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CONSUMER DIMENSION OF SMART HOME IN THE PERSPECTIVE OF SOCIETY 5.0 DEVELOPMENT

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Purpose: The aim of the article was to determine how intelligent solutions in the field of smart home are perceived by the consumers and to identify smart home systems considered to be the most valuable consumer solutions, for the user convenience and safety.
Design/methodology/approach: In order to achieve the aim of the article, a study was conducted on a sample of 741 respondents. The CAWI technique was used in this research and the measurement tool was electronic questionnaire.
Findings: In the light of the obtained results, very positive attitudes of consumers towards smart home solutions were revealed. The highest rated systems were multifunctional sensors, monitoring systems and heating or air conditioning control systems. The vast majority of the respondents confirmed their knowledge of smart home solutions, but not more than one in three respondents admitted to owning such systems. The perception of smart home solutions correlates negatively with the age of consumers and positively with the financial situation and place of residence, while the possession level correlates positively with the consumers' financial situation.
Research limitations/implications: A limitation of the study is the non-random sample, which makes it impossible to relate the results to the general population. Furthermore, the conducted study was carried out in accordance with the descriptive function of scientific research. Such a nature of the study enables the description and recording of the occurrence of a specific phenomenon. It is therefore worth undertaking in the future further research of an explanatory nature, the results of which would make it possible to draw conclusions about cause-and-effect relationships in the perception of smart home systems, taking into account the variables mediating and moderating the studied relationships.
Practical implications: The way of perceiving smart home systems correlates positively both with the degree of customers' knowledge and the state of ownership, and the correlation strength in both cases is at a comparable level. Therefore, the perception of smart home systems does not necessarily result from having personal experience with their use, but also can only be based on the customers' acquaintance. It can therefore be concluded that marketing communication strategies aimed at increasing the awareness of smart home systems will allow to gain recognition of their usefulness and, as a result, will be effective in increasing the smart home market.

Originality/value: The undertaken research attempts to fill the gap in determining the consumer's optics regarding the predilection of smart home systems. The user's perspective allows us to understand the cognitive component of buyers' attitudes towards smart homes, taking into account the local dimension of the study (opinions of Polish consumers).

Keywords: smart home, intelligent buildings, society 5.0.

Category of the paper: Research paper.

1. Introduction

The smart home is a human-centric intelligent living environment created by the convergence of IT to the residential environment. The smart home service is becoming an attractive market with high growth potential. Connectivity in the home already existed 10 years ago, but at a basic level and in the form of home automation. Thanks to the integration of smart devices with high-speed wired and wireless Internet, big data and cloud computing, it is now growing into a giant industry (Kim et al., 2017). To facilitate the implementation and adoption of smart home technology, it is important to explore the user perspective and current state of smart homes (Marikyan et al., 2019). Given the rapid pace of development in this field, there is a strong need to keep an eye on this industry. Against this background, the purpose of the article was formulated, which was to determine how intelligent solutions in the field of smart home are perceived by consumers. The goal implementation was based on both secondary and primary sources in the form of an empirical study conducted using the survey method on a sample of 741 units. The undertaken research were to fill the gap in the scope of determining the consumers' optics regarding the predilection of smart home systems, and in the long-term perspective - opportunities for the widespread commercialization of this technology.

As part of the implementation of the main goal, specific objectives were also taken into account, including determining which smart home systems are perceived as the most valuable, serving the user's comfort and safety, as well as identifying the degree of smart home solutions popularization. Taking into account the local dimension of the study (the opinion of Polish consumers) may also fill the research gap related to the differences in the smart home perception by consumers representing different countries (Balta-Ozkan et al., 2014; Straub et al., 1997).

The article is organized as follows: first an introduction is presented, then (in the second part) a systematic review of the literature on the smart home is made, establishing the theoretical basis of the research, presenting and discussing smart home solutions in the perspective of consumer utility and the specificity of society 5.0. These considerations formed the basis for the research questions development. The third section presents the proposed research methodology (context, sample and applied measures). The fourth section presents the results, followed by a discussion in the fifth section. The last section concludes by discussing research implications and limitations as well as future research directions.

2. Literature review

2.1. Systematic literature review on smart home

In order to identify the current state of knowledge and evaluate the existing literature, as well as to indicate further research directions, a systematic literature review was carried out, taking into account Scopus database. The analysis made it possible to identify over 9,800 full-text and peer-reviewed publications (the phrase "smart home" in the title, abstract, keywords, repeated publications were removed). At this stage the database wasn't limited only to social sciences, but also included publications in the field of engineering and technical sciences, medicine, humanities, as well as environmental sciences.

