping strategy as effective in gaining market position. Similarly, participation in tenders for public property valuations, where the lowest price is the criterion for selecting a valuer, was also rated negatively. Membership in professional associations was rated surprisingly low. Although all respondents are active members of such an association (MSRM) and certainly appreciate the organisation's efforts to integrate the local community, they do not perceive the association's role as an institution that supports individual careers.

CONCLUSIONS

This preliminary research was designed to provide insight into the challenges faced by newcomers to the profession, assess the advisability of further research in this area, and offer recommendations for future studies. Based on the research conducted with a limited sample, it is not possible to draw general conclusions on this issue. The results presented in the article are merely an attempt to outline the scope of the phenomenon being studied, and any conclusions are the Author's reflections based on a literature review and the opinions of several appraisers. The presented conclusions require broader research and further verification.

Based on the literature review and preliminary research, it can be expected that young appraisers encounter difficulties at the start of their professional careers. They have to go through a long and formalised process of

preparation for the profession, and then, right after they pass the exam, they are usually left on their own, without the possibility of support from more experienced colleagues. They work in a highly competitive environment in terms of price and quality, confront the pressures and expectations of customers, and their work is constantly subject to evaluation.

They are not, however, helpless in this market, as they excel in using new technologies and can leverage existing digital tools both for work and for promoting their services. They also enhance their professional qualifications and pursue specialised service paths.

For almost ten years, there has been a gradual decline in the number of new professional licenses issued, and consequently a decline in the number of new valuers entering the profession. At present, the reasons for this decline are not known, so it is worth examining the problem more closely to propose possible solutions.

The importance of this issue confirms the need for further research in this area. To obtain reliable results and formulate general conclusions, follow-up studies should be conducted with a significantly larger sample size and supplemented with additional research methods, such as in-depth interviews, case studies, analysis of appraisers' work diaries, focus group interviews, etc. Further research could consider:

- increasing the territorial scope of the research to assess regional differences, e.g. due to the activities of local institutions and organisations;
- conducting surveys on the entire population of property valuers to learn the opinions of experienced colleagues as well;
- checking whether, in addition to the decrease in the number of licenses issued, the number of postgraduates and apprenticeship completers is decreasing at the same time;
- an assessment of the desired directions of change in preparation for the profession;
- an assessment of the desired directions of change in the market for real estate valuations.

An equally interesting area of research could involve investigating the extent of the phenomenon of resignation from the profession or the suspension of professional activities. This phenomenon has yet to be studied, and the results of such research could reveal the real difficulties and challenges within the profession.

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Changes in the real estate office market in the face of the Fourth Industrial Revolution: A case study of Krakow

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ABSTRACT

Objective: This article examines the impact of the Fourth Industrial Revolution on the office real estate market, focusing on Kraków, Poland.

Material and methods: The study employs in-depth interviews, targeting two experienced office managers specialising in lease management in Kraków, the largest regional office market in Poland. While qualitative research is inherently non-representative, this approach was chosen to gain a deeper understanding of the context of the studied phenomena.

Findings: The study reveals that technological advancements significantly influence market dynamics. Office buildings equipped with the latest technologies are more likely to achieve quick commercialisation. In the context of remote work, tenants demand highly optimised and eco-friendly office solutions to attract and retain employees.

Research limitations: The study's focus on Kraków presents a limitation, as market conditions may vary in other regions. Additionally, the research is constrained by the availability of data and the uneven distribution of market knowledge.

Research implications: The findings highlight the necessity for continuous technological adaptation in the office real estate market. Further research involving diverse market participants from various locations would enhance understanding. This study emphasises the profound effects of the Fourth Industrial Revolution on shaping tenant expectations and office market trends.

Keywords: Fourth Industrial Revolution; Commercial Real Estate; Office buildings; ESG; Remote work

JEL codes: R3, M1, M2

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INTRODUCTION

The purpose of this article is to present the changes in the real estate office market in the face of the Fourth Industrial Revolution. This revolution, also known as Industry 4.0, introduces advanced digital technologies that impact various sectors of the economy, including the real estate market. In the context of these transformations, the key research questions to be addressed include:

- How does the Fourth Industrial Revolution and proptech influence (or will influence) the real estate market?
- How have tenant expectations regarding office space, its usage, and amenities changed?
- Has the aspect of sustainable buildings, ESG, and green certifications become particularly important in recent years?
- What does the future hold for the office market in Krakow?

