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Research Article

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Factors Influencing Consumer Adoption of Smart Home Systems: A Socio-Demographic Perspective

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Abstract The purpose of this research is to determine the factors influencing consumers' adoption of smart home systems. Within this context, the relationships between factors such as perceived benefit, perceived risk, functionality, and price and their effects on the adoption of smart home systems were investigated. Additionally, whether there were significant differences in the mentioned factors based on gender, age group, education level, marital status, and income level was investigated. The population of the study consists of individuals living in Turkey who use smart home systems, while the sample comprises 556 individuals selected from this population. The data for the study were collected through a survey and evaluated using quantitative analysis methods. The statistical analyses were conducted using the SPSS 25 software, applying descriptive statistical methods, Pearson correlation analysis, independent samples t-test, and one-way variance analysis. The analyses reveal that consumers' overall levels of adoption of smart home systems are slightly above average. However, it is observed that the first three factors significantly influencing the adoption of smart home systems are price, perceived benefit, and functionality, respectively. Furthermore, strong and very strong positive and significant relationships were found among all factors related to the adoption of smart homes. Furthermore, it is concluded that the approach to smart homes varies significantly according to gender, age group, education level, marital status, and income level.

Keywords Smart home · planned behavior · technology adoption · consumer · Technology Acceptance Model

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Introduction

The integration of smart home systems represents a prevalent trend as part of the Internet of Things (IoT), signaling larger shifts in the types of products and services consumers use. Smart homes are conceived as fully connected passages of devices, providing convenience and security, but are largely receiving attention for energy efficiency and quality of living. Adoption of IoT devices for smart homes is variable across populational demographics, with a significant influence attributable to socio-demographic factors. These socio-demographic factors inform the technology adoption decision-making process, creating value for stakeholders who consider research on socio-demographic differences in home smart technologies as applicable.

One of the primary considerations for home consumers adopting technologies is the perceived value of smart home systems. Existing research emphasizes that consumers are more inclined to purchase systems when they understand the benefits of smart home systems, including the benefits of and the convenience from systems adopted for energy use, safety, and home comfort (Sequeiros et al., 2021). If examined according to futures or aging populations, the conveniences provided by smart home technologies to older adults are highly adoptable (Lau et al., 2022). As the population ages, more technologies will be created facilitations independent living purposes, safety, and mitigating risk, which puts agendas in understanding the technology use and needs of older adults (Patskanick et al., 2024).

Examining socio-demographic factors such as age, gender, and income are still significant drivers of consumer attitudes toward smart home technologies. Studies show that older adults show conflicting attitudes toward home smart technologies due to either confusion of efficacy employing the technology alone or usage concerns at the household level, and hurdles of understanding privacy and security implications (Wei et al., 2023). Under certain volition of cognitive barriers and social situations, older consumers are developing a rapport of acceptance for smart home systems (Patskanick et al., 2024). Each demographic objective highlights the need to develop marketing strategies to address specific aspects of ambivalence toward home smart technology consumers.

Security and privacy are significant understanding consumers have surrounding technologies, and even further for smart home technologies. Home smart technology could possess a risk of data breaches and thieves gaining access to homes, which would not support overall comfort for consumers. Security becomes complacent if trust in technology is fostered, and particularly trust because of the amount of personal data currently shared, is paramount (Liu et al., 2021). Both findings are essential to overcome through oversights of complex user experiences deemed unavailable or concerns managing personal data.

Finally, due to the complex ecosystem of smart home devices, connections, multiple connectivity protocols, necessary object usage (smart hubs), or other barriers to adoption, can be overwhelming for consumers wishing to maintain the value proposition of the device. Consumers are probably confused about how devices will integrate into their home (Phan & Kim, 2020). Barriers will reduce as smart home devices become more universal, easier to use or integrate, and more interoperable with each iteration (Türkyılmaz & Altındağ, 2022).

Recent advancements in smart home technologies have been profoundly shaped by the integration of artificial intelligence (AI) and sustainable energy solutions, yielding homes that are more efficient, secure, and environmentally responsible (Gazieva et al., 2023; Șerban & Lytras, 2020). The advent of sophisticated AI techniques, including deep learning and machine learning models, has enabled smart residential systems

to optimize energy consumption and automate everyday tasks, thereby enhancing user comfort while simultaneously reducing operational costs (Camacho et al., 2024; Khan et al., 2020). These innovations are not merely confined to the incorporation of intelligent applications within isolated systems but also extend to a comprehensive integration of IoT-based devices, which serve as the cornerstone of modern smart home architectures (Sepasgozar et al., 2020; Tarhouni & Aloui, 2024).

Concurrently, the incorporation of renewable energy sources has underscored the transition toward sustainable energy practices within domestic environments. AI-driven energy management systems are increasingly being deployed to facilitate real-time monitoring, predictive analytics, and the optimal distribution of renewable resources, such as photovoltaic systems and wind power, within smart grid frameworks (Hassan et al., 2023). Such systems not only enhance energy efficiency but also contribute significantly to reducing the overall carbon footprint of households, aligning with the global impetus toward net-zero emissions and sustainable living (Camacho et al., 2024; Stecuła et al., 2023).

These technological advancements promote a dynamic and responsive home environment wherein AI models continuously learn from user behavior and external variables to deliver personalized and energy-efficient services (Almusaed et al., 2023; Lashkari et al., 2019). In essence, the convergence of AI, IoT, and sustainable energy solutions is fundamentally redefining the smart home paradigm, thereby fostering innovative living spaces that deliver both technological sophistication and environmental sustainability (Singh & Dhablia, 2023).

The adoption of smart home systems has emerged as a significant area of interest in contemporary consumer technology research. As households increasingly integrate advanced technologies into their daily lives, understanding the factors that influence consumer acceptance becomes essential. This study aims to explore the socio-demographic factors that affect consumer adoption of smart home systems, using the Technology Acceptance Model (TAM) as a theoretical framework.

Strzelecki et al. (2024) emphasized that the increasing affordability of smart home technologies is a critical factor driving their adoption, yet they also noted a lack of understanding regarding the elements that sustain continued use. This suggests that while initial adoption may be influenced by economic factors, ongoing usage is contingent on user satisfaction and perceived benefits.

The role of socio-demographic factors cannot be understated. Cannizzaro et al. (2020) conducted a nationally representative survey in the UK, revealing that trust in smart home devices, privacy concerns, and user satisfaction are significantly influenced by socio-demographic characteristics. Older adults, for example, may exhibit different attitudes toward technology compared to younger users, often due to varying levels of technological literacy and perceived utility (Tiersen et al., 2021). Wong and Leung (2016) further explored how the attributes of smart home devices can enhance the quality of life for elderly users, indicating that tailored solutions are necessary to meet the unique needs of this demographic.

