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Exploring Smart Home Mobile Apps Market: A Topic Modeling Approach to Mobile App

Akıllı Ev Mobil Uygulamaları Pazarını Keşfetmek: Mobil Uygulama Değerlendirmeleri Üzerinde Bir Konu Modelleme Yaklaşımı

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ABSTRACT

Today's consumers have been experiencing new technologies in recent years with the intensive use of mobile devices and technology. Smart home technologies, one of the recent decades' technologies, facilitate consumers' home lives and create different research contexts for consumer research. Smart home technologies containing various devices and sensors can be used through mobile applications and consumer experience is crucial for understanding the marketplace. The study examining the context of smart home mobile apps aims to identify the topics covered in user reviews of smart home mobile apps. For this purpose, topic modeling methodology through BERTopic transformer-based model is employed in the study and 15.157 user reviews regarding 35 mobile apps in Google Play store are used as study sample. Individual topics detected in topic modeling are grouped into eight main topics (brand/model mention, feature, functionality, products/devices, service experience, user experience, user feedback, user interface). The topics concluded in the study help understanding of smart home mobile apps market and the study extends the eWOM concept by smart home mobile applications context.

JEL Codes: M30, M31
Keywords: Smart home, Digital marketing, Mobile application, User reviews, Word of mouth

ÖZ

Günümüz tüketicileri son yıllarda mobil cihazların ve teknolojinin yoğun kullanımıyla birlikte yeni teknolojilerle tanışmaktadır. Son on yılların teknolojilerinden biri olan akıllı ev teknolojileri, tüketicilerin ev yaşamlarını kolaylaştırmakta ve tüketici araştırmaları için farklı araştırma bağlamları oluşturmaktadır. Çeşitli cihaz ve sensörleri bünyesinde barındıran akıllı ev teknolojileri, mobil uygulamalar aracılığıyla kullanılabilmektedir ve tüketici deneyimi pazarı anlamak için büyük önem taşımaktadır. Akıllı ev mobil uygulamaları bağlamını inceleyen bu çalışma, akıllı ev mobil uygulamalarına ilişkin kullanıcı yorumlarında yer alan konuları keşfetmeyi amaçlamaktadır. Bu amaçla çalışmada BERTopic dönüştürücü tabanlı konu modelleme metodolojisi kullanılmış ve Google Play mağazasında 35 mobil uygulamayla ilgili yazılmış 15.157 kullanıcı yorumu çalışma örneklemi olarak kullanılmıştır. Konu modellemesinde tespit edilen tekli konular sekiz ana konu grubunda (marka / model bahsi, özellik, işlevsellik, ürünler / cihazlar, hizmet deneyimi, kullanıcı deneyimi, kullanıcı geri bildirimi ve kullanıcı arayüzü) toplanmıştır. Çalışmada tespit edilen konular, akıllı ev mobil uygulamaları pazarının anlaşılmasına yardımcı olmaktadır ve çalışma, elektronik kulaktan kulağa pazarlama kuramını akıllı ev mobil uygulamaları bağlamında genişletmektedir.

JEL Kodları: M30, M31
Anahtar Kelimeler: Akıllı ev, Dijital pazarlama, Mobil uygulama, Kullanıcı değerlendirmeleri, Kulaktan kulağa pazarlama

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Introduction

The use of smart home systems for today's consumers is increasing over time. Smart home systems, which offer a comprehensive consumer experience where different types of devices interact with each other, are one of the areas that will maintain their potential in the coming years. Understanding how smart home systems serving consumers in different contexts are accepted/adopted in the market is essential for marketing decision-makers. At this stage, consumer feedback must be processed to obtain market insights.

Previous studies on smart homes/smart home systems examine the context with various aspects such as user acceptance (Hubert et al., 2019; Shuhaiber & Mashal, 2019; Yang et al., 2017), benefits and barriers (Hong et al., 2020; Nascimento et al., 2023), customer purchase intention (Nilashi et al., 2022) and companionship with smart home devices (Lee et al., 2017). Since there are a few studies on mobile app contexts, this study aims to examine the context of smart home mobile apps.

The research questions refer to:

i) What are the overall evaluations of users in the context?

ii) What are the topics included in the user reviews?

iii) What are the topic groups included in user reviews?