To answer these questions in our study, we employed the method of in-depth interviews, targeting two experienced office managers specialising in lease management in Kraków, the largest regional office market in Poland. While qualitative research is inherently non-representative, this approach was chosen to gain a deeper understanding of the context of the studied phenomena.

The selection of Kraków as the focus of our research was deliberate, as it is the largest regional real estate market in Poland, hosting a diverse range of companies from various sectors of the economy. This characteristic makes it a particularly rich environment for examining trends and dynamics in the office rental market.

Additionally, we selected managers from two distinct property management companies with differing scales of operation. This choice was made to enhance their roles as key informants, providing diverse perspectives on market trends and ensuring a more comprehensive understanding of the subject matter.

This methodological approach allowed us to capture nuanced insights into the phenomena under investigation, offering valuable contributions to the discourse on office market dynamics in the context of the Fourth Industrial Revolution.

The study's findings will provide insights into how modern technologies and changing tenant needs are shaping the office real estate market, as well as how Krakow is coping with the challenges and opportunities associated with Industry 4.0.

LITERATURE REVIEW

The scientific literature describing the impact of the Fourth Industrial Revolution (also known as Revolution 4.0 and Industry 4.0 (Schwab, 2018) on the office real estate market is limited, but a few valuable studies in this area can be highlighted. Furmanek (2018) explains the main ideas of the Fourth Industrial Revolution, defining it as a general concept based on ubiquitous digitisation, information technologies (noticeable in every aspect of life), virtual simulations in decision-making processes, reliance on real-time data processing, the Internet of Things, and the widespread dissemination of new manufacturing technologies.

Bartkowiak, Górską, Koszel, Mazurczak, Strączkowski, and Kinelski (2023) describe new technologies in the real estate market, with particular emphasis on proptech (property technology). This term encompasses processes, products, and business ideas utilising the latest resources in information and communication technologies. They also identify the main goal of proptech: increasing efficiency and optimising construction technology, development activities, the investment process, and property management. Their research confirms that modern technologies play an important role in the choice of premises for most future tenants.

In the book by Belniak, Głuszak, and Zięba (2013), information can be found about popular certification systems for green (mainly office) buildings and the benefits of investing in sustainable real estate. However, the research also highlights current barriers of green constructions in Poland: a lack of adequate awareness and conviction among users regarding its advantages, financing issues and a superficial understanding of the concept of sustainable development.

One of the most well-known certification systems, LEED, is also described in an article by Głuszak, Małkowska and Marona (2021). Their research indicates that decision-making factors regarding green certifications depend on location, policies, environmental regulations, and socioeconomic conditions. They also vary over time. The adoption level of certifications is correlated with the overall level of innovation in the economy.

Research by C. W. Starr, J. Saginor and E. Worzala (2021) shows Industry 4.0's impact on real estate. It includes smart building solutions such as minimising energy costs, measuring air quality and building capacity regarding spacing. The goal of smart buildings is to implement sustainable technologies

and improving users experience. During the COVID-19 pandemic, Industry 4.0 findings especially helped to create healthy workplaces. Authors particularly mention the Building Information Modelling (BIM) concept. It provides a digital representation of both functional and physical characteristics of the property. Also financial aspects of buildings and the real estate sector employees' daily tasks are widely influenced by Industry 4.0.

Z. Tan and N. G. Miller (2023) provided insights on sustainability-focused proptech startups in the article. After interviewing several commercial office buildings, it turned out that all of them were using tools like customised platform systems for asset management and operation. Real estate owners highlight that digitalisation plays a significant role in their sustainability initiative on net-zero operation, energy efficiency and healthy building attributes. The consolidation of the proptech industry through the standardisation and acquisition of startups by established firms will address integration challenges for these companies.