In addition to perceived usefulness, perceived ease of use—defined as the degree to which a person believes that using a particular system would be free of effort—also significantly impacts adoption attitudes. Shih (2013) argues that a high perceived ease of use can positively influence consumer attitudes toward smart home services, although it does not directly correlate with adoption. This nuanced understanding suggests that while ease of use is important, it must be coupled with tangible benefits to encourage adoption. Furthermore, the interplay between user satisfaction and technology adoption was highlighted by Orlov (Orlov et al., 2024), who asserted that usability and reliability are critical determinants of user satisfaction, which in turn influences the likelihood of adopting smart home technologies.

The adoption of smart home systems is a multifaceted issue influenced by various factors, including perceived usefulness, ease of use, and socio-demographic characteristics. The integration of these elements within the Technology Acceptance Model provides a robust framework for understanding consumer behavior in this context. As the market for smart home technologies continues to grow, further research is essential to unravel the complexities of user acceptance and to develop strategies that enhance the adoption rates among diverse consumer segments.

In this study, the adoption of smart home systems is examined through the Technology Acceptance Model (TAM) framework, incorporating a comprehensive set of factors that influence consumer preferences. Key dimensions such as Adoption Intention, Perceived Value, Perceived Benefit, Perceived Risk, Functionality, Design, Brand Name, Price, Perceived Service Usability, Perceived Network Size, Perceived Complementarity, and Privacy Concern are explored to understand their roles in shaping user attitudes and decision-making processes. By integrating these variables within the TAM framework, this research aims to provide a deeper insight into the socio-demographic determinants of smart home adoption, offering valuable implications for both academia and industry stakeholders. As smart home technologies continue to evolve, identifying the factors that drive or hinder their adoption becomes increasingly crucial for enhancing consumer acceptance and fostering widespread adoption across diverse user groups.

In terms of contribution to the literature, this study provides a comprehensive examination of smart home adoption through the Technology Acceptance Model (TAM) framework, integrating a diverse set of factors. While existing studies have individually examined perceived usefulness, ease of use, and security concerns, this study extends the discussion by incorporating a broader socio-demographic perspective, considering how variables such as income, education level, age, gender, and marital status influence adoption decisions. Additionally, by analyzing factors like Perceived Benefit, Perceived Risk, Functionality, Brand Name, and Perceived Complementarity, this research offers a holistic understanding of consumer attitudes toward smart home technologies. The findings contribute to the growing body of knowledge on consumer technology adoption, providing practical insights for developers, policymakers, and marketers seeking to enhance the design, accessibility, and security of smart home systems, ultimately fostering higher adoption rates and user satisfaction.

Methodology

Population and Sample

The population of the study consisted of consumers aged 20 and above who had previously purchased and currently used any product within the scope of smart home systems in Türkiye. The sample consisted of 556 individuals selected from among these through convenient and snowball sampling methods. Snowball sampling is often considered appropriate because of the difficulty of accessing a well-defined target population and the need to reach individuals with specific experiences or awareness. Although the snowball sampling method was appropriate for reaching participants in this study, it is important to acknowledge that such non-probability sampling techniques may introduce certain biases. These methods can limit the generalizability of the findings due to the potential homogeneity among respondents and the lack of representation of the broader population.

There are no official statistics regarding the number of people who have purchased and are currently using any product within the scope of smart home systems in Türkiye. However, in a survey conducted in 2022 with the participation of 1046 individuals, the usage rate of home technologies such as security, lighting,

smoke detectors, etc., was determined to be in the range of 20-21% (Statista, 2022). Information regarding the region where the research was conducted is not provided, but this rate was considered to be quite high and the usage rate of smart home technology was accepted as 10% for the calculation of sample adequacy. Based on the 2022 Address-Based Population Registration System (ADNKS) results, the population aged 20 and over in Türkiye is 60.229.333 (TÜİK, 2022). Roughly 10% of this figure amounts to approximately 6,025,000 individuals. In cases where the number making up the population is known, one of the formulas commonly used to determine the number of units to be included in the sample is as follows:

$$n = \frac{Nt^2pq}{d^2(N-1) + t^2pq}$$

In this formula; n: number of individuals to be sampled, N: number of individuals in the population, t: theoretical value obtained according to the t table at a certain significance level, p: frequency of occurrence of the event under investigation, q: frequency of non-occurrence of the event under investigation, and d: sampling error (Yazıcıoğlu and Erdoğan, 2014). When applying this formula to our study with a confidence level of 95% and a sampling error of 5%, the calculated required sample size was 384 individuals. We included 556 individuals in our research, approximately 1,5 times this calculated number.

Participants were reached through convenient (easy) and snowball sampling methods. Convenient (easy) sampling is based on selecting units that are easily accessible from among those thought to represent the population. Snowball sampling is conducted by reaching a new individual exhibiting suitable characteristics for participation in the research through a participant who has already joined the research (Tuna, 2016).

Data Collection Method

The research data were gathered through a questionnaire comprising two sections. The initial part encompassed a "Demographic Information Form" crafted by the researcher, containing five multiple-choice queries covering gender, age group, marital status, income level, and education level.

The measurement scale was developed by adapting items from previously validated and widely used instruments in the literature. The scale was designed to measure users' approaches toward smart home systems. A total of 45 items were included in the scale, which was structured using a 7-point Likert format (1 = Strongly Disagree, 7 = Strongly Agree).

The items related to functionality were adapted from the studies of Ziamou and Ratneshwar (2002) and Yu et al. (2017). The items used for the measuring design were derived from the scales developed by Van der Heijden (2004) and Cyr et al. (2006). The items related to price were adapted from the studies of Teng and Lu (2009) and Yu et al. (2017), while the items related to brand name were based on the scales developed by Brucks et al. (2000) and Yu et al. (2017).

Among the variables related to platform features, perceived service availability was measured using the items developed by Hong and Tam (2006). The perceived network size and perceived complementarity were evaluated based on the scale proposed by Lin and Lu (2011). Privacy concerns were measured using the items developed by Nepomuceno et al. (2014). The items related to perceived benefit were taken from the study of Hsu & Lin (2016), while the items related to perceived risk were adapted from the scales developed by Yang et al. (2015) and Featherman & Pavlou (2003). Finally, the measurements related to perceived value and adoption intention were derived from the scales developed by Kim et al. (2007).

The sub-dimensions included adoption intention, perceived value, perceived benefit, perceived risk, functionality, design, brand name, price, perceived service usability, perceived network size, perceived

complementarity, and privacy concerns. Notably, within the scale, 7 items in the price and perceived risk sub-dimensions were reverse-coded before analysis.

To ascertain the validity of the Smart Home Systems Approach Questionnaire, an exploratory factor analysis (EFA) was conducted. Initially, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of 0,934, deemed "excellent" for sampling adequacy according to Field (2009). Furthermore, Bartlett's Test of Sphericity produced a chi-square value of 34375.124 with $p < .05$, meeting the criteria for data suitability for factor analysis (Büyüköztürk, 2011). Based on these results, a factor analysis was pursued.