Consistent with the research aim, the study retrieves online review data from the Google Play Store (Google, 2024a) and employs the BERTopic (Grootendorst, 2022) topic modeling methodology to extract topics from the user reviews. The topic modeling approach examines text data to discover underlying topics within the text, focusing on the content itself. In this study, online reviews from the Google Play Store are used as the text content for a topic modeling approach. An examination of 15,157 reviews from 35 mobile apps, conducted using the topic modeling methodology, yields 104 individual topics grouped into eight topic groups. The study begins with a literature review section that focuses on smart home technologies, continues with a data and methodology section that covers the details of data collection and analysis, presents the results and concludes with a conclusion and recommendations section.

Literature Review

One area of technology that significantly influences the daily lives of today's consumers in many ways is the consumer's home environment and the devices and systems they use within it. The concept of "home," which can traditionally be expressed as the environment in which one lives and the time spent there, has become one of the areas affected by the impact of technology. Smart home as one of the fields that technological advances affect consumers' individual lives is defined as "*a residence equipped with computing and information technology which anticipates and responds to the needs of the occupants, working to promote their comfort, convenience, security and entertainment through the management of technology within the home and connections to the world beyond*" (Aldrich, 2003). The technological concept underlying smart homes can be better understood by examining the individual components of smart homes. According to Balta-Ozkan et al. (2013), there are four key characteristics of smart homes: a communication network that enables devices to communicate with each other, intelligent controls that manage the system, sensors that collect information and smart features that respond to information from sensors/user instructions/or system providers. When evaluated based on four characteristics, the smart home concept, which encompasses a comprehensive technological system, is identified in consumer research as one of the areas where today's consumers are significantly influenced by technology.

As the smart home concept has a comprehensive nature, evaluation of categories in the smart home is crucial for understanding the sub-components. According to De Silva et al. (2012), there are three major application categories for smart home types: providing services to residents by recognizing and detecting residents' actions and health conditions, storing and retrieving of multimedia content in smart home, surveillance-purposed protecting of home from burglary, theft and natural disasters. They also add a fourth type, energy management to their study. These categories signal the smart home market's usage across various industries and contexts. For example, the first category is primarily related to healthcare and the elderly segment of the population can be a more relevant target group. The second category is related to daily life and the third category focuses on security. On the other hand, Marikyan et al. (2019) present the services and enabling technologies into five categories as comfort, monitoring, health therapy, support and consultancy in their study, which reviews the smart home literature. The smart home concept offers a wide variety of consumer

behavior contexts, offering a broad scope of services.

The consumer side of the smart home concept can be examined through its benefits and adoption. On the benefits side, according to Marikyan et al. (2019), the user benefits of smart homes can be grouped into five categories: health-related, environmental, financial and psychological benefits. For the adoption side, dual perspectives as drivers and barriers can be used to understand consumer behavior. Li et al. (2021) examine the smart home concept through a systematic literature review and present a conceptual framework that encompasses motivators such as energy efficiency, utility cost savings, quality of life enhancement, better home-based healthcare services, social status or prestige and technology savviness. These motivations can serve as drivers of smart home adoption for consumers. On the other side, Li et al. (2021) also highlight the barriers of smart home adoption as: distrust and adoption resistance, negative perception regarding smart home, financial concerns, privacy and security concerns as perceived risks and technology anxiety. These barriers represent the negative / obstacle side of smart homes regarding consumer behavior. The user side of smart home research contributes to understanding of the adoption and usage of smart home in the market. In this context, user experience (UX) is a multidimensional concept encompassing all interaction processes individuals establish with a product, service or system -especially with digital solutions such as smart home technologies. This experience is not limited to the moment of using the technology. Still, it includes a wide range of time and emotional-cognitive reactions, from pre-use expectations to the perception of functionality during the use process and post-use evaluations. Elements such as the intuitive controllability of smart thermostats, the sense of security provided by security cameras or the ease of interaction with voice assistants directly shape the user experience (Coşkun & Atesgoz, 2020, p. 116). Today, with the acceleration of digitalization, the use rate of smart home technologies is also increasing and the satisfaction arising from the experiences with these technologies is on the agenda (Anderson & Srinivasan, 2003, p. 125). This level of satisfaction results from individuals' interactions with technological systems; It emerges as a personal assessment of the extent to which one's needs, expectations and goals for quality of life are met (Eriksson & Nillson, 2007, p. 159).