Another article written by P. Ross and K. Maynard (2021) highlights the role of the Fourth Industrial Revolution in creating modern workplaces. The advent of autonomous, intelligent, and sentient urban infrastructure will propel the next industrial revolution beyond 'smart buildings' and 'smart cities'. Although this period presents its fair share of challenges, it also offers a chance and an obligation to shape our desired lifestyles and work environments within our cities. Additionally, it enables us to bring global communities together and foster the development of sustainable economies.

R. Oosthuizen (2022) indicates that the risk of the Fourth Industrial Revolution is the cause of replacing a third of the jobs that exist today. It will also influence how the commercial real estate operates and may reduce its actual users and demand. The STARA (smart technology, artificial intelligence, robotics, and algorithms) concept will be the reason for eliminating occupations. Robotic dexterity and intelligence continue to advance, and the innovation of affordable autonomous units progresses; there is the potential for these machines to outperform humans in a multitude of work settings and dynamic activities.

Many researchers note a growing role of smart buildings in their environment, and already a relatively large and still growing number of so-called smart technologies are present in the real estate sector. The technologies can be grouped into the following nine categories: drones, UAVs, the internet of things (IoT), clouds, software as a service, big data, 3D scanning, wearable

technologies, virtual and augmented realities (VR and AR), and artificial intelligence (AI) and robotics (Ullah, Sepasgozar and Wang, 2018).

Rymarzak and Madera (2020) analysed the Tri-City office space market in sustainable buildings in terms of supply and demand. In recent years, there has been a noticeable trend in constructing office buildings according to sustainable construction standards. Ecological certification requires meeting numerous criteria, including indoor environmental quality, energy efficiency, and transport accessibility. Proper water and waste management, as well as the use of natural building materials, are also important. Meeting these requirements confirms the building's ecological character and its compliance with sustainable development principles.

Janicka (2014) discusses the development of the green office building market in Poland. She presents the main ecological certification systems for buildings, such as BREEAM and LEED, and their growing popularity among developers and investors. The benefits of constructing sustainable office buildings include lower operating costs, higher rents and sale prices, and better working conditions for employees. At the same time, she points out challenges such as higher construction and certification costs. Although green buildings currently constitute a small part of the Polish office market, their share is growing rapidly, mainly due to foreign tenants and investors. The author predicts that in the future, ecological certification may replace the traditional classification of office buildings.

Strumiłło (2023) analyses the importance of sustainable work environments in modern office buildings as an element of ecological urban development. The study covers aspects ranging from building construction to interior design. The author emphasises the need to adapt spaces to the changing requirements of employees, especially after the experiences of remote work during the COVID-19 pandemic. The author indicates that well-designed, sustainable offices can improve work quality, increase productivity, and positively impact employees' health and well-being, making them a key element in urban planning. Furthermore, the author draws attention to the growing role of areas conducive to human interactions and collaboration in office spaces. Investments in sustainable work environments can bring long-term benefits for both employers and employees, while also contributing to the overall improvement of quality of life in cities.

Considering the cited research, it is important to emphasise the significant impact of the Fourth Industrial Revolution on the office real estate

market and the ongoing adaptation process. New technologies and the concept of sustainable development impose specific actions on all participants in the real estate market. The fourth industrial revolution and sustainable development are closely linked in real estate. Advanced technologies like Internet of Things, Artificial Intelligence, and big data enable efficient resource management in buildings, contributing to sustainability goals. These technologies optimise indoor conditions, reduce energy consumption, and facilitate data-driven decision-making in property management. Consequently, the fourth industrial revolution is transforming real estate practices while supporting sustainable development objectives.

RESEARCH METHODOLOGY

To carry out the research process, in-depth interviews with 2 respondents were conducted. Each interview lasted approximately 1.5 hours, providing ample time for a comprehensive exploration of the research topic. The interviews took place in June 2023, specifically in Kraków, Poland. A total of 11 questions were utilised to guide the interviews and gather valuable insights from the participants. 4 of them were related to Industry 4.0. The interview respondents included the head of one of the leading commercial real estate office agencies and the leasing director of one of the biggest due to the space office complexes in Kraków. The scope of the study involves gathering information from the respondents regarding the current situation of the office real estate market in Kraków, as well as their opinions and forecasts. The primary objective of the research was to identify the impact of the Fourth Industrial Revolution and the changes it has brought about in the office real estate market.