The validity, represented by the explained variance, of the Smart Home Systems Approach Questionnaire was determined to be 88.04%. Given that this value surpassed 50%, the questionnaire was deemed valid (Büyüköztürk, 2011). Moreover, to assess the reliability of the questionnaire, Cronbach's Alpha reliability analysis was conducted for both the overall scale and each sub-dimension separately (refer to Table 1). As shown in Table 1, the scale exhibited a reliability coefficient of 0,993, with values exceeding 0,90 observed across all sub-dimensions. This aligns with the classification by George & Mallery (2003), where values of 0,90 and above are considered highly reliable.

Table 1

Reliability Findings of the Approach to the Smart Home Systems Scale

	Adoption Intention	Perceived Value	Perceived Benefit	Perceived Risk	Functionality	Design	Brand Name Usability	Price	Perceived Service Usability	Perceived Network Size	Perceived Complementarity	Privacy Concern	**Scale General**
Cronbach Alpha	0,925	0,927	0,976	0,973	0,965	0,991	0,994	0,974	0,988	0,977	0,969	0,978	**0,993**

Hypotheses of the Study

The adoption of smart home systems is influenced by a multitude of factors, including adoption intention, perceived value, perceived benefit, perceived risk, functionality, design, brand name usability, price, perceived service usability, perceived network size, perceived complementarity, and privacy concerns.

The intention to adopt smart home systems is significantly influenced by perceived value, which encompasses the benefits that consumers expect to receive from using these technologies. Research indicates that perceived usefulness and satisfaction are pivotal in forming positive adoption intentions (Gu et al., 2019; Wei et al., 2019). For instance, a study highlighted that service quality and perceived usefulness directly enhance user satisfaction, which in turn fosters the habitual use of smart home services (Gu et al., 2019). Furthermore, perceived value mediates the relationship between service innovation and consumers' willingness to use smart home technologies, emphasizing its importance in the adoption process (Li, 2022).

Consumers weigh the perceived benefits of smart home systems against the potential risks. The perceived benefits include enhanced convenience, security, and energy efficiency, which are crucial for motivating adoption (Wong & Leung, 2016). Conversely, perceived risks, particularly concerning privacy and security, can deter users from embracing these technologies.

The functionality of smart home systems, including their ease of use and integration with existing home environments, is vital for consumer preference. Studies have shown that users favor systems that offer seamless interoperability and user-friendly interfaces (Yang et al., 2017). Additionally, design esthetics and

the overall user experience contribute to the perceived usability of smart home technologies, influencing consumer choices (Wong & Leung, 2016). A well-designed system that aligns with consumer expectations can enhance the perceived value and reduce the perceived risk.

Brand reputation plays a significant role in shaping consumer perceptions of smart home systems. Established brands are often associated with reliability and quality, which can enhance perceived trust and usability (Liu et al., 2021). Price sensitivity also affects adoption intentions; consumers are likely to evaluate the cost against the perceived benefits and functionalities offered by smart home systems (Pliatsikas & Economides, 2022). Thus, competitive pricing strategies can enhance market penetration and consumer acceptance.

The usability of the services provided by smart home systems is crucial for consumer satisfaction. Users expect high-quality service that is responsive and reliable (Gu et al., 2019). Additionally, the perceived network size, which refers to the extent of connectivity and compatibility with other devices, influences consumer preferences. A larger network size can enhance the perceived complementarity of smart home devices, making them more appealing to potential users (Wei et al., 2019).

Privacy concerns remain a significant barrier to the adoption of smart home technologies. Consumers are increasingly aware of the implications of data collection and surveillance associated with smart home systems. Research indicates that addressing these concerns through transparent data practices and robust security measures can mitigate perceived risks and enhance consumer trust (Liu et al., 2021). Thus, companies must prioritize privacy in their smart home offerings to foster greater acceptance among consumers. In line with the literature mentioned above, the H1 hypothesis has been described as follows:

H1: There is a statistically significant relationship among the factors influencing consumers' preferences for smart home systems.

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H2: Consumers' preferences for smart home systems significantly differ by gender.

Younger consumers often perceive greater value in smart home technologies due to their familiarity with technology and the benefits these systems offer, such as convenience and enhanced lifestyle. Research indicates that younger individuals are more adept at utilizing smart home technologies, which correlates with their higher education levels and income, leading to a greater affinity for such innovations (Arar et al., 2021; He et al., 2022). In contrast, older adults may view these technologies as complex or intrusive, which can diminish their perceived value and benefits (Baek et al., 2022). The perceived benefits of smart home systems, such as improved healthcare, safety, and social involvement, are particularly significant for older adults, as they often seek solutions that promote independent living and enhance their quality of life (Jain et al., 2024; Wei et al., 2023).

Older adults may have heightened concerns regarding privacy and the reliability of smart home technologies, which can hinder their adoption (Sequeiros et al., 2021). In contrast, younger consumers typically exhibit lower perceived risks, viewing smart home functionalities as integral to modern living (He et al., 2022; Katuk et al., 2018). The functionality of smart home systems, including ease of use and integration with existing technologies, is paramount for all age groups, but particularly for older adults who may require more intuitive interfaces (Cho & Choi, 2020; Yaldaie et al., 2023).

Some researches emphasize that systems must be user-friendly to cater to older adults, who may struggle with complex interfaces (Cho & Choi, 2020). Conversely, younger users may prioritize esthetic design and advanced functionalities, which can enhance their overall experience with smart home technologies (Shih, 2013). Established brands often instill confidence in their products, particularly among older consumers who may be more risk-averse (Arar et al., 2021; Maswadi et al., 2022). Price perception also varies by age group, with younger consumers often more willing to invest in innovative technologies, while older adults may be more price-sensitive, focusing on the long-term value and cost-effectiveness of smart home solutions (Maswadi et al., 2022; Wei et al., 2023).

Older adults may require more support and simpler services to feel comfortable with technology (Baek et al., 2022; Uddin et al., 2010). Additionally, perceived network size, or the extent of connectivity and integration with other devices, can enhance the appeal of smart home systems, especially for younger users who are

accustomed to interconnected devices (Katuk et al., 2018; Qiu et al., 2022). Privacy concerns are particularly pronounced among older adults, who may fear the implications of data collection and surveillance inherent in smart home technologies. Younger consumers, while also concerned about privacy, may prioritize the benefits of connectivity and convenience over these risks (He et al., 2022; Maswadi et al., 2022). Addressing these privacy concerns through transparent practices and robust security measures is essential for fostering trust across all age groups. Drawing from the aforementioned studies, the H3 hypothesis has been defined as follows:

H3: Consumers' preferences for smart home systems significantly differ across different age groups.