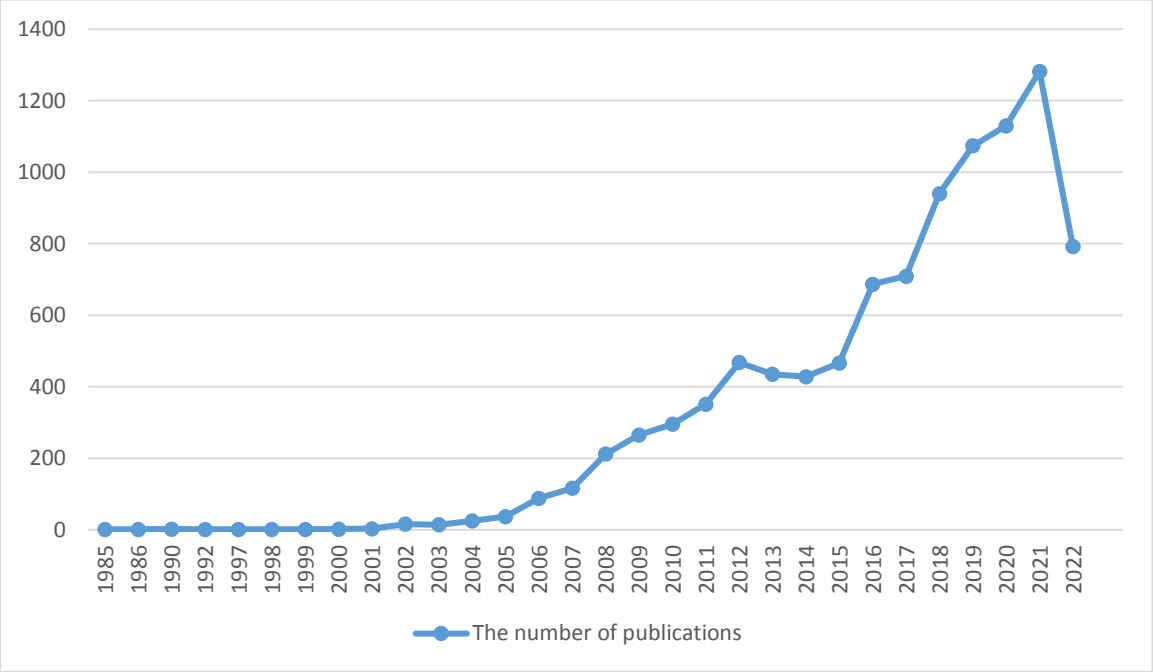

Figure 1. The number of publications on smart home from particular years.

Source: own elaboration based on Scopus database resources.

As part of the systematic literature review methodology, a number of publications from individual years were analyzed (figure 1). This made it possible to conclude that the issue of technology related to the smart home area is popular among researchers, and a rapid increase in interest has been observed especially since 2012 (data for 2022 should be considered incomplete as of the date of preparation of this publication, i.e. 14/09/2022). This seems fully justified due to the dynamic development of digital technologies observed in this period and the increasing possibilities of market implementation of solutions based on artificial intelligence. Taking into account, on the one hand, the indicated intensity of the observed changes and, on the other hand, the dynamics of the number of publications, further analyzes focused on the period of the last 10 years.

In the analyzed period, the list of disciplines that most often refer to the issues of smart home is wide. Most publications in this field are related to Computer Science (37.1%), Engineering (24.0%), Mathematics (8.6%), Energy (4.9%), Physics and Astronomy (4.4%). Decision Sciences (4.1%) and Social Sciences (3.4%).

The obtained publication database was analyzed using bibliometric techniques. An analysis of keyword frequency and research problems was carried out. Selected keywords related to smart home were subjected to quantitative analysis. The visualization of their frequency (keyword frequency analysis) was presented in the form of a "word cloud", where the frequency of occurrence was reflected in the size and thickness of the font (Figure 2).

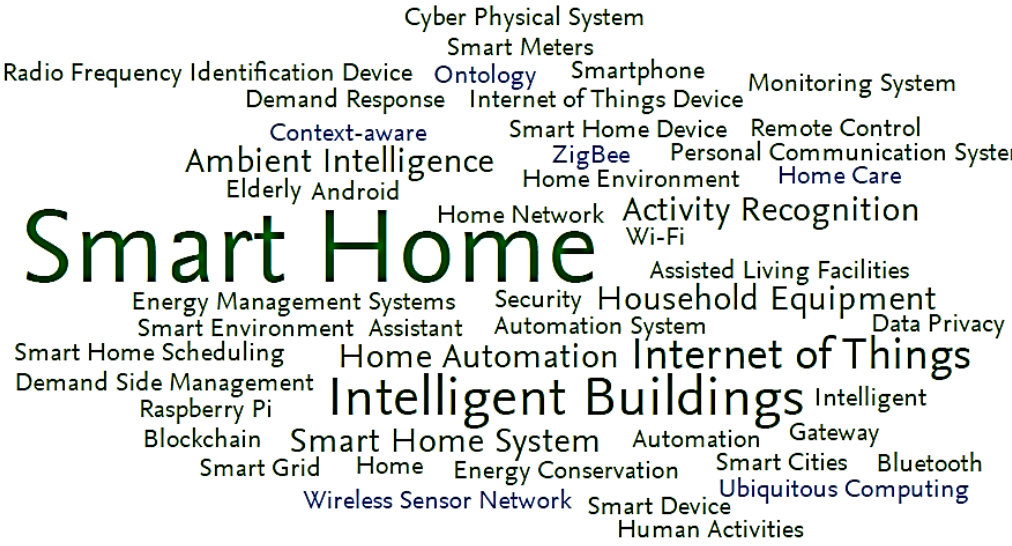

Figure 2. Keyword frequency analysis for smart home (2012-2021).

Source: own elaboration based on Scopus database resources.

The most frequently appearing keywords are *smart home* (the increase in the number of publications in the analyzed period by 180.2%), *intelligent buildings* (increase by 31.6%), *Internet of Things* (increase by 3,005.0%), *ambient intelligence* (increase by 854.5%), *household equipment* (increase by 215.4%), *home automation* (increase by 140.0%), *activity recognition* (increase by 91.7%).

Despite the fact that the issue of the smart home arouses interest of researchers all over the world, the analysis of the number of publications, taking into account individual countries, showed that the most active in this area are China, the United States, India, Great Britain and South Korea (figure 3). This does not seem to be surprising, considering the current position and strategy of these countries in the development of digital technologies and building their economic position in the world on this basis.