The selection of respondents was based on their professional positions and the nature of their work. The first respondent is responsible for selecting suitable office spaces for specific clients, while the second is in charge of the commercialisation of a particular property. This allowed obtaining a broader perspective on the current situation of the office real estate market. To achieve the research objective, the following questions were posed to the respondents :

Q1: How does the Fourth Industrial Revolution and proptech influence (or will influence) the real estate market?

Q2: How have tenant expectations regarding office space, its usage and amenities changed?

Q3: Has the aspect of sustainable buildings, ESG, and green certifications become particularly important in recent years?

Q4: What does the future hold for the office market in Krakow?

RESULTS & DISCUSSION

Respondents agreed that the Fourth Industrial Revolution has had a significant impact on the office real estate market. They acknowledged that this impact is not only noticeable but also brings numerous benefits for all market participants. In particular, they highlighted the importance of integrating various systems with building applications, which have been made possible due to advanced technology. These integrated applications have revolutionised building and office space management, leading to notable optimisation benefits. The integration of smart technologies goes beyond basic building management. Internet of Things (IoT) devices and AI-powered analytics are being deployed to gather and analyse data on space utilisation, energy consumption, and occupant behaviour. This data-driven approach allows for predictive maintenance, optimised resource allocation, and improved decision-making for both building managers and tenants. However, the increased reliance on interconnected systems also raises cybersecurity concerns, necessitating robust security measures to protect sensitive data and building operations.

One of the key advantages is the ability to reserve workstations or parking spaces, streamlining the process and ensuring that employees have access to the necessary resources when they need them. Additionally, these applications provide real-time information about events within the office complex or building, allowing for improved communication and coordination among users. Moreover, they also play a crucial role in registering employee attendance, offering insights into office utilisation and productivity, especially in an era where remote work is prevalent.

Among the revolutionary proptech solutions, the respondents identified the Building Management System (BMS). The BMS aids in resource control and savings by preventing failures or identifying instances of excessive electricity consumption in specific workstations or other office areas. This level of advanced monitoring and optimisation not only promotes greater efficiency but also contributes to cost reduction and sustainability efforts, aligning with the rising popularity of eco-friendly solutions in the industry.

The rise of remote and hybrid work models, accelerated by recent global events, has further complicated the office real estate landscape. Technologies enabling hot desking and activity-based working are becoming increasingly prevalent. These systems not only facilitate flexible work arrangements but also provide valuable data on space utilisation. Moreover, office designs are evolving to support seamless collaboration between on-site and remote workers, incorporating advanced audiovisual equipment and virtual meeting spaces.

Looking ahead, the respondents anticipate that the impact of the Fourth Industrial Revolution will become even more pronounced. They predict an increasing demand for control over individual building elements, such as lighting, HVAC systems, and security, as tenants prioritise customisation and personalisation of their office spaces. Moreover, the respondents highlighted the growing expectations for eco-friendly features and sustainability initiatives, as tenants place greater emphasis on environmentally responsible practices.

The respondents have similar observations regarding new tenant expectations for office space. Respondent I, a broker in the office real estate market, noted the trend of *"flight to quality, flight to centre."* *"When tenants decide to rent office space, they expect the highest quality in the best location (city centre)."* This is closely linked to the application of modern building technologies. Respondent II, responsible for the commercialisation of a large office complex, believes that *"Today's office and its design should positively impact employees' well-being. Currently, many new functions and spaces are emerging that differ from the typical office. The coworking function of the office is very important today, where employees should integrate and spend time pleasantly rather than just working at their desks."* In this case as well, it can be stated that modern technologies and continuous optimisation of space according to prevailing trends are currently very important aspects in choosing a workplace.

The growing significance of sustainable buildings, environmental, social, and governance (ESG) principles and green certifications in the real estate industry is widely visible (as mentioned in Tomasik & Marona, 2024). Participants in the office real estate market are becoming increasingly aware of the importance of these factors. Green certifications, such as BREEAM or LEED, have become the benchmark that tenants expect and that investors and developers must adhere to.