With the integration of mobile and digital services into every aspect of life, the service quality provided in smart home technologies has become one of the basic elements determining user satisfaction. In this context, service quality in smart home systems is not limited to the product's functionality alone, but also includes a holistic evaluation of the system's installation, controllability via mobile application, technical support processes and post-use services (Santos, 2003). In other words, mobile service quality is directly related to how effective and user-friendly all digital interactions of smart home users are, starting from the product supply to the usage process and resolving possible problems (Zeithaml et al., 2000). The sustainability of this digital interaction process is primarily shaped by users' trust in the system provider. In smart home technologies, trust is evaluated as the sum of the user's subjective beliefs that the system provider will fulfill its commitments, protect personal data and intervene promptly in problems it encounters (Kim et al., 2008). This trust that the user has in the service provider forms the basis of the long-term relationship between the user and technology by reducing perceived digital risks and uncertainties (Gefen, 2000).

The consumer side of the smart home concept is examined through several theories, including the Theory of Planned Behavior, the Technology Acceptance Model and the Diffusion of Innovations. Yang et al. (2017) examine the acceptance of smart home services using the theory of planned behavior in their study and conclude that the factors affecting the adoption of smart home services include mobility, security/privacy risk and trust in the service provider. Shuhaiber and Mashal (2019) focus on the acceptance of smart homes in Jordan by employing the Technology Acceptance Model. They conclude that the factors affecting attitude towards smart homes are trust, awareness, enjoyment, perceived usefulness and perceived ease of use. Additionally, they find that attitude towards smart homes also influences intention to use smart homes. Vrain and Wilson (2021) employ diffusion of innovation theory in their study, which examines the adoption and non-adoption of energy-saving smart home technologies. In addition to these studies, multiple theories can be combined in a single study. For example, Hubert et al. (2019) employ the technology acceptance model, innovation diffusion theory and risk theory in the same study that examines the acceptance and adoption drivers for smart home usage.

According to Allsop et al. (2007), word of mouth (WOM) relies on unfiltered communication between users, due to the non-commercial nature of this communication. As a result, word-of-mouth communication is perceived as

more credible than marketer-initiated communication. The electronic version of WOM, also known as electronic word of mouth (eWOM), offers market insights through the online data available on the web, such as online reviews. According to Netzer et al. (2012), consumer discussions and the topics they write about in a category can be used by companies to gather information about online discussions and marketing opportunities, market structure and competitive landscape, as well as product features of companies and their competitors. From this point of view, employing user reviews on online platforms for marketing research can contribute to an understanding of the smart home market. This study utilizes online reviews as its data source and extends the eWOM theory to the smart home context.

Material and Methods

Online reviews, defined as "*peer-generated product evaluations posted on company or third party websites*" (Mudambi & Schuff, 2010), provide valuable insights for decision-makers regarding customer and marketing perspectives. Online reviews contain both numerical ratings and open-ended text elements as review texts. As Zhao (2021) points out, the information included in text-based comments is greater than the information included in numerical rating-type data. Since the text messages contain various components, such as entity names, brand names and positive/negative evaluations, the task of today's brands is to identify relevant data sources on the web for their markets and employ the appropriate methodologies to make sense of online reviews.

Mobile app markets provide consumer feedback information about mobile apps on the web and the Google Play Store (Google, 2024a), as one of the popular mobile app markets is selected as the platform for the sample apps. The categories or the descriptive information regarding the apps can help detect the mobile apps in specific markets. This study utilizes the Google Play Store as the source of app samples and employs search queries to identify the study sample. The study employs the Python programming language (Van Rossum & Drake Jr., 1995) on the Google Colab platform (Google, 2024b) for data collection and analysis. The data collection stage uses a code package titled "Google-Play-Scraper" (Mingyu, 2024) for retrieving the user reviews from Google Play Store. The specific search function in the code package is used to prepare the sample list for the study. Two search queries are used and the retrieved results are combined to have the sample list. The search parameters are set to the English language (lang="en"), the U.S. market (country="us") and keywords related to "smart home" and "home automation". Only two main keywords are selected and additional keywords (such as energy security, home security) are not used in the sample. As a result, a total of 35 apps are listed as the sample of apps for the study. Following the app sample decision, the reviews are retrieved using the following parameters: English language reviews (lang='en'), U.S. market reviews (country='us') and most relevant reviews (sort=Sort.MOST_RELEVANT). Data collection took place on 25.10.2024.

