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THE IMPACT OF INTERNET OF THINGS (IOT) AND DIGITAL MARKETING ON CUSTOMER ENGAGEMENT IN THE EGYPTIAN REAL ESTATE INDUSTRY

Yara A. Ebeid[1], Prof. Dr. Ashraf Labib[2], Dr. Dina Elsalmy[3]

[1]MSc in Business Administration Student, Arab Academy for Science and Technology and Maritime Transport (AASTMT), yaraaliobeid862@gmail.com
[2]Dean of College of Management and Technology at Arab Academy for Science and Technology and Maritime Transport (AASTMT), dr.a.labib@gmail.com
[3]Assistant professor at Arab Academy for Science and Technology and Maritime Transport (AASTMT), dina.elsalmy@outlook.com

Abstract:
This study explores the combined impact of the Internet of Things (IoT) and digital marketing on customer engagement in the Egyptian real estate market. While previous research has focused separately on the effects of IoT or digital marketing, this research examines both variables together. Using a quantitative approach, data was collected from 396 customers, and the analysis conducted with Smart PLS software revealed a significant positive impact of IoT, particularly through smart home technologies, alongside digital marketing strategies. The findings highlight the potential of integrating these two elements to enhance customer satisfaction, deepen engagement, and provide a competitive advantage in the real estate industry, offering valuable insights for stakeholders to improve customer interactions and adapt to market trends.

Keywords: Internet of Things, IoT, Digital Marketing, Customer Engagement, Real Estate industry, Smart homes.

Biographical Notes: Yara A. Ebeid is a master's student at the Arab Academy for Science, Technology, and Maritime Transport. She graduated second in her batch with a bachelor's in Management Information Systems, earning a GPA of 3.96/4.

1. Introduction

Technological advancements, especially the Internet of Things (IoT), have revolutionised the real estate industry by improving automation, security, and energy efficiency. These innovations enhance operational efficiency, simplify property management, and offer more personalized customer experiences. As the fourth industrial revolution nears, the real estate sector is increasingly incorporating technology, with smart cities, buildings, and homes becoming integral to daily life, growing smarter and more connected over time. (Akindele et al., 2021).

In today's tech-driven era, customers are the primary focus for companies, with many using the internet to save time and access current information about products and services they trust. Alongside the Internet of Things (IoT), digital marketing has become crucial in the real estate industry, changing how properties are marketed and sold. The shift towards digital marketing has been accelerated by technological advancements and changing consumer behaviors, especially during the COVID-19 pandemic. This transformation has enabled real estate companies to reach

broader audiences, enhance customer engagement, and streamline the sales process, complementing the effects of IoT in the industry.

This research examines the impact of the Internet of Things (IoT) and digital marketing on customer engagement in the Egyptian real estate industry. IoT is measured through wireless connection and application platform, while digital marketing is assessed using eWOM and content marketing. Customer engagement is represented by satisfaction. The study explores the relationships between these variables, presenting a conceptual framework and the methodology used to collect data. The findings, along with their implications, limitations, and future research directions, are discussed in the following sections.

2. Literature Review

2.1 Internet of Things (IoT)

The Internet of Things (IoT), introduced in 1999 by Procter & Gamble, is a concept that links everyday objects with wireless sensors to facilitate communication and connectivity (Andreeva and Batueva, 2014). Defined as a "global infrastructure for the information society," IoT interconnects physical and virtual objects through evolving technologies, playing a key role in modern digital ecosystems (Samsonov et al., 2013).

IoT represents a new phase in the Internet's evolution, where networks and sensors interact under standardized protocols to benefit industries and individuals (Martynov and Syzdaltsev, 2013). In the real estate sector, IoT contributes to the management of building and device lifecycles through platforms like IoT Platform as a Service (PaaS), enhancing smart building functionality and shifting the industry's focus toward data-driven insights (IOT Dubai Pulse, 2021; Deloitte, 2021). Smart buildings, now defined by "Location, Experience, Analytics," emphasize personalized, mobile-based experiences for tenants and users.

2.1.1 Wireless Connection

The Internet of Things (IoT), cloud computing, and wireless sensor networks are crucial ICT tools for the development of smart cities, as they enable efficient communication, data exchange, and connectivity, improving urban infrastructure and service delivery (Zanella et al., 2014). Wireless communication has become essential in modern urban settings, supporting a range of applications from smart home systems to real-time data collection, and offering flexibility and scalability.

This adaptability is particularly beneficial for real estate enterprises, as it allows for better integration of systems and devices, enhancing operations, customer interactions, and providing real-time feedback, ultimately contributing to smarter urban living and improved city management (Ericsson, 2022).

2.1.2 Application Platform

Application platforms are essential for real estate professionals, supporting tasks like data management, valuations, and marketing (Sawyer et al., 1999; Babatunde & Ajayi, 2018). These platforms improve customer engagement by streamlining application development and execution (Chappell, 2011).

However, the real estate sector is still transitioning from outdated Web 1.0 solutions to more advanced technologies (Hromada, 2016). The Technology Acceptance Model (TAM) explains technology adoption through perceived usefulness and ease of use, which are key to evaluating the effectiveness of these platforms (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Davis, Bagozzi, & Warshaw, 1989).

2.2 Digital Marketing

Digital marketing refers to marketing within an automated online environment, aiming to meet customer needs effectively by using online platforms to engage potential customers (Magrath and McCormick, 2013). It enables businesses to attract consumers by providing valuable information and creating interactive, targeted communication strategies. In the real estate industry, digital marketing has revolutionised the way homebuyers and clients connect with project consultants, brokers, and agents, making it more profitable for real estate companies to reach their target audience online (Akinwamide and Bello, 2019).