Higher perceived benefits, such as energy savings, enhanced security, and increased comfort, lead to a greater willingness to invest in smart home technologies. Research indicates that when consumers recognize the value of platform services, they also perceive greater value in smart home products, enhancing their overall experience (Tang & Inoue, 2021). This aligns with findings that emphasize the importance of perceived usefulness and satisfaction in driving the continuous use of smart home services (Gu et al., 2019; Nascimento & Fettermann, 2023).

The functionality of smart home systems is another critical factor. Consumers prefer user-friendly systems and offer seamless integration with existing devices (Cho & Choi, 2020; Hubert et al., 2019). Research has shown that perceived ease of use significantly affects adoption intentions, particularly among older adults who may find complex systems daunting (Zhou et al., 2024). The design and usability of smart home interfaces are essential for ensuring that users can interact with the technology without frustration.

A well-designed product that aligns with consumer expectations can enhance perceived value and usability (Hubert et al., 2020; Yaldaie et al., 2023). Brand name recognition can further bolster consumer confidence, as established brands are often associated with reliability and quality (Shih, 2013).

Price remains a significant barrier to adoption, particularly for consumers with lower educational backgrounds who may have limited financial resources (Nascimento & Fettermann, 2023). Studies suggest that consumers weigh the cost against the perceived benefits and functionality of smart home systems, making affordability a crucial consideration in their decision-making process (Sequeiros et al., 2021; Yang et al., 2017).

Consumers are more inclined to adopt smart home technologies that can integrate with various devices and services, enhancing their overall functionality (Tang & Inoue, 2021; Türkyılmaz & Altındağ, 2022). This interconnectedness can lead to a more cohesive and satisfying user experience, further encouraging adoption (Nascimento & Fettermann, 2023). Based on the literature reviewed above, the H4 hypothesis is expressed as follows:

H4: Consumers' preferences for smart home systems significantly differ by education level.

Research indicates that married individuals may prioritize functionality and security features more than single individuals, who might focus on cost and ease of use (Li et al., 2021). For instance, married couples often seek systems that enhance family safety and convenience, while single consumers may be more inclined to adopt technologies that offer entertainment and personal convenience (Mamonov & Benbunan-Fich, 2020). Married consumers may perceive higher value in systems that support family dynamics and household management, while singles may evaluate value based on personal lifestyle enhancements (Al-Husamiyah & Al-Bashayreh, 2022; Marikyan et al., 2019).

Married consumers often report a higher frequency of perceived benefits related to comfort and security, such as routine activity automation and remote home management (Nascimento et al., 2022). In contrast,

single consumers might prioritize benefits that enhance their individual lifestyle, such as energy savings and entertainment options (Maznah et al., 2021).

Studies have shown that married individuals may exhibit greater concern over the privacy risks associated with smart home systems, as these technologies often involve the collection and sharing of personal data (Wang et al., 2023). This concern can lead to hesitance in adopting smart home technologies, particularly if the perceived risks outweigh the anticipated benefits. On the other hand, single consumers may be less concerned about privacy issues, focusing instead on the immediate benefits and functionalities offered by smart home systems (Liu et al., 2021).

Married couples often look for systems that can integrate seamlessly into their daily routines and enhance household management, emphasizing the importance of user-friendly interfaces and reliable performance (Wright & Shank, 2019; Zhang et al., 2020). In contrast, single consumers may prioritize esthetic design and innovative features that align with their personal style and lifestyle preferences (Luor et al., 2015).

Price sensitivity is another factor that can differ between married and single consumers. Research suggests that married individuals may be more willing to invest in higher-priced smart home systems if they perceive significant long-term benefits, such as energy savings and enhanced security (Al-Husamiyah & Al-Bashayreh, 2022; Li et al., 2021). Conversely, single consumers may be more price-sensitive and inclined to opt for budget-friendly options that still meet their basic needs (Jacobsson et al., 2016). Brand reputation also plays a crucial role; married consumers might prefer established brands known for reliability and security, while singles may be more open to exploring newer brands that offer innovative features at competitive prices (Mennicken & Huang, 2012; Tural et al., 2021). In light of previous research, the H5 hypothesis has been proposed as follows:

H5: Consumers' preferences for smart home systems significantly differ by marital status.

Consumers with higher income levels often perceive greater value in smart home technologies due to their ability to enhance convenience, security, and energy efficiency. Studies indicate that perceived value is a critical determinant of consumer acceptance, particularly in relation to the modularity and inter-consumer connectivity offered by smart home platforms (Tang & Inoue, 2021). Furthermore, the perceived benefits, such as improved quality of life and enhanced safety, significantly influence adoption intentions among affluent consumers (Hubert et al., 2019; 2020). In contrast, lower-income consumers may prioritize immediate cost savings and practicality over advanced functionalities, which can affect their perceived value of smart home systems.

The perception of risk associated with smart home technologies varies with income levels. Higher-income consumers may be more willing to embrace new technologies despite potential risks, such as privacy concerns, because they can afford to mitigate these risks through enhanced security measures (Liu et al., 2021). Conversely, lower-income consumers often exhibit heightened sensitivity to perceived risks, which can deter them from adopting smart home systems (Hubert et al., 2019; Paetz et al., 2011).

Functionality is a paramount consideration for consumers across all income levels, but the emphasis on design and ease of use may differ. Higher-income consumers tend to favor esthetically pleasing designs and advanced functionalities that align with their lifestyle preferences (Chin et al., 2023). In contrast, lower-income consumers may prioritize basic functionalities that offer immediate utility, such as energy management and home security (Pliatsikas & Economides, 2022).

Brand reputation plays a significant role in the adoption of smart home technologies, particularly among higher-income consumers who may associate established brands with quality and reliability (Chin et al., 2023; Gu et al., 2019). Price sensitivity is more pronounced among lower-income consumers, who often view smart home systems as luxury items rather than necessities (Tural et al., 2021).

The usability of smart home systems is crucial for adoption, especially for older adults or less tech-savvy individuals (Maswadi et al., 2020; Zhang et al., 2024). Higher-income consumers may have greater access to support services and resources that enhance usability, while lower-income consumers may struggle with the complexity of these systems (Maswadi et al., 2020; Tural et al., 2021). Additionally, perceived network size, which refers to the interconnectedness of devices within a smart home ecosystem, can influence adoption intentions. Consumers with higher income levels may be more inclined to invest in comprehensive systems that offer extensive connectivity (Gu et al., 2019; Hubert et al., 2020).

Privacy remains a significant barrier to the adoption of smart home technologies, particularly for lower-income consumers who may lack trust in the security of their personal data (Liu et al., 2021). Addressing these concerns through transparent communication and robust security measures is essential for fostering trust and encouraging adoption across all income levels. Grounded in the discussed literature, the H6 hypothesis has been articulated as follows:

H6: Consumers' preferences for smart home systems significantly differ by income level.