Consistent with the text-based nature of review data, the topic modeling methodology is employed in the study. According to Blei (2012), topic modeling algorithms refer to statistical methods that enable the analysis of text, the discovery of themes within the text, how these themes connect to each other and how they change over time. It examines the text using statistical approaches to identify the topics included within it. The traditional topic modeling approach relies on a bag-of-words approach, which ignores information from word orderings (Alghamdi & Alfalqi, 2015). As methodologies advance over time with the help of new technologies, methodologies that evaluate text contexts emerge in scientific research. For example, language representation models such as BERT (Devlin, 2018) are introduced. This study uses BERTopic (Grootendorst, 2022) methodology, which uses clustering techniques and a variation of TF-IDF to generate consistent topic representations, to discover the topics in the app reviews.

BERTopic (Grootendorst, 2022) examines the text and extracts the topics with count, representative words and representative docs information. No pre-processing tasks are implemented, as transformer-based models can handle contextual nuances. A sample topic value is presented in Table 1. In the analysis stage, individual topics detected by BERTopic (Grootendorst, 2022) were evaluated through the naming stage and grouped into topic groups.

Table 1.

Sample Topic Result in Topic Modeling

Count	Name	Representation	Representative_Docs
513	0_alexa_echo_music_amazon	['alexa', 'echo', 'music', 'amazon', 'with', 'to', 'she', 'play', 'and', 'devices']	["*Alexa has gotten difficult to work with when trying to link other services such as Big Sky and Wyze Smart cameras, everything was great a year ago, I guess Google did an upgrade and it's not working with Alexa to link devices with Alexa via Android. Everything else is great with Alexa , but how frustrating it's been trying to link other devices and accounts with Alexa. Shopping great....and the smart devices from Amazon. BUT WHEN IT COMES TO LINKING DEVICES FORGET ABOUT IT!*", *'After this last update, when I try to play amazon music through alexa app on my phone there is no music. This is only happening when trying to play from the alexa app on my phone (through phone speaker, echo buds and echo auto) Amazon music plays fine through my other alexa devices (echo dot, etc.) This seems to be an issue with the newest update and Android phones on Android 12 or later. I reinstalled the app twice and was able to get it to work, but after an hour it stopped playing again.'*, *"It works great but when it's connected to Alexa it does not give you the option to say (alexa turn off) you can only say (alexa turn on) need to update that"*]

Results

The data collection stage resulted in a wide range of smart home / home automation mobile apps (35 apps) and data collection query with "Most Relevant" 500 reviews ended up with 500 reviews for each app. However, some of the mobile apps had less than 500 reviews for the criteria and the final study sample consists of 15.157 reviews. Mobile app names and review volume for each app are listed in Table 2.

Table 2.

Study Sample Details

Name	N	Name	N	Name	N
AlfredCamera Home Security app	500	LG ThinQ	500	SmartHome	500
Amazon Alexa	500	Mi Home	500	SmartHome (MSmartHome)	500
Aqara Home	292	Nest	500	SmartRent	500
Blink Home Monitor	500	ORVIBO Home	500	SmartThings	500
FRITZ!App Smart Home	51	Philips Hue	500	TP-Link Tapo	500
Google Home	500	Progress Smart Home	73	Tuya Smart	500
Govee Home	500	Resideo - Smart Home	500	Vivint	500
Home Assistant	500	Ring - Always Home	500	Wyze - Make Your Home Smarter	500
Homey — A better smart home	208	Roku Smart Home	500	eWeLink - Smart Home	500
IFTTT - Automate work and home	500	Smart Home Collection	19	myQ Garage & Access Control	500
IKEA Home smart	375	Smart Home Manager	500	Умный Дом.ру	139
Kasa Smart	500	Smart Life - Smart Living	500	Total	15.157

Before examining the application comments in the context of Smart Home using topic modeling, it can be helpful to evaluate the overview in terms of rating scores. For this purpose, Figure 1 shows the distribution of rating scores in the comments and Figure 2 lists the average rating score values for each application.

Figure 1.