The push for sustainability extends beyond certifications. Modern office buildings are incorporating features such as solar panels, green roofs, and advanced waste management systems. From a financial perspective, while these

green initiatives often require higher upfront investments, they can lead to significant long-term cost savings and increased property values. Additionally, many governments are implementing regulations and offering incentives to promote sustainable building practices, further driving the adoption of eco-friendly solutions in the office real estate sector.

One of the core priorities within the context of sustainable buildings is energy consumption. The focus is on reducing energy requirements through efficient design and technology integration. The aim is to create buildings that minimise energy consumption and promote a more sustainable future. Additionally, there is a growing emphasis on zero-emission buildings, which entails the adoption of renewable energy sources and the elimination of carbon emissions.

Another critical consideration is the carbon footprint of the construction sector. The construction industry has a substantial environmental impact, mainly due to the energy-intensive nature of building activities. As a result, reducing the carbon footprint of the construction sector has become a key objective for stakeholders. This involves implementing construction practices that minimise greenhouse gas emissions, optimising materials and waste management, and integrating sustainable design principles from the outset.

These findings regarding the importance of sustainable buildings and green certifications align with previous research in the field. Previously mentioned literature review (Głuszak, Małkowska and Marona 2021 and Janicka 2014) consistently emphasises the significance of certifications in demonstrating environmental commitment, as well as their positive effects on the values and market appeal of properties. Furthermore, the integration of ESG principles and the adoption of sustainable practices are increasingly seen as a competitive advantage, attracting both tenants and investors who prioritise environmental responsibility.

The future of the office real estate market is closely tied to the Fourth Industrial Revolution and its solutions. Respondent I believes that *"modern buildings that meet the current standards of green buildings and have green certifications, as well as being at least aligned with the concept of zero emissions, will have a viable existence. We will also observe a significant focus on the relocation of companies that entered Krakow between 2005 and 2010. These properties have aged somewhat and no longer meet the standards and expectations of today's employees."* Respondent II agrees on this matter, stating, *"The next few*

years will be a huge challenge for the office market in terms of attracting clients, defining the functions of offices, and revitalising existing projects."

In conclusion, the Fourth Industrial Revolution is profoundly reshaping the office real estate market. The integration of advanced technologies, the emphasis on sustainability, and the shifting expectations of tenants are creating both opportunities and challenges for stakeholders. As the industry continues to evolve, adaptability and innovation will be key to success. The future of office real estate lies in creating flexible, sustainable, and technologically advanced spaces that can meet the diverse and changing needs of businesses and their employees.

CONCLUSIONS

The research findings and literature review provide solid evidence of the impact of the Fourth Industrial Revolution on the office real estate market. Moreover, the integration of the latest technologies in buildings significantly enhances their likelihood of achieving swift commercialisation. Tenant expectations have also evolved in this regard, especially in the era of remote work, where offices featuring optimised and eco-friendly solutions are particularly attractive to employees. As the influence of the Fourth Industrial Revolution in this sector continues to grow, it becomes imperative to adapt planned office projects and revitalise existing ones.

In this context, green certifications for office projects play a crucial role in attracting future tenants. Such certifications serve as decisive factors in their selection, emphasising the increasing importance placed on sustainability and environmental responsibility. However, it is important to note that this research topic requires further exploration from both theoretical and practical perspectives. Multiple facets exist through which the impact of the Fourth Industrial Revolution on the office real estate market can be analysed, and broader investigations are needed to comprehend the phenomenon comprehensively. Although the study focuses primarily on Kraków, Poland, it is worth acknowledging that the situation may vary across different locations. Therefore, it is essential to recognise the limitations of such research, including the availability of credible sources and the varying levels of knowledge and information asymmetry prevalent in the market. Engaging with other participants in the office real estate market from diverse areas and gathering their opinions can provide valuable insights. These opinions, often shaped by

individual experiences, can guide future research directions and contribute to a more comprehensive understanding of the subject matter.

It is worth considering that predictions for the office real estate market may not always align perfectly with actual outcomes. Therefore, analysing the discrepancies between projected outcomes and real-world results from specific years can offer a valuable perspective for advancing this research. By exploring these discrepancies, researchers can gain a deeper understanding of the factors that influence market dynamics and improve the accuracy of future forecasts.

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