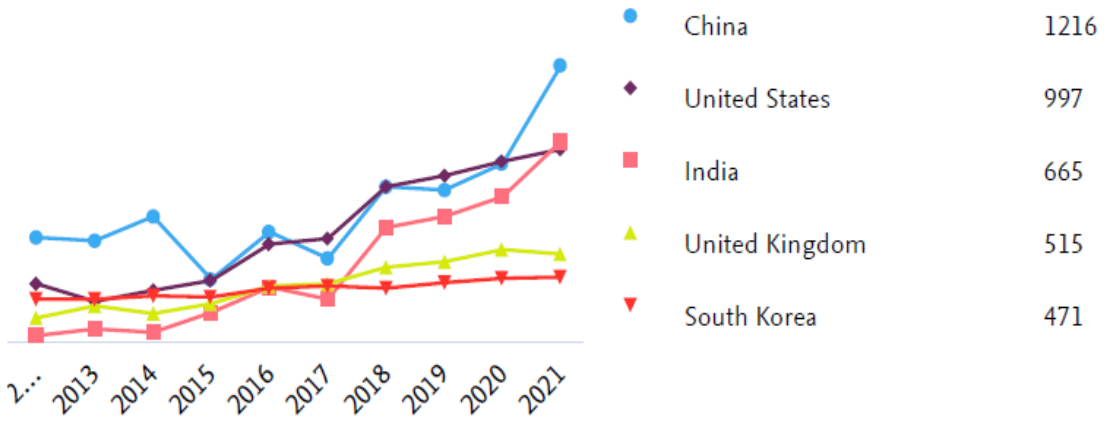

Figure 3. The most active countries in terms of the number of publications for the phrase smart home (2012-2021).

Source: own elaboration based on Scopus database resources.

The presence of the indicated countries at the forefront, those who actively research and shape the framework for a better understanding of the essence and application dimension of smart home technology, is also reflected in the publications of individual research centers. Among the five most active universities, according to the number of publications on smart home issues in the analyzed period, there were primarily American (*Washington State University Pullman*), Chinese (*Xidian University*, *Chinese Academy of Sciences*), British (*Ulster University*), Korean (*Electronics and Telecommunications Research Institute*), and Indian universities (*Vellore Institute of Technology*, *Anna University*).

Subsequently, the conducted analysis was limited to the areas related to the category Business, Management and Accounting, which is the area of consideration of this publication. This allowed the identification of key research perspectives and the identification of those areas of smart home issues that require further research.

The total number of publications in the field of smart home technologies in the Business, Management and Accounting category in the analyzed period amounted to 217 (figure 4). At the same time, in the area of Business, Management and Accounting, the Field-Weighted Citation Impact was at the level of 1.81, which means that publications in this field are cited slightly more often compared to the global average for similar publications in all disciplines combined (1.59).

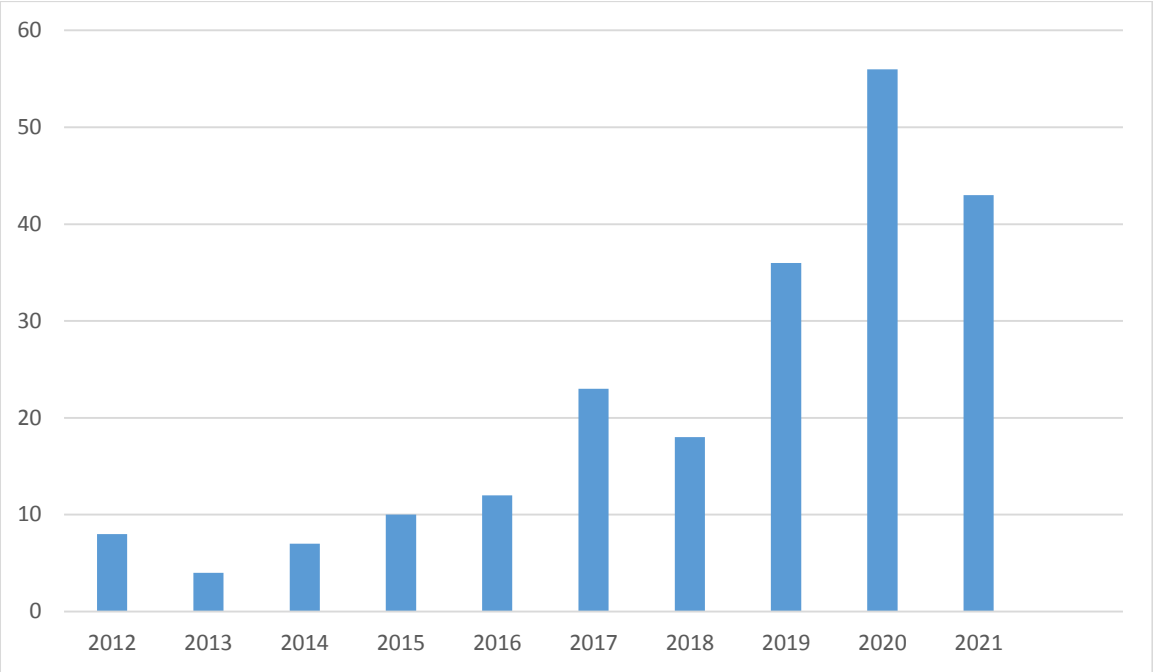

Figure 4. The number of publications in the Business, Management and Accounting category from particular years.

Source: own elaboration based on Scopus database resources.

The analysis of the keywords frequency related to the topic of smart home in the Business, Management and Accounting category and the results of quantitative analysis (presented in the form of a "word cloud" - Figure 5) showed that the most popular words includes keywords previously indicated also in other disciplines, but in the analyzed area, the increases in the number of publications are definitely more pronounced in the case of the following phrases: *smart home* (increase by 566.7%), *intelligent buildings* (350.0%), *home automation* (500.0%), *household equipment* (566.7%). In the case of the *Internet of Things* the increase in the number of publications in the analyzed period was 2,700.0%, and in the case of *smart home system* and *ambient intelligence* 400.0%. The analysis of other keywords showed that the number of publications concerning the words: *home care* and *energy conservation* remained constant, but in case of *energy management systems* there was a significant decrease in the number of publications (a decrease of 50%).