Rating Score Distribution

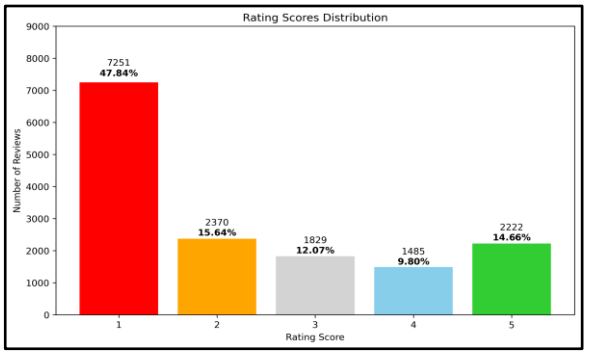

Figure 1 presents a skewed left distribution regarding rating scores, with more than 60% of reviews on the negative side (47.84% for 1-star ratings and 15.64% for 2-star ratings). The majority of the reviews (7,251 reviews) contain 1-star rating scores, while 12.07% of reviews

represent neutrality with 3-star rating scores and less than 25% of reviews represent the positive side through 4- and 5-star ratings. Following the overall distribution, evaluating the apps by average rating scores can be helpful to examine the context.

Figure 2.

Correlation Between Rating Score and Review Length

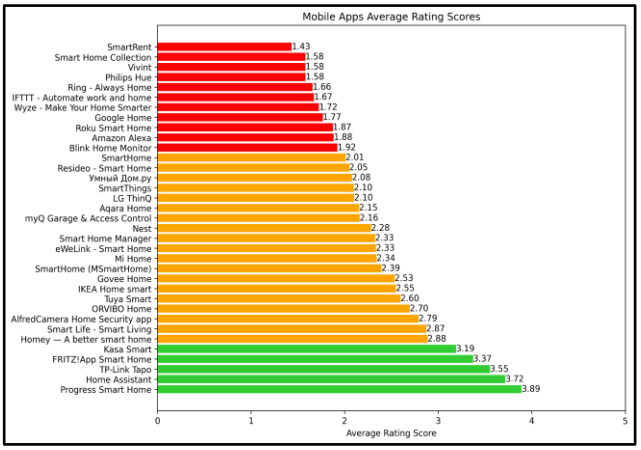

Figure 2, which presents the average scores for individual apps, indicates a minimum average rating score of 1.43 and a maximum average rating score of 3.89. The average rating scores in the graph are divided into three categories by three colors: the red category for apps with average rating scores below 2, the orange category for apps with average rating scores between 2 and 3 and the green category for apps with average rating scores higher than 3. It is found that most apps are categorized as red or orange. “Kasa Smart”, “FRITZ!App Smart Home”, “Home Assistant” and “Progress Smart Home” are the apps with the highest average rating scores. Since the distribution in Figure 1 and the categories in Figure 2 present an unbalanced distribution, the topic modeling methodology implemented on the text content can identify the topics included in the reviews, which can lead to the discovery of topics for informed marketing decisions.

Following the individual examination of extracted topics, the topics are named by author through representative keywords. Then they are combined into topic groups based on their content coherence. Table 3 presents the topics and topic groups in the user reviews.

Table 3.

Topics Groups and Individual Topics

Brand / Model Mention					
Brand Mention	Company Decision Regarding Integrating / Scope of App	Device/Brand Mention	Platform Mention	Specific Model/Product Mention	
Feature					
Alarm	Automation	Camera Picture Quality	Color Options / Names & Color Wheel	Coloring of Lights/Leds	Data & Graph Issue
Energy Monitoring	Geofence	Group Functionality for Bulbs	Hub Connection Problems	Integration of Devices	Live View
Location Information	Motion Detection & Motion Notification	Motion Detection & Recording Setting	Motion Detection Sensitivity	Multi View for Cameras	Notification Sound
Notification to Other Device	Pairing with Device	Pet Feeding	Photos Feature in Frame App/Device	Presence Sensor	Router Connection
Scheduling	Specific Function of App	Sunrise / Sunset Timer Request	Temperature	Temperature Display	Thermostat Connection
Timer	Tv Remote Connection	Unlocking Feature	Video Playback	Water Leak Sensor	WiFi Controlling
Functionality					
Bluetooth Connection + Privacy	Bulk Delete Videos	Camera	Camera Connection	Camera Recording	Connection
Connectivity	Crash	Delay in Notification	Device Add / Control	Device Compatibility	Device Connection Problem
Device Finding Capability	Door Unlock Status	Incorrect Password	Interface Problem	Login and Fingerprint/Biometric	Microphone
Notification	Opening/Close Problem	Problem after Updates	Random Connection Lose	Region Compatibility	Renaming Routine Names
Slow Performance Issue	Thermostat	Timestamp on Video	URL Adress	User Interface Change	Wifi Band (5GHz)
Wifi Settings Change					

Table 3.