Data Analysis

Quantitative analysis methods were employed to evaluate the data of the study. For this purpose, SPSS 25 software was utilized, and descriptive statistical methods, Pearson correlation analysis, independent samples t-test, one-way analysis of variance (ANOVA), and Hochberg GT2 post-hoc test were applied. The reason for using the Hochberg GT2 is that the compared group sizes are not similar (Field, 2009). Furthermore, all analyses were conducted at a 95% confidence interval and evaluated at a significance level of $p < .05$. Additionally, the skewness and kurtosis values of the relevant scores were examined to determine whether the normal distribution assumption was met (refer to Table 2).

Table 2

Skewness and Kurtosis Values for Subscale Scores

	Adoption Intention	Perceived Value	Perceived Benefit	Perceived Risk	Functionality	Design	Brand Name	Price	Perceived Service Usability	Perceived Network Size	Perceived Complementarity	Privacy Concern
Skewness	−0.567	−0.387	−0.456	−0.521	−0.33	−0.549	−0.14	−0.28	−0.552	−0.51	−0.462	−0.416
Kurtosis	−0.499	−0.796	−0.919	−0.662	−1.038	−0.671	−1.307	−1.21	−0.697	−0.742	−0.782	−0.851

In social sciences, especially when the sample size is large, it is often recommended to use skewness and kurtosis values to assess normality instead of relying solely on the Kolmogorov-Smirnov or Shapiro-Wilk tests, which can be overly sensitive in detecting minor deviations (Ghasemi & Zahediasl, 2012). Acceptable ranges for skewness and kurtosis are typically between −1 and +1 (George & Mallery, 2010). Additionally, the coefficient of variation can be used to evaluate the relative variability of the data (Rumsey, 2016). Based on these indicators, the data in this study can be considered to be normally distributed.

Relationships Among Factors Affecting the Adoption of Smart Homes

The relationships between subscale scores representing factors affecting the adoption of smart homes were examined using Pearson correlation analysis, and the findings are presented in Table 3.

The correlation analysis results indicate that there are significant relationships among the factors influencing consumers' preferences for smart home systems. The strongest positive correlations were observed between the intention to adopt and key factors such as perceived value, perceived complementarity, and perceived network size, suggesting that consumers' willingness to adopt smart home systems is shaped by how they perceive the system's overall value and its integration within their existing technological ecosystem. Additionally, price, perceived benefit, functionality, and brand name were moderately correlated with adoption intention, indicating that while these factors are important, their influence may vary based on individual consumer priorities.

Moreover, price exhibited a strong positive correlation with perceived benefit, highlighting that consumers associate higher-priced smart home systems with greater advantages. However, price had only a moderate correlation with most other subscales, implying that while cost is a significant factor, it is not the sole determinant of consumer preferences. Across all dimensions, most factors were strongly interrelated, reinforcing the idea that smart home adoption is influenced by a combination of perceived benefits, risks, usability, and financial considerations rather than a single dominant factor. These findings confirm the hypothesis that various interdependent factors collectively shape consumer decisions regarding smart home technologies.

Based on these findings, the hypothesis "H1: There is a statistically significant relationship among the factors influencing consumers' preferences for smart home systems" is supported.

Table 3

Correlation Findings for Relationships Among Subscale Scores

Dimension		1	2	3	4	5	6	7	8	9	10	11	12
1. Adoption Intention	r	1	.790	.684	.760	.677	.764	.648	.389	.767	.764	.717	.702
	p		**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
2. Perceived Value	r		1	.776	.903	.787	.899	.745	.506	.894	.905	.850	.812
	p			**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
3. Perceived Benefit	r			1	.830	.911	.822	.835	.723	.831	.838	.793	.751
	p				**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
4. Perceived Risk	r				1	.858	.970	.806	.534	.969	.978	.914	.917
	p					**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
5. Functionality	r					1	.873	.799	.667	.856	.847	.786	.772
	p						**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
6. Design	r						1	.802	.545	.959	.975	.919	.893
	p							**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
7. Brand Name	r							1	.636	.798	.814	.754	.727
	p								**.000**	**.000**	**.000**	**.000**	**.000**
8. Price	r								1	.527	.547	.512	.481
	p									**.000**	**.000**	**.000**	**.000**
	r									1	.964	.912	.885

Dimension		1	2	3	4	5	6	7	8	9	10	11	12
9. Perceived Service Usability	p										**.000**	**.000**	**.000**
10. Perceived Network Size	r										1	.940	.909
	p											**.000**	**.000**
11. Perceived Complementarity	r											1	.837
	p												**.000**
12. Privacy Concern	r												1
	p												

Examination of Attitudes Toward Smart Homes Based on Sociodemographic Characteristics

The results of the detailed analyses conducted based on the participants' sociodemographic characteristics are presented below in detail under relevant subheadings.

Gender

An independent samples t-test was conducted to determine whether there were significant differences between men and women regarding their attitudes toward smart homes, and the findings are presented in Table 4. All types of scores examined on the adoption of smart homes displayed significant differences based on gender ($p < .05$). In other words, men and women exhibit distinct approaches toward smart homes across all features.

Table 4

Comparison of Subscale Scores by Gender

Dimension	Female (Mean)	Male (Mean)	t	p
Adoption Intention	5.17	4.24	6.90	0.000
Perceived Value	5.34	4.13	9.28	0.000
Perceived Benefit	5.84	4.24	14.03	0.000
Perceived Risk	5.48	4.28	8.87	0.000
Functionality	5.72	4.24	12.33	0.000
Design	5.66	4.27	10.26	0.000
Brand Name	5.58	4.30	10.11	0.000
Price	6.00	5.32	8.16	0.000
Service Usability	5.57	4.27	9.35	0.000
Perceived Network Size	5.54	4.26	9.56	0.000
Perceived Complementarity	5.47	4.20	9.64	0.000
Privacy Concern	5.37	4.29	7.71	0.000

When reviewing the means, it was observed that the means for all subscales were higher for women than for men. Thus, it can be concluded that women's preferences are significantly more dominant than men's across all subscales. Women tend to adopt smart homes more and perceive more value, benefit, risk, functionality, and usability. Additionally, design, brand name, price, network size, complementarity, and privacy concerns are more prominent reasons for preference among women compared to men.

Based on these findings, the hypothesis "H2: Consumers' preferences for smart home systems significantly differ by gender" is supported.