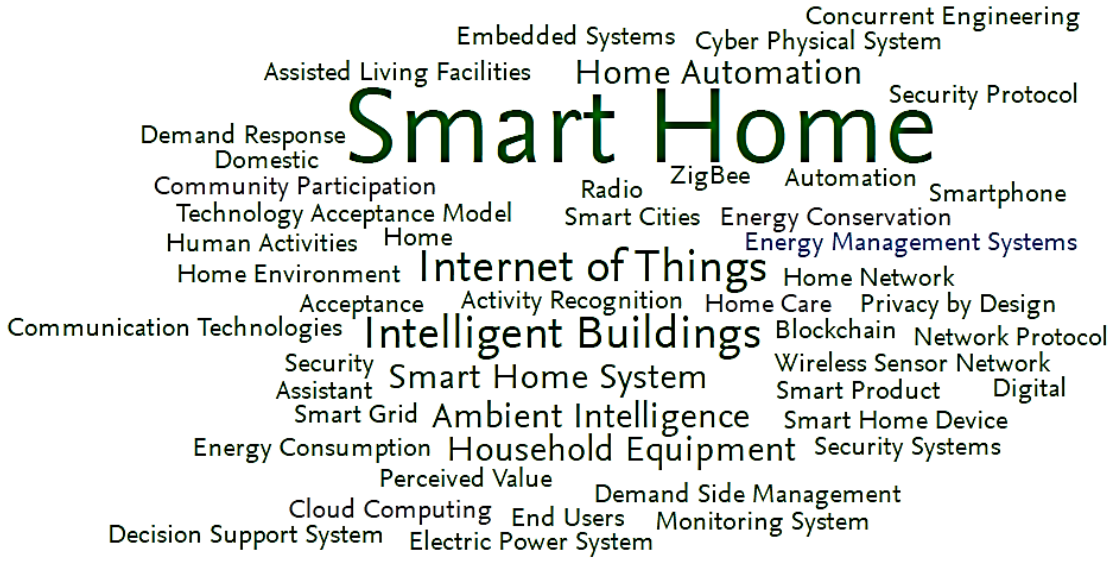

Figure 5. Keyword frequency analysis for smart home for the category Business, Management and Accounting (2012-2021).

Source: own elaboration based on Scopus database resources.

The results of the analysis of the number of smart home publications in the Business, Management and Accounting category, taking into account individual countries, showed that the most active in this area are India, China, the United States, Germany, Great Britain and South Korea. Research of this kind are an important interest area of among others *Nanjing Institute of Technology* oraz *Tsinghua University, Korea Advanced Institute of Science and Technology, Sungkyunkwan University, Anna University, Westfälische Wilhelms-Universität Münster*, *Technische Universität Berlin, University of South Florida* and *University of Nottingham*.

In accordance with the methodology of systematic literature review, in the next step, an analysis of citations was carried out, which made it possible to identify publications requiring further exploration (Table 1).

Table 1.
The most frequently cited publications dealing with the issues of smart home for the category Business, Management and Accounting

Authors	Title	Year	Source title	Citation Count
Risteska Stojkoska B.L., Trivodaliev K.V.	A review of Internet of Things for smart home: Challenges and solutions	2017	Journal of Cleaner Production	735
Marikyan D., Papagiannidis S., Alamanos E.	A systematic review of the smart home literature: A user perspective	2019	Technological Forecasting and Social Change	225
Paetz A.-G., Dütschke E., Fichtner W.	Smart Homes as a Means to Sustainable Energy Consumption: A Study of Consumer Perceptions	2012	Journal of Consumer Policy	182
Yang H., Lee H., Zo H.	User acceptance of smart home services: An extension of the theory of planned behavior	2017	Industrial Management and Data Systems	147

Cont. table 1.

Kim Y., Park Y., Choi J.	A study on the adoption of IoT smart home service: using Value-based Adoption Model	2017	Total Quality Management and Business Excellence	114
Shin J., Park Y., Lee D.	Who will be smart home users? An analysis of adoption and diffusion of smart homes	2018	Technological Forecasting and Social Change	105
Mocrii D., Chen Y., Musilek P.	IoT-based smart homes: A review of system architecture, software, communications, privacy and security	2018	Internet of Things (Netherlands)	103
Alaiad A., Zhou L.	Patients' adoption of WSN-Based smart home healthcare systems: An integrated model of facilitators and barriers	2017	IEEE Transactions on Professional Communication	82
Ehrenhard M., Kijl B., Nieuwenhuis L.	Market adoption barriers of multi-stakeholder technology: Smart homes for the aging population	2014	Technological Forecasting and Social Change	72
Balta-Ozkan N., Amerighi O., Boteler B.	A comparison of consumer perceptions towards smart homes in the UK, Germany and Italy: reflections for policy and future research	2014	Technology Analysis and Strategic Management	68
Shuhaiber A., Mashal I.	Understanding users' acceptance of smart homes	2019	Technology in Society	64
Hubert M., Blut M., Brock C., Zhang R.W., Koch V., Riedl R.	The influence of acceptance and adoption drivers on smart home usage	2019	European Journal of Marketing	59

Source: own elaboration based on Scopus database resources.

Among the most frequently cited publications for the smart home phrase in the Business, Management and Accounting category, there were largely publications dealing with the use of smart technology and IoT-based solutions in the field of smart home, especially in the areas of effectiveness and efficiency of system architecture, software, communication and smart home application. They pay particular attention to the aspects of automation, interoperability and mobility of the proposed solutions.