Topics Groups and Individual Topics (Continued)

Products / Devices					
Air Conditioner	Blind	Dehumidifier	Doorbell / Doorbell Camera	Fridge / Refrigerator Function	Garage Door Open/Opener
Lights	Smart Plug	Smart Tag	Speakers	Thermostat	Vacuum Cleaner
Washing Machine					
Service Experience					
Account Creation Requirement	Pay for Playback Videos	Praise of Previous Product/Brand	Pro Services (Non Free Services)	Pro Subscription Level Limits	Service Plan Changes
Subscription/ Pro Service After Free Service	Support Service				
User Experience					
Ads Implementation in App	Ease of Use	Login / Login Persistence	Notification Option for Never Ask Again	Usefulness	
User Feedback					
Praise	Privacy Concern	Star Evaluation Expression			
User Interface (UI)					
Dark Mode Request	Landscape Mode	Widgets			

Table 3 summarizes the results of the topic modeling methodology, including individual topics and groups of topics. There are eight topic groups, namely: brand/model mention (5 topics), feature (36 topics), functionality (31 topics), products/devices (13 topics), service experience (8 topics), user experience (5 topics), user feedback (3 topics) and user interface (3 topics). The diversity of topic groups and individual topics signals the scope of user conversations in the mobile app context, as users express different aspects in their reviews.

The most comprehensive topic groups are feature and functionality topic groups. While they cover common topics among the topic groups, the feature topic group specifically signals the smart home context in the reviews. Firstly, the feature topic group contains several usages of smart home applications such as alarm, energy monitoring, geofence and presence sensor. Evaluating the scope of services/usages in the market through reviews contributes to marketing decision-making in the smart home context. Topic modeling also concludes products/devices topic group covering the individual product/device topics and the combination of feature and products/devices topic groups can be helpful for marketing decision-making. Secondly, the functionality topic group encompasses both the typical mobile app experiences (crash, notification) and context-specific smart home experiences (device add/control, door unlock status, timestamp on video). The functionality topic group can help identify user issues and solve or improving mobile apps or services.

The Brand/Model mention topic category indicates that users are including brand, model and platform names in their user reviews. Brands like Alexa, Roku, AT&T, Nest, Telus and Chromecast are mentioned in the representative words for the topics. Brands in the smart home market can easily identify individual topics or issues related to their brands through topic modeling and they can also highlight areas of potential competitive action by examining user reviews of other competitors.

The mobile app experience is evaluated through two topic groups in the study: Service experience and user experience. User experience encompasses ad implementation in the app, ease of use, login/login presence, notification options for 'never ask again,' and overall usefulness. Even the topic category can have commonality with functionality topic group, the personal experiences indicated in user reviews can be examined separately. Service experience topic groups reflect the service structure of the smart home market, as users discuss subscription plans, plan changes and pro subscription level limits. In addition to general topics in service plans, users also mention specific actions taken by the companies. “Account creation requirement”, “pay for playback videos”, “subscription / pro service after free service” topics signal the individual actions that took place in the market. In addition to two topic groups, the user interface topic groups highlight design-related topics in the user reviews, such as requests for dark mode, landscape mode and widgets.

Conclusion and Recommendations

The study explores the landscape of smart home mobile applications by analyzing user reviews from the Google Play Store. A dataset comprising 15,157 reviews from 35 different applications was used, from which 104 distinct topics were extracted and grouped into eight main topic categories. The analysis reveals that many of these reviews are associated with low ratings (1-star and 2-star), suggesting prevalent user dissatisfaction in the early stages of adoption. Furthermore, the study identifies three primary categories of smart home mobile apps, reflecting the diversity of product offerings and user expectations in this emerging market.