Age

One-way analysis of variance (ANOVA) was conducted to examine the approach of participants toward smart homes across different age groups and to determine if there were any significant differences among the groups. The findings are presented in Table 5. The age distribution of participants was as follows: 90 individuals in the 20-29 age group, 159 in the 30-39 age group, 193 in the 40-49 age group, and 114 in the 50+ age group, making a total of 556 participants. The letters (a, b, c, d) represent different age groups in the post-hoc analysis, where a corresponds to the 20-29 age group, b to the 30-39 age group, **c** to the 40-49 age group, and d to the 50+ age group. These letters indicate the statistical groupings derived from the post hoc comparisons, showing which age groups are significantly different from each other.

Table 5

Comparison of Subscale Scores by Age

Dimension	20-29 (Mean)	30-39 (Mean)	40-49 (Mean)	50+ (Mean)	F	p	Difference
Adoption Intention	4.01	4.62	5.11	5.14	12.56	.000	c,d > a,b
Perceived Value	4.00	4.74	5.04	5.37	13.98	.000	c,d > a,b
Perceived Benefit	4.26	5.07	5.24	6.04	27.21	.000	d > a,b,c
Perceived Risk	3.91	5.03	5.18	5.50	18.37	.000	b,c,d > a
Functionality	4.23	5.14	5.14	5.80	19.33	.000	b,c,d > a
Design	4.08	5.18	5.22	5.58	15.38	.000	b,c,d > a
Brand Name	4.19	5.09	4.92	5.98	24.94	.000	d > a,b,c
Price	5.44	5.40	5.69	6.45	27.82	.000	d > a,b,c
Service Usability	4.08	5.09	5.14	5.58	14.30	.000	b,c,d > a
Perceived Network Size	4.04	5.04	5.18	5.52	15.26	.000	b,c,d > a
Perceived Complementarity	4.04	4.89	5.20	5.37	12.90	.000	b,c,d > a
Privacy Concern	4.11	5.10	5.02	5.21	9.05	.000	b,c,d > a

The findings revealed significant differences in participants' attitudes toward smart home systems across all sub-dimensions based on age groups ($p < .05$). Analyzing the mean scores suggests that attitudes toward smart home adoption tend to become more positive with increasing age. To further explore these differences, the Hochberg GT2 post hoc test was conducted, identifying specific variations among the age groups.

The results indicate that participants aged 40 years exhibit significantly higher adoption intention and perceived value compared to younger individuals, suggesting that older consumers recognize greater benefits and are more inclined to adopt smart home technologies. Furthermore, those aged 50 and above demonstrated stronger perceptions of benefits, placed greater importance on brand reputation, and prioritized price more than younger participants, implying that older consumers considered both functional and financial aspects when evaluating smart home systems. Additionally, individuals aged 30 and above reported higher perceptions of risk, functionality, design, perceived service usability, perceived network size, perceived complementarity, and privacy concerns than those under 30, indicating that as consumers age, they develop a more comprehensive and cautious approach toward smart home technologies. The results suggest that age plays a crucial role in shaping consumer perceptions and decision-making processes, with

older individuals generally showing stronger preferences and a more thoughtful evaluation of smart home technologies.

These findings support the hypothesis "H3: Consumers' preferences for smart home systems significantly differ across different age groups" is supported.

Education Level

One-way analysis of variance (ANOVA) was conducted to examine the participants' attitudes toward smart homes based on education level and determine if there were any significant differences among the groups. The results are presented in Table 6. The education level distribution of participants was 45 individuals in the Primary/Middle School group, 359 in the High School group, 124 in the Undergraduate group, and 28 in the Graduate group, making a total of 556 participants. In the post hoc analysis, a represents Primary/Middle School, b represents High School, c represents Undergraduate, and d represents Graduate. Groups sharing the same letter are not significantly different from each other, whereas those with different letters indicate statistically significant differences.

Based on the findings, notable differences were observed in participants' attitudes toward smart homes across all aspects, contingent on their educational background ($p < 0,05$). When reviewing the means, a trend emerged indicating that scores generally increased alongside higher levels of education. Postgraduate degree holders showed significantly greater intent to adopt compared with other participants. Moreover, this intent was notably higher among high school and undergraduate degree holders than among those with primary and secondary education.

Table 6

Comparison of Subscale Scores by Education Level

Dimension	Primary/ Middle (Mean)	High School (Mean)	Undergraduate (Mean)	Graduate (Mean)	F	p	Difference
Adoption Intention	2.36	4.83	5.24	6.29	58.35	.000	d > a,b,c
Perceived Value	2.31	4.72	5.74	6.69	92.14	.000	d > a,b,c; c > a,b; b > a
Perceived Benefit	2.32	4.84	6.85	7.00	367.78	.000	d > a,b,c; c > a,b; b > a
Perceived Risk	2.29	4.82	6.10	6.78	109.10	.000	c,d > a,b; b > a
Functionality	2.47	4.86	6.68	5.93	191.81	.000	c > a,b,d; d > a,b; b > a
Design	2.47	4.91	6.17	7.00	100.99	.000	d > a,b,c; c > a,b; b > a
Brand Name	2.76	4.79	6.33	6.68	112.75	.000	c,d > a,b; b > a
Price	5.75	5.19	6.96	7.00	201.14	.000	c,d > a,b; a > b
Service Usability	2.29	4.86	6.21	6.64	104.54	.000	c,d > a,b; b > a
Perceived Network Size	2.37	4.83	6.10	7.00	110.01	.000	d > a,b,c; c > a,b; b > a
Perceived Complementarity	2.53	4.71	6.11	7.00	100.05	.000	d > a,b,c; c > a,b; b > a
Privacy Concern	2.50	4.84	5.72	6.55	65.11	.000	d > a,b,c; c > a,b; b > a

The post hoc analysis using the Hochberg GT2 test revealed significant contrasts among educational groups regarding their perceptions of smart home systems. Postgraduate degree holders exhibited the highest perceptions of value, benefits, design, perceived network size, perceived complementarity, and privacy concerns compared to other groups. These perceptions were also higher among undergraduate

degree holders than among high school graduates and those with lower education levels, while high school graduates scored higher than individuals with lower education. Similarly, both undergraduate and postgraduate degree holders perceived greater risks, brand significance, and perceived service usability compared to other groups, with high school graduates also scoring higher than those with lower education levels. These findings suggest that higher education levels are associated with a more analytical and comprehensive evaluation of smart home technologies, where individuals recognize both the potential advantages and risks.

Additionally, functionality was a critical preference factor, with significantly higher ratings among the undergraduate and postgraduate participants compared to the others. Moreover, postgraduates demonstrated stronger functionality preferences than high school graduates and those with lower education levels, while high school graduates also preferred functionality more than the lowest education group. A similar pattern was observed for price preferences, where undergraduate and postgraduate participants displayed significantly higher price sensitivity, yet individuals with lower education levels exhibited stronger price preferences than high school graduates. This suggests that while higher-educated consumers evaluate smart home systems based on their technological benefits, lower-educated consumers may focus more on cost-effectiveness and affordability when making purchasing decisions. These findings highlight that education level plays a crucial role in shaping consumer perceptions and adoption tendencies regarding smart home systems.