The conducted analysis showed that among the most frequently appearing issues related to the smart home technology, particularly two threads of consideration stand out - the first related to the broadly understood concept of sustainable consumption, and the second embedded in the context of the aging of the society. According to the first trend, smart homes are perceived as a way to sustainably use energy. The growing literature on the subject focuses on services related to energy consumption and management of solutions offered by smart homes perceived by the market's demand side representatives. The second trend focuses on showing the possibilities of a smart home in providing a much wider range of services related to supporting life, health and safety. These considerations focus in particular on the issue of implementing healthcare systems as part of solutions offered by smart homes, in response to the growing

needs of an aging population. These topics were intensively undertaken by researchers, which allowed to achieve a high level of recognition of these research areas.

The raised issues also relate to the users understanding and acceptance of smart homes. This is reflected in the searching for a multi-faceted approach to the factors conditioning the smart home technology acceptance by users and determining the adoption and diffusion of smart home solutions. The analysis of the collected material clearly shows that research on issues related to the IoT technologies implementation in the smart home area is up-to-date. At the same time, research on the level of their social acceptance is still insufficient in the context of constantly enriching smart home devices with new functionalities resulting from the AI implementation, which justifies the need for further research in this area.

2.2. Smart home solutions in the context of consumer usability

A smart home is a place of residence equipped with a communication network, connecting sensors and home devices that can be remotely monitored, accessed or controlled, and which provides services that meet the inhabitants' needs (Chan et al., 2009; Reinisch et al., 2011). The smart home is built by solutions that use an IoT-based set-top box to monitor, control and manage a smart grid that connects all electronic devices that can be used in a home, such as a boiler, air conditioners, electric lights, sewage, heating devices, door lock, surveillance camera and other (Kim et al., 2017).

In smart home systems, the home network is the basis, in which all electronic devices used at home are connected through a wired or wireless two-way communication system (King, 2003). Integration and communication of various systems via the smart home network is enabled by sensors, i.e. devices used to detect the location of people and objects or to collect data on states (e.g. temperature, energy consumption, open windows). The smart home network therefore consists of two elements - a "physical connection" and a "communication protocol". The physical element is responsible for connecting components within individual systems - most often a wired connection or a radio signal. Whereas, a "communication protocol" is a common language through which different components can communicate with each other and exchange information (Balta-Ozkan et al., 2014). In turn, Diegel et al. (2005) described the smart home system by indicating four integrated and cooperating intelligence levels, which create a living environment at the smart home: smart devices, smart controls, smart management and smart sensors. The existence of this home area network connecting and coordinating various technological components and information is what distinguishes a smart home. It is thanks to the connected network of devices and sensors that a smart home differs from a house that is only equipped with standalone highly advanced technological features, such as smart devices (Scott, 2007).

Smart home offers the opportunity to improve the quality of life of household members by offering new services (e.g. health monitoring) or more effective control and management of existing services (e.g. remote activation and deactivation of security systems). Smart homes

should enable consumers to control and reduce their energy consumption more effectively, while increasing the comfort and convenience of various domestic activities, from space heating (by automatically adjusting thermostat settings to actual weather temperatures) to water heating (by detecting household behavior patterns and providing hot water about the required temperature in the right amount at the right time) and safety (e.g. through sensors detecting open windows in an uninhabited apartment and alerting the householder) (Balta-Ozkan et al., 2014).

The energy trilemma problem, encompassing concerns about energy security, the threat of climate change and the uncertainty of energy prices, has resulted in a rapid growth of interest in smart systems, with the growing literature on smart meters and demand-side schemes focusing on energy consumption services that offer smart homes (Balta-Ozkan et al., 2014). Efficient management of energy consumption and promotion of sustainability is possible through the integration of technological functions such as smart heating and smart meters (Scott, 2007). A smart home can offer various systems in this respect, such as detailed control of smart devices (heaters, air conditioners and other devices), the ability to remotely manage electrical devices, reporting data on energy consumption and related costs, and communication between any local microgenerators (e.g. solar panels on the roof) (Balta-Ozkan et al., 2014). As a result, smart meters placed between the household and the grid enhance utility and energy control, although their benefits are often unclear to homeowners (Pepermans, 2014).

2.3. Society 5.0 as consumers of smart home systems

The concept of the "smart home" as today's new living space, where various household support systems are interconnected and converged using ICT (information and communication technology) (Kim et al., 2017), meets the expectations of consumers representing society 5.0. Society 5.0 is otherwise an information society, ultra-intelligent, where everyone can lead a high-quality, comfortable life thanks to the combination of physical and cyberspace through the fully usage of the information and communication technologies (Mourtzis et al., 2022). Society 5.0 is an information society, constituted by universal access to ICT and the Internet, the ability to use them, developed and widespread IT knowledge and a positive assessment of these manifestations in society at the full user level (Nath, 2017). In such circumstances, positive relations between people and technology will ensure sustainable development in all social aspects (e.g. education, health, democracy, economy) (Ferreira, Serpa, 2018).

Thanks to the high degree of combining cyberspace with physical space society 5.0 is able to balance economic progress and social well-being, by providing goods and services that address various hidden needs (Deguchi et al., 2020), including consumer needs. Society 5.0 balances the best interests of society as a whole, which includes solving social problems, with the best interests of individuals, which proves human focus (Matsuoka, Hirai, 2020). What distinguishes the 5.0 society is therefore the fact that instead of realizing the desired utilities through separate systems operating in a limited scope (such as maintaining comfort in

a room or optimal energy supply), this society will have systems that will work for the entire community in an integrated way. To ensure the happiness of all society members, comfort will be implemented in all aspects of life, including energy, transport, medical care, shopping, education, work and leisure. The basis for achieving this goal will be systems that collect diverse and extensive data from the real world in iterative cycles. These data will then be analyzed and processed by advanced IT systems, such as artificial intelligence, and the obtained information will be used in the real world, making the society members lives more happy and comfortable (Deguchi et al., 2020).