In the second stage of the analysis, the identified topics are organized into broader conceptual categories, with the feature and functionality groups emerging as the most comprehensive. The feature and products/devices topic groups illustrate the broad spectrum of smart home consumption, encompassing various devices and their related functions. These findings correspond to the Task-Technology Fit (TTF) Model (Goodhue & Thompson, 1995), which emphasizes that user performance improves when the features of a technology align well with the tasks it is intended to support. Accordingly, users' focus on specific features-such as remote access, automation capabilities, or device compatibility-demonstrates their expectations for task-effective functionalities. At the same time, the topic groups focusing on functionality and service experience highlight areas where users frequently encounter issues, such as connectivity problems, app crashes, or unsatisfactory customer service. These user complaints reflect service delivery shortcomings and are conceptually aligned with the SERVQUAL model (Parasuraman et al., 1988), which assesses service quality based on reliability, responsiveness and assurance.

This study integrates multiple theoretical perspectives to explain user adoption and experience in the context of smart home mobile applications, as derived from the analysis of user reviews. One of the primary theoretical foundations is the Diffusion of Innovations Theory (Rogers, 2003), which outlines adopting new technologies across five stages: knowledge, persuasion, decision, implementation and confirmation. These stages are reflected in the study's thematic findings—user experience, service experience and user interface—which represent the multifaceted nature of user engagement with smart home apps.

Within the user experience topic group, themes such as in-app advertisements, ease of use, login systems and notification management reflect how users interact with and assess the application's utility. These themes align with the Technology Acceptance Model (TAM) (Davis et al., 1989), particularly with perceived usefulness and perceived ease of use, which are shown to be central predictors of technology adoption. For instance, users who perceive the app as easy to navigate and helpful in managing home automation tasks are more likely to adopt and continue using it.

The service experience topic group, which includes issues related to subscription plans, payment models and account creation requirements, demonstrates how perceptions of fairness, cost-effectiveness and transparency affect user attitudes. These aspects are well explained by the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1977), which argues that individual attitudes and subjective norms drive behavior. Negative experiences-such as forced upgrades or unclear subscription structures-can adversely influence users' behavioral intentions, particularly among more risk-averse segments of the adoption curve, like the early and late majority.

In addition, user interface concerns, such as requests for dark mode, landscape orientation and widget functionality, highlight users' expectations for personalization, accessibility and aesthetic experience. These features are essential during the persuasion and implementation stages of the innovation adoption process, where early adopters assess how well a product fits into their daily routines and preferences. Furthermore, the study's findings resonate with the constructs of the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). Specifically, performance expectancy corresponds with the functionality topic group, as users evaluate how well the app supports their smart home tasks. Effort expectancy is reflected in the ease of use theme, while facilitating conditions are associated with requests for interface improvements such as dark mode and landscape view. These findings suggest that user adoption is shaped by both direct performance evaluations and broader contextual and design-related factors.

The study extends the eWOM theory by evaluating the context of smart home mobile apps in the U.S. market. For the methodological side, the study uses a novel methodological approach as a transformer-based approach -BERTopic (Grootendorst, 2022)- and it contributes to a better understanding of the user

reviews. Previous studies on the smart home concept have examined the adoption and diffusion of this concept using traditional methodologies. This study extends this approach by combining online data sources as samples and the BERTopic approach (Grootendorst, 2022) as a novel methodology.

The study also contributes to the managerial/practical aspects, as the topics included reflect the user's perspective within the context. Examining the topics concluded in the study can help decision-makers understand the consumers' concerns and improve the services.

The study has limitations in terms of sample scope and methodology. As the study focuses on the U.S. market for smart home mobile apps, future research can extend the sample to other markets where smart home mobile apps are popular. Individual market evaluations and comparisons between multiple markets can be helpful to understand the research area better. The study also employs topic modeling methodology, which focuses on the content side of the user reviews. Further research can examine the emotional aspect of user reviews and utilize sentiment analysis (Canbolat & Pinarbasi, 2022) to identify sentiments in user reviews, thereby enhancing the understanding of the research area.