Based on these findings, since notable differences were observed in participants' attitudes toward smart homes across all aspects, contingent on their educational background ($p < 0,05$), the hypothesis "H4: Consumers' preferences for smart home systems significantly differ by education level" is supported.

Marital Status

An independent samples t-test was conducted to examine whether there was a significant difference between these groups in their approach to smart homes. The marital status groups consisted of 248 married and 308 single participants. The findings are presented in Table 7. The findings are presented in Table 7.

Table 7

Comparison of Scale Scores by Marital Status

Dimension	Married (Mean)	Single (Mean)	t	p
Adoption Intention	5.64	4.12	12.38	.000
Perceived Value	5.78	4.11	14.04	.000
Perceived Benefit	6.55	4.11	33.95	.000
Perceived Risk	6.03	4.17	15.61	.000
Functionality	6.24	4.22	21.25	.000
Design	6.15	4.25	15.78	.000
Brand Name	6.25	4.11	21.86	.000
Price	6.60	5.01	27.07	.000
Service Usability	6.17	4.14	17.01	.000
Perceived Network Size	6.12	4.15	17.02	.000
Perceived Complementarity	6.11	4.03	17.87	.000
Privacy Concern	5.87	4.18	13.45	.000

As shown in Table 7, all the score types examined for consumers' adoption of smart homes significantly differ by marital status (p < 0,05). In other words, married and single individuals exhibit different approaches to all the features of smart homes. When examining the means, it is seen that the averages for married individuals are higher than for singles in all sub-dimensions. Accordingly, it can be said that the preferences of married individuals are significantly more pronounced than those of singles in all sub-dimensions. Married individuals adopt smart homes more, perceiving more value, benefit, risk, functionality, and usability. Additionally, design, brand name, price, network size, complementarity, and privacy concerns are more dominant preference factors for married individuals compared to singles.

Based on these findings, the hypothesis "H5: Consumers' preferences for smart home systems significantly differ by marital status" has been accepted.

Income Level

A one-way ANOVA was conducted to examine whether there was a significant difference between participants' approaches to smart homes by income level. The findings are presented in Table 8. In this table, a represents individuals with an income of less than 10.000 (n=166), b represents those earning between 10.000 and 19.999 (n=212), and c represents those with an income of 20.000 or more (n=178), with these groups used in post-hoc comparisons to indicate statistically significant differences. Accordingly, participants' approaches to smart homes significantly differed by income level in all sub-dimensions (p < .05). When examining the means, it is generally observed that the scores increase with the increase in income level. However, to determine between which income levels the differences exist, Hochberg's GT2 post hoc test was used for comparisons.

Table 8

Comparison of Scale Scores by Income Level (TL)

Dimension	<10.000 (Mean)	10.000-19.999 (Mean)	20.000+ (Mean)	F	p	Difference
Adoption Intention	3.31	5.37	5.50	154.33	0.000	b,c > a
Perceived Value	3.32	5.21	5.86	190.57	0.000	b,c > a
Perceived Benefit	3.28	5.38	6.76	1335.90	0.000	b,c > a
Perceived Risk	3.29	5.38	6.15	254.32	0.000	b,c > a
Functionality	3.40	5.46	6.34	418.69	0.000	b,c > a
Design	3.41	5.49	6.21	230.49	0.000	b,c > a
Brand Name	3.50	5.22	6.35	276.90	0.000	b,c > a
Price	4.75	5.55	6.84	420.77	0.000	b,c > a
Service Usability	3.33	5.39	6.23	242.82	0.000	b,c > a
Perceived Network Size	3.30	5.40	6.20	267.34	0.000	b,c > a
Perceived Complementarity	3.39	5.15	6.20	206.30	0.000	b,c > a
Privacy Concern	3.30	5.45	5.85	187.17	0.000	b,c > a

The results indicate that income level has a significant impact on consumers' perceptions and preferences regarding smart home systems, as all dimensions show statistically significant differences (p = 0,000) across the income groups.

The findings indicate that income level plays a significant role in shaping consumers' perceptions and adoption intentions regarding smart home systems. Consumers in the highest income group (20.000+)

consistently reported the highest mean scores across all dimensions, suggesting that they perceive smart home systems as more valuable, beneficial, and reliable. The most pronounced differences between income groups were observed in Perceived Benefit (F = 1335,90), Functionality (F = 418,69), and Price (F = 420,77), highlighting that individuals with higher incomes not only recognize greater advantages in these technologies but also find them more functional and are more willing to invest in them despite their cost. This pattern suggests that financial capacity significantly influences adoption decisions, as higher-income consumers are better positioned to assess both the functional and financial aspects of smart home systems.

In contrast, consumers in the middle-income group (10.000-19.999) scored significantly higher than those in the lowest income group (<10.000) across all dimensions but still remained below the highest income group. This finding suggests that while middle-income consumers recognize the benefits of smart home systems, their perceptions are not as strong or developed as those in the highest income category. Meanwhile, the lowest income group consistently reported the lowest mean scores across all dimensions, indicating that financial constraints negatively impact the adoption intention, perceived value, and perceived usability of smart home technologies. These individuals may perceive smart home systems as less accessible or unnecessary luxuries, making affordability a primary barrier to adoption. Overall, the results confirm that income level is a key determinant of consumer preferences, with higher-income individuals perceiving smart home technologies as more valuable, usable, and trustworthy, while lower-income individuals exhibit significantly lower interest and confidence in adopting these innovations.

Based on the findings, the hypothesis "H6: Factors influencing consumers' preferences for smart home systems significantly differ by income level" has been accepted.

Discussion and Conclusion

The purpose of this study was to identify the essential aspects that strongly shape consumers' acceptance of smart home systems in Türkiye, a developing and vibrant digitally evolving market. Recently, there has been a surge in the use of smart technology in daily life and shifting consumer expectations for technologies that increase convenience, safety, and efficiency, among others, leading to increased interest in smart homes. However, understanding the processes shaping consumer adoption behavior remains a relevant issue, particularly in developing economies where socio-economic and cultural contexts are likely to shape technology usage behaviors. In this domain, the study provides valuable insights into how consumers adopt smart home systems in Türkiye based on an amalgamation of various technological and socio-demographic factors while yielding important implications for both theory and practice in good faith.