The smart home concept fits perfectly into this philosophy, carrying a number of utilitarian values for the users. Smart houses save time, which is a scarce commodity of the modern consumer, save money and energy, and in a more holistic approach help to increase the energy efficiency of the local community, bringing quantifiable results that translate into the well-being of the entire society, in which the self-interest of each of its members and the public interest are in balance.

3. Research Methodology

3.1. Research methods and sample characteristics

On the basis of the literature review conclusions and in the context of achieving the assumed article objective, a quantitative descriptive study was conducted. The CAWI (Computer Assisted Web Interview) technique was used in this research and the measurement tool was electronic questionnaire. The main advantage of the CAWI survey is to provide the respondents with the preferred pace to complete the questionnaire in their natural environment. In the case of the online survey, there is no direct contact with the interviewer so the respondents are more likely to feel more comfortable in providing answers. The data was collected from April to June 2022. The judgemental sampling method (Kaczmarczyk, 2011) was used. Assuming that representatives of society 5.0 are open to new technological solutions and prone to use them, the research was focused on people who regularly use the Internet (at least once a day). In addition, the research was focused on representatives of the younger generations, who have developed technical skills and everyday digital habits, i.e. using the Internet and mobile devices, than older generations, who show significant differences in the virtualization of individual aspects of their lives compared to the latter (Bennett et al., 2008). To ensure an optimal response rate, the respondents were guaranteed total anonymity. The study was conducted on a total of 741 respondents. The starting point for determining the non-random sample size was the range method, according to which the minimum sample for general marketing research is 500 people (Kaczmarczyk, 2011).

Based on the literature studies, a number of research questions were formulated:

- RQ1: How are smart home systems perceived in terms of their value to consumers?
- RQ2: Which of the smart home systems are perceived as the most valuable, i.e. consumer solutions serving the user's convenience and safety?
- RQ3: What is the smart home systems familiarity degree among the respondents?
- RQ4: What is the smart home systems dissemination degree among respondents?
- RQ5: Is there a relationship between consumers' perception of smart home systems and their ownership?
- RQ6: Is there a relationship between consumers' perception of smart home systems and their familiarity (awareness and knowledge about them)?
- RQ7: Is there a relationship between consumers' perception of smart home systems and their characteristics, i.e. age, education, place of residence and household's financial situation?

Of those who participated in the study, 63.8% were women and 36.2% were men. The average age of the respondents was M=31.14. 20.6% of the respondents declared a very good household financial situation, 44.3% - good household financial situation, 26.3% - an average household financial situation, 5.7% - bad household financial situation and 3.1% - a very bad household financial situation. Residents of big cities (with more than 500,000 inhabitants) accounted for 33.5%, inhabitants of cities from 200,000 to 500,000 accounted for 13.0%, inhabitants of cities from 50,000 to 200,000 accounted for 18.5%, inhabitants of cities up to 50 000 accounted for 14.4%, and 20.6% were respondents living in rural areas. Furthermore, respondents were people with a master’s degree (34.7%), while 35.90% had a bachelor-level education, 22.3% had a secondary-school education, 3.8% basic and 3.4% primary-school education.

3.2. Measures

The questions in the questionnaire concerned the perception of selected smart home systems (i.e. lighting control systems, heating/air-conditioning control systems, entrance/garage gate control systems, window/door closing systems, energy consumption control systems, monitoring systems, multifunctional sensors, e.g. smoke carbon monoxide, air humidity) as valuable consumer solutions (for consumer convenience and safety). Questions about the respondents' attitudes were based on a five-point Likert scale, where 1 = "strongly disagree" and 5 = "strongly agree", and questions describing the degree of smart home systems familiarity and ownership were based on a nominal dichotomous scale. Perception index (PEI), familiarity index (FMI) and possession index (POI) were created on the basis of the set of questions containing seven statements concerning each type of smart home systems. The indicators were calculated by summing up the test items, where PEI takes values from 7 to 35 points, and FMI and POI from 0 to 7 points.

When examining the interdependence for quantitative features, in the case of variables that were characterized by a linear relationship, the Pearson correlation coefficient (r) was used, while in the absence of a linear relationship and when analyzing the interdependence of ordinal variables, non-parametric statistics were used - Spearman's rank correlation coefficient (rho) (Wiktorowicz et al., 2020).

4. Results

The main cognitive objective of the study was to determine which of the smart home systems are, in the opinion of the respondents, most valuable consumer solutions, serving convenience and safety. In the light of the respondents' answers, the most important smart home systems include multifunctional sensors (e.g. smoke, carbon monoxide, air humidity), with an average mark of M = 4.57 out of five (SD = 0.85). These solutions were positively evaluated (the percentage of "strongly agree" and "agree" answers combined) by nine out of ten respondents (figure 6). The vast majority of respondents (95.4%) also admitted that they know such solutions (they have heard about such systems, know what they are used for and are aware of their availability on the market). At the same time, however, only every third of the respondents (33.7%) admitted that he had such solutions in his home. Over four out of five respondents also indicated that valuable consumer solutions are monitoring systems (M = 4.38; SD = 0.92), heating or air conditioning control systems (M = 4.37; SD = 0.89) and gate control systems (M = 4.35; SD = 0.91). Most of the respondents know this type of solution, but only one in four of them have it on average. In the case of gate control systems, knowledge was confirmed by 95.4% of respondents, and possession by 24.6%. In the case of heating/air conditioning control systems, it was 96.1% (knowledge) and 28.2% (possession), and in the case of monitoring systems 96.0% and 23.1% of respondents, respectively. It is somewhat surprising that highly rated energy consumption control systems (M = 4.34; SD = 0.92) are known to 86.5% of the respondents and owned by only 15.0% of them. This may mean a certain discrepancy between the declarations of respondents claiming such systems as definitely valuable consumer solutions, while the actual state of ownership, does not confirm these opinions.