Hakem Değerlendirmesi: Dış bağımsız.
Yazar Katkıları: Fikir-FP; Tasarım-FP; Denetleme-FZ; Kaynaklar-FZ; Veri Toplanması ve/veya İşlemesi-FP; Analiz ve/ veya Yorum-FP; Literatür Taraması-FZ; Yazıyı Yazan-FZ; Eleştirel İnceleme-FP
Çıkar Çatışması: Yazarlar, çıkar çatışması olmadığını beyan etmiştir.
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Genişletilmiş Özet

Akıllı ev sistemlerinin günümüz tüketicileri için kullanımı zaman geçtikçe artmaktadır ve farklı cihaz türlerinin birbirleriyle etkileşime girdiği kapsamlı bir tüketici deneyimi sunan akıllı ev sistemleri, önümüzdeki yıllarda potansiyelini koruyacak alanlardan biridir. Farklı bağlamlarda tüketicilere hizmet eden akıllı ev sistemlerinin pazarda nasıl kabul edildiğini/benimsendiğini anlamak, pazarlama karar vericileri için önemlidir. Bu aşamada, pazar içgörüleri elde etmek için tüketici geri bildirimleri işlenmelidir. Bu çalışmada, mobil uygulamalar bağlamı üzerinde durulmuş ve Google Play Store (Google, 2024a) platformundaki kullanıcı değerlendirmeleri üzerinden akıllı ev sistemleri pazarında değerlendirme yapılmıştır. Çalışmanın araştırma soruları; 1) Akıllı ev sistemleri pazarında kullanıcıların genel değerlendirmeleri nasıldır?, 2) Kullanıcı değerlendirmelerinde yer alan konular nelerdir?, 3) Kullanıcı değerlendirmelerinde yer alan konu grupları nelerdir? olarak belirlenmiştir.

Çalışmanın araştırma sorularıyla uyumlu olarak, 35 mobil uygulamanın toplam 15.157 kullanıcı değerlendirmesine ulaşılmış ve BERTopic (Grootendorst, 2022) isimli konu modellemesi yöntemiyle değerlendirilmiştir. Çalışma bulgularında, öncelikle mobil uygulamaların puan değerlendirilmelerinin dağılımına yer verilmiştir. Buna göre dağılım sola çarpık bir özellik taşımakta olup, kullanıcı değerlendirmelerinin %60'ından fazlası olumsuz taraftadır (%47,84'ü 1 yıldızlı derecelendirmeler ve %15,64'ü 2 yıldızlı derecelendirmeler). Ayrıca kullanıcı değerlendirmelerinin çoğunluğu (7251 adet) 1 yıldız puanına sahipken, değerlendirmelerin %25'inden azı 4 ve 5 yıldız puanına sahip değerlendirmelerle olumlu tarafı temsil eder. Daha sonra çalışma bulgularında, her uygulamanın ortalama değerlendirme puanlarına yer verilmiş ve uygulamalar kırmızı kategori (ortalama puanı 2'nin altında olanlar), turuncu kategori (ortalama puanı 2 ile 3 arası olanlar) ve yeşil kategori (ortalama puanı 3'den yüksek olanlar) olarak listelenmiştir.

Çalışmanın temel bulgularında ise konu modelleme yöntemi sonucu tespit edilen 104 konu isimleri ve sekiz ana konu grubuna yer verilmiştir. Buna göre sekiz ana konu grubu; marka / model bahsi (5 konu), özellik (36 konu), işlevsellik (31 konu), ürünler / cihazlar (13 konu), hizmet deneyimi (8 konu), kullanıcı deneyimi (5 konu), kullanıcı geri bildirimi (3 konu) ve kullanıcı arayüzü (3 konu) olarak sıralanmıştır. En kapsamlı konu grubunun, özellik ve işlevsellik grubu olduğu tespit edilmiştir. Özellik ile ürünler/cihazlar konu grupları, akıllı ev tüketimindeki çeşitliliğinde cihazlar ve onların özellikleri üzerinden ortaya koyarken; işlevsellik konu grubu hem genel düzeydeki temaları hem de akıllı ev bağlamına özgü konuları kapsamaktadır. Özellik konu grubu, farklı özellikleri veya görevleri tanımlamak için kullanılabilir ve literatürde görev teknolojisi, uyum modelinin (Goodhue & Thompson, 1995) göstergesi olabilir. Öte yandan, işlevsellik ve hizmet deneyimi konu grupları, kullanıcıların sorun yaşayabileceği özellikleri/maddeleri yansıtabilir ve Servqual (hizmet kalitesi) konusunun (Parasuraman vd., 1988) göstergesi olabilir. Çalışma, elektronik kulaktan kulağa pazarlama kuramını akıllı ev sistemleri bağlamında ve mobil uygulamalar kapsamında genişletmektedir. Bağlamda yer alan konuların ve konu gruplarının tespit edilip değerlendirilmesi, sektörel uygulamalar için yol gösterici olabilecektir.