The investigation illustrated that the general adoption of smart home systems was somewhat above the mean. This indicates a favorable disposition toward smart home technologies, but still demonstrates an area for growth. The investigation identified three factors: price, perceived benefit, and functionality as significantly important. Specifically focusing on price, it related positively toward adoption, which indicated that the learner has sensitivity to the subjective financial cost associated with smart home systems. Similarly, the perceived benefits to the user, particularly the convenience, and limiting access to the home were beneficial to the user, and energy efficiency; functionality were other significant dimensions extending to shaping consumer behaviors. Considering all these elements, the study suggested that consumers valued the practical, life-improving, and value-unitizing aspects of smart home systems, specifically concerning decent brands providing the practical parts. In addition to this, the study was also able to identify practical functionality and ease of use as significant determinants of adoption; consumers generally preferred

systems providing user-friendly, reliable, and accessible features that assist with daily life tasks and reduce technology use complexity. Another key finding was that consumers generally possess a positive perception of privacy aspects related to smart home systems; perceiving these technologies as safe with respect to their personal data, opening to assist with routine, and valuable life improvements.

Another significant contribution of this study was with respect to the socio-demographic variables, including marital status and income level, which previous studies have generally avoided. The findings revealed that these aspects are key components of consumers' access to the technology, and more importantly, whether to purchase them. This observation was consistent with the view of Van Dijk (2020), who indicated that socio-economic inequalities—the digital divide—could limit consumers' access to technological solutions. In this sense, the current study implied more inclusion strategies to reach broader or alternative segments of consumers to use smart home technologies when purchasing based on socio-demographic elements.

Another area of interest was the relationships between adoption-related factors, which were not solitary but strongly mutually connected. All adoption-related factors were found to have a strong positive correlation, indicating that consumers evaluating or perceiving smart home systems was a complete package with multiple dimensions simultaneously. Moreover, the study suggested that an improvement in one area, i.e., design or functionality, was strongly likely to reflect a positive indication with other areas, i.e., usability, privacy, or perceived value. Finally, the study provides compelling evidence that consumers' adoption tendencies toward smart home systems vary significantly based on gender, age, education level, marital status, and income level. These demographic variables were found to meaningfully differentiate consumer perceptions and adoption behaviors across all examined factors. This result reinforces the importance of developing differentiated marketing and design strategies that consider the diverse needs, preferences, and expectations of various consumer segments.

The outcomes of this research offer valuable perspectives regarding the variables that impact consumer adoption of smart home systems and yield significant contributions to the monitoring of relevant systems in theory and practice. Consistent with previous literature (Gu et al., 2019; Hsu & Lin, 2016; Kim et al., 2007) and the Technology Acceptance Model (TAM), perceived benefit, perceived risk, functionality, and price appeared to be the most significant variables influencing adoption behavior. Among these four, price was the most significant indicator and supported previous findings regarding consumers' price sensitivity (Teng & Lu, 2009; Yu et al., 2017), particularly in emerging markets.

The significant role impacts of perceived benefit also provides further support for Wong & Leung (2016) and Hsu & Lin (2016), in that consumers' perceptions of increased convenience, efficiency, and security contribute considerably to their evaluation of the adoption of smart home systems. Furthermore, functionality, ease-of-use, and usability were also important predictors of adoption and were consistent with Ziamou & Ratneshwar, (2002) and Van der Heijden (2004) studies.

Significantly, all the variables showed strong and statistically significant relationships. This finding is important because it highlights that consumers are likely to make holistic consumer evaluations regarding smart home systems, which is consistent with Yang et al. (2017) and the reported synergistic nature of system usability, trust, and perceived value.

A further theoretical contribution of this study is that it illustrated that socio-demographic characteristics are also important moderator variables that shape consumer attitudes toward smart home systems. The socio-demographic differences that were found, for gender, age, education, marital status, and income

differences, extend previous literature (Shin et al., 2018; Wei et al., 2019), which has largely disregarded the moderator role of these variables in the smart technology context. Female consumers had significantly higher adoption intention and rated all dimensions of adoption more positively than males. These results align with findings by Shin et al. (2018) and Nikou (2019), who found that females show more sensitivity toward emotional and experiential values when adopting new technologies.

Older adults demonstrated increased perceived benefit, brand sensitivity, and price sensitivity, supporting prior research (Baek et al., 2022; Demiris et al., 2004). Moreover, older adults' higher perceived risks were aligned with assertions by Pal et al., (2018), who observed that privacy and security are particularly important to elderly users.

Educational level had a positive and statistically significant effect on all adoption factors, corroborating Baudier & Ammi (2020) and Shin et al. (2018) that education heightens users' ability to assess opportunities and risks associated with new technologies.

An important finding from this study indicates that married participants reported significantly greater adoption intentions and perceptions across all factors compared with single participants. In part, this supports the literature (Al-Husamiyah & Al-Bashayreh, 2022), suggesting that family-oriented consumers probably viewed functionality, security, and usability as more important as they considered the wider implications of smart home systems for all family members.

Income level significantly differed in adoption behavior. Higher income consumers rated smart home systems as more beneficial, valuable, and functional, despite the greater expense, which aligns with Hubert et al. (2020). Although income did not completely align with previous research and findings. Yang et al. (2017) and Shin et al. (2018)) that state income may influence user perceptions indirectly in various contexts.

While privacy was an important concern among participants, it was not the most important factor in their intention to adopt. However, concern for privacy did emerge as a statistically significant factor in their intention to adopt, a finding that is consistent with the concerns expressed by Nepomuceno et al. (2014) and Yang et al. (2015), indicating that privacy/security is a concern when adopting technology on platforms. Moreover, perceived service usability, perceived network size, and perceived complementarity appear to support the conclusions of Hong and Tam (2006) and Lin and Lu (2011) that platform-related factors are important in the decision-making process of consumers.

Although these findings provide valuable insights into the adoption of smart home systems, there are some limitations. First, this study was conducted in a geographically defined country (Türkiye), limiting the study sample to consumers in that country. Thus, the findings may not be generalizable to other geographic or cultural contexts. Future studies might expand the scope of this study, including consumers from different countries or regions, to understand the implementation and adoption of smart home systems in comparative contexts, including possible cultural influences on adoption.

Second, the study used a cross-sectional research design where consumer perceptions were obtained at one point in time; however, technology adoption is a potential evolving process; therefore, consumer perceptions and behaviors may change. Longitudinal research designs can further examine how consumer attitudes, perceptions of service usability, perceived network size, and perceived complementarity evolve as technologies become more accessible and frequently adopted.

Third, the data were obtained through a self-reported questionnaire. There is a potential for common method bias and social desirability bias, meaning that participants may not have responded in the way

they intended and rather provided socially desirable answers to the questions posed rather than answering based on their own behaviors or beliefs. Using other methods of data collection can help address this shortcoming.

Finally, while the study focused on some aspects of the Technology Acceptance Model (TAM) in assessing smart home systems, there are other variables that have been studied together with TAM factors, for example, trust as a protective factor, technology anxiety, perceived innovativeness, or environmental concern —one or all of which could provide a fuller understanding of consumer adoption behaviors. In particular, examining the psychological or contextual factors that impact consumers in their decision-making may provide deeper insight into consumers' processes of adopting smart home technologies.

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