The respondents' ratings were slightly lower for the other solutions. Window/door closing systems were indicated as valuable consumer solutions by just over three out of four respondents (M = 4.14; SD = 1.02), knowledge of them was confirmed by nine out of ten of them, but only every tenth respondent (10.5%) confirmed having them. On the other hand, lighting control systems with the lowest average rating (M = 4.13; SD = 1.03) are known to 95.6% of respondents, and nearly every fifth of them possess it (19.6%).

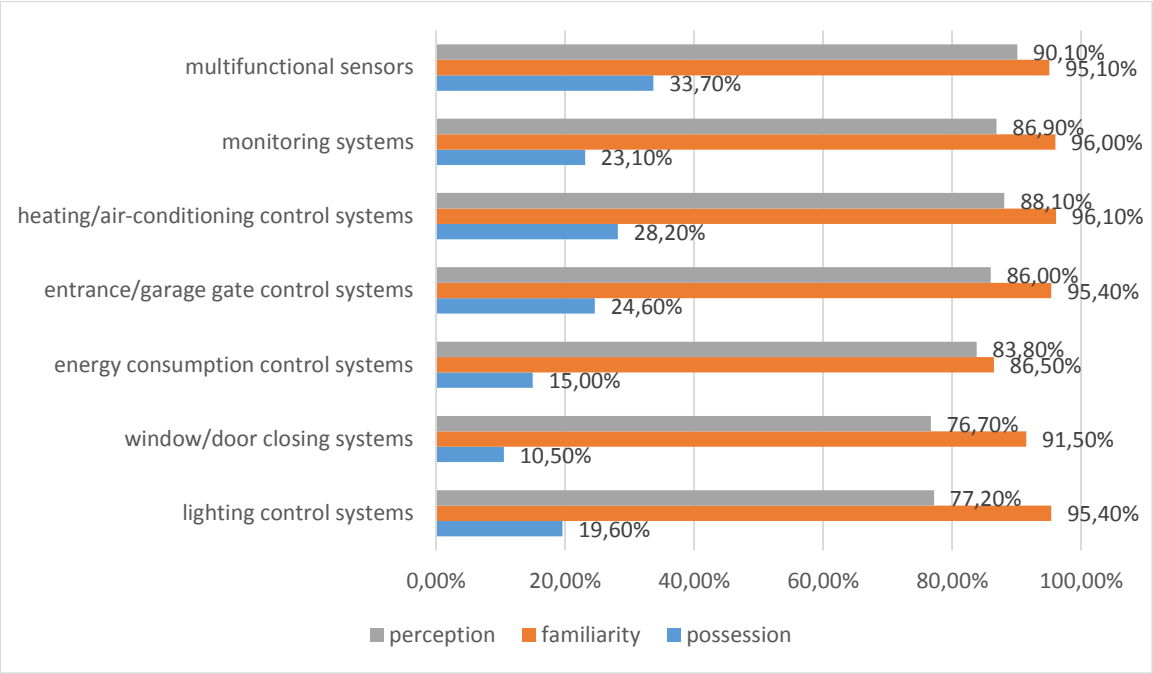

Figure 6. Smart home systems perception, familiarity and possession among respondents.

Source: empirical study

In the course of further analyses, the existence of the relationship between the perception of individual smart home systems and their possession, familiarity and the surveyed variables characterizing the respondents was verified. Variables which were indicated as potential correlates in the light of research results (Balta-Ozkan et al., 2014; Shin et al., 2018), such as age, household financial situation, place of residence (due to differences in infrastructure) and education were also taken into account. The results of the analysis are presented in Table 2.

Table 2.

Smart home systems perception, familiarity and possession and respondents' characteristics – correlational statistics (n=741)

Zmienne badane	1.	2.	3.	4.	5.	6.	7.
1. PEI	1						
2. FMI	0.286**	1					
3. POI	0.223**	0.156***	1				
4. age	-0.094*	-0.162****	0.012	1			
5. household's financial situation	0.123**	0.151***	0.164***	-0.025	1		
6. place of residence	0.120**	0.032	-0.029	0.072	0.071	1	
7. education	0.019	0.046	0.054	0.226**	0.077*	0.221**	1

Note. Correlation significant at the level: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Source: empirical study.

The conducted statistical analyzes showed the existence of a number of dependencies between the perception, familiarity, possession of smart home systems and respondents' characteristics. There were also statistically significant relationships between the respondents' education level and other metric variables (i.e. age, household financial situation and place of

residence), but the strength of the correlation between these variables was low and their collinearity was not observed.

In the light of the obtained results, the existence of a relationship with a similar strength of correlation was demonstrated both between PEI and FMI ($r = 0.286$, $p < 0.01$), as well as between PEI and POI ($r = 0.223$, $p < 0.01$). In both cases, the values of the correlation coefficients are positive, which means that the examined variables increase in the same direction - people who confirmed knowing or having smart home systems more often express definitely positive opinions about this type of solutions.

There was also a relationship between the PEI and age ($r = -0.094$, $p < 0.05$), household financial situation ($rho = 0.123$, $p < 0.01$) and place of residence of the respondents ($rho = 0.120$, $p < 0.01$). PEI is negatively correlated with age, which means that younger people more often perceive smart home solutions positively than older people, but the strength of the correlation is weak. However, in the case of the material situation and place of residence, the correlation is slightly stronger and positive, which means that more positive opinions about the smart home are more often expressed by wealthier people living in larger urban centers.

It was also noted that the FMI is negatively correlated with age ($r = -0.162$, $p < 0.001$) and positively correlated with the household financial situation ($rho = 0.151$, $p < 0.001$). Knowledge of smart home systems is therefore more often confirmed by younger and better off people. The latter also more often declare having smart home solutions, because a positive correlation has been shown with POI ($rho = 0.164$, $p < 0.001$).

5. Discussion

The home is the householder identity expression (Davidoff et al., 2006) where the residents meet a variety of needs, from security to entertainment and comfort. These needs should be the focus of attention in the context of understanding consumer attitudes and smart home perception. The consumer knowledge area is always related to understanding the buyers' preferences and the reasons for their behavior and opinions that may affect their attitude towards products or services (Gregor, Kalińska-Kula, 2016).

The perception of smart home systems, as in the case of new ICT technologies (Lin et al., 2012; Venkatesh et al., 2012; Modliński et al., 2022), in a positive dimension is determined by the perceived benefits, and reduced the perceived risks (including privacy concerns and resistance to innovation) (Kim et al., 2017), but the decisive aspect is smart home utilitarian value for the consumer. Smart technologies make it possible to monitor, control and support residents, which can improve the quality of their lives (Marikyan et al., 2019). Among the variety of smart home systems, one can indicate those that are particularly valuable consumer solutions, serving the convenience and safety of users.

The conducted study allowed to indicate several interesting conclusions. In the light of the obtained results, the very positive attitudes of the respondents towards smart home solutions were clearly visible, and this did not necessarily apply only to those solutions already possessed by the respondents. The vast majority of respondents also confirmed familiarity of smart home systems - such opinions were expressed by an average of nine out of ten respondents, but definitely less possess such systems – only every third, fourth and even every tenth of them. Respondents considered the examined solutions, such as lighting control systems, heating/air conditioning systems, as well as energy consumption control systems, to be very valuable consumer solutions, serving the well-being and security of users. These observations are consistent with the perspective of Reinisch et al. (2011) and Scott (2007), according to which the main service provided by the smart home is the effective management of energy consumption and the promotion of sustainable development.

Monitoring systems and multifunctional sensors were also rated very positively. This seems to confirm the observations of Marikyan et al. (2019) that smart sensors, integrated into an intelligent system, offer management, monitoring, support and response services as well as a number of benefits, not only economic, but also social, related to health, emotions, sustainable development and safety. In the last mentioned aspect, the systems for controlling the entrance gate and closing windows or doors, appreciated by the respondents, play an important role. The smart home, by allowing users to control these systems remotely, reduces the household members burden with daily household activities, supporting a peaceful and safe lifestyle (Chan et al., 2009; Amiribesheli et al., 2015).

The perception of smart home solutions, as well as their knowledge, are negatively correlated with the consumers' age and positively with their financial situation. These observations in terms of age are consistent with the results of studies according to which a similar relationship exists for other information and communication technology (ICT) services/products (Bennett et al., 2008; Hsu, Lin, 2016), but they are also in opposition to the results research by Shin et al. (2018), according to which older consumers are more likely to buy smart home systems than younger consumers, who currently generate less market demand. The perception of smart home solutions is also positively correlated with the respondents' place of residence, but the level of possession correlates (positively) only with the household financial situation. This observation is consistent with the results of research by Shin et al. (2018), according to which the effects of the income variable indicate that the propensity to adopt and purchase smart home technology will be greater for respondents with higher incomes.

The perception of smart home systems correlates positively with both the degree of their familiarity and the possession. People who have confirmed knowledge or possession of more smart home systems more often express definitely positive opinions about this type of solutions. Importantly, the strength of correlation in both cases is at a comparable level. It can therefore be concluded that the perception of the value of smart home systems is not necessarily related to having personal experience with their use, but may well be based on the familiarity of these

systems and consumers' general knowledge about them. The cognitive component, i.e. the belief about what the attitude object is, which is one of the three components of buyers' attitudes (next to the artifactual and behavioral components) may arise both as a result of experience and knowledge (Falkowski, Tyszka, 2009). The results obtained therefore suggest that marketing communication strategies aimed at increasing the awareness of smart home services can lead to the recognition of their usefulness and, as a result, will be effective in disseminating this type of systems and increasing the smart home market.

6. Summary

Society 5.0 fills the gap between cybernetic and physical space, providing a balanced environment for the functioning of an individual, taking into account their economic and social needs (Srinivasa et al., 2022). The convergence of ICT to the residential environment increases the comfort, well-being and security of residents in an intelligent living environment. The smart home creates a home environment that has ambient intelligence and automatic control, which allows it to respond to the residents behavior and provide them with various amenities (de Silva et al., 2012). A key challenge for the smart home market is to communicate clearly the offered benefits, whether they are the financial benefits (e.g. by reducing energy demand) or services that meet the need for security. The user's perspective allows us to understand the convictions that are the basic component of buyers' attitudes towards smart homes, and this perspective was the focus of the considerations of this work and the purpose of the research conducted for its needs.

The limitation of this study is the non-random nature of the sample, which makes it impossible to refer the obtained results to the general population. It should also be remembered that the conducted study was carried out in accordance with the descriptive function of scientific research, the implementation of which was to describe and record the occurrence of a specific phenomenon without giving its cause. After that the next step can proceed, which is an attempt to explain the reasons for its occurrence. It is therefore worth undertaking further research of an explanatory nature, the results of which would make it possible to draw conclusions about cause-and-effect relationships in the field of consumer attitudes towards smart home systems, taking into account the mediating variables and variables moderating the examined relationships.

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