One of the key advantages of digital marketing in real estate is its cost-effectiveness, offering affordable ways to connect with customers through various channels such as social media, websites, SEO, content marketing, and paid digital ads (Olukolajo et al., 2015). Digital marketing helps improve brand loyalty, boosts sales performance, provides market insights, builds new client relationships, and enhances visibility. Additionally, it allows for more targeted marketing and customization of outreach to specific customer segments, ultimately lowering marketing costs compared to traditional methods.

2.2.1 Electronic Word-of-Mouth (eWOM)

The term "electronic word of mouth" (eWOM) emerged in the mid-1990s as the internet began transforming consumer interactions (Rosario et al., 2020). eWOM refers to the online exchange of information about products or brands through social media, websites, and mobile devices (Yora et al., 2020), and can influence consumer expectations and purchasing decisions by offering both positive and negative feedback (Chen & Law, 2016).

While eWOM is a trusted source of information, businesses risk losing control over customer communications regarding their products (Chen et al., 2017). Studies have explored how experiences can impact eWOM, with some suggesting that negative eWOM can be more influential (Nam et al., 2020). Additionally, the dynamics of eWOM can be shaped by the expertise of opinion leaders and the relationships between strong and weak ties in the digital space (Ki & Kim, 2019; Koo, 2016).

2.2.2 Content Marketing

Content marketing is a strategy focused on creating and distributing valuable content to attract and engage a target audience, ultimately leading them to become consumers (Kotler & Keller, 2017). This includes various forms of content such as blogs, social media posts, videos, and e-books shared through websites and social media platforms (Fauzan et al., 2022).

The goal of content marketing is to produce relevant, timely, and consistent material to capture and retain the attention of a specific audience, influencing their consumer behavior (Chairina et al., 2020). Originating from publishing, content marketing uses engaging text, images, and videos to draw viewers to the content, a tactic now primarily employed in digital platforms (Holliman & Rowley, 2014).

2.3 Customer Engagement

Customer engagement, as understood by marketing practitioners, primarily focuses on the interactions between a company and its customers, occurring at various levels such as the brand, product, and individual service provider levels (Peppers & Rogers, 2006; Stringer, 2006). Engagement can involve physical, cognitive, and emotional involvement of customers during and after service interactions, with high engagement often associated with positive customer experiences (Baron, Harris & Davis, 1996; Bendapudi & Leone, 2003).

Additionally, customer engagement can be measured through behaviors like word-of-mouth, company assistance, and customer-to-customer interactions, with key factors such as perceived quality, service convenience, and fairness influencing its value (Ferrinadewi, 2008;

Fitriyana, 2013). The presence of a strong brand trust is also linked to better engagement outcomes, reflecting a long-term, committed relationship based on utilitarian factors (Essays, 2018).

2.3.1 Satisfaction

Customer satisfaction, a key element of market orientation, measures the gap between a client's expectations and their actual experience (Kotler, 2000). It is a critical factor for organizational success, as satisfied customers often generate positive word-of-mouth, recommend the business, and return for future services (Mulder, 2018).

To achieve this, companies must understand customer needs, anticipate feedback, and use collected data to improve offerings. Since services are intangible and can raise concerns about performance, delivering high-quality services that meet customer expectations helps alleviate these worries and fosters better interactions (Prentice, 2013).

2.4 Variables Relationships:

2.4.1 Wireless Connection and Satisfaction

Several studies examine the factors influencing customer loyalty and satisfaction in wireless communications. Reyes-Menendez et al. (2018) highlight the importance of wireless service quality, including Wi-Fi access, network reliability, and speed, in shaping customer loyalty. Chatzoglou and Gournas (2014) focus on customer perceptions of marketing strategies in the wireless telecommunications market, emphasizing pricing transparency, service reliability, and brand reputation.

Roy (2013) investigates the impact of wireless internet service quality on customer satisfaction, stressing factors such as performance, pricing, and customer support. Seo et al. (2008) explore customer retention in the mobile telecom market, identifying service quality, pricing, and competition as key influences on retention strategies.

H1: Wireless connection has a positive direct impact on Satisfaction.

2.4.2 App Platform and Satisfaction

Recent studies have examined factors affecting user satisfaction with applications. Budi Pratomo et al. (2023) found that content, accuracy, usability, and timeliness significantly impact satisfaction, while format had little effect. Similarly, their study of the "MyPertamina" app revealed the same key factors for improving user satisfaction.

Napitupulu (2023) emphasized the importance of information system and service quality in enhancing customer satisfaction. Radwan et al. (2023) identified that perceived utility, ease of use, security, and trust are crucial for smart application adoption and satisfaction, particularly in government services.

H2: Application Platform has positive direct impact on Satisfaction.

2.4.3 eWOM and Satisfaction

Research on electronic word-of-mouth (eWOM) highlights its significant role in influencing customer satisfaction, with key reasons for posting reviews including customer satisfaction, dissatisfaction, and service recovery (Dixit et al., 2019; Kim et al., 2009). eWOM communication, particularly through social media, can enhance perceived value and service performance by facilitating interaction and addressing customer concerns (Konuk, 2019; Kim et al., 2015).

Positive or negative eWOM can also impact brand image, as favorable comments can improve consumer attitudes, while negative feedback can harm the brand's reputation, ultimately affecting customer satisfaction, loyalty, and trust (Barnes, 2001; Lee et al., 2009; Aaker et al., 2007).

H3: eWOM has positive direct and indirect impact on Satisfaction.

2.4.4 Content Marketing and Satisfaction

Digital content marketing is essential for customer satisfaction, as it provides valuable, accurate information that builds trust (Rust et al., 2002; Andaç et al., 2016). It influences customer behaviour and purchasing decisions through engaging, targeted content, particularly on social media (Baltes, 2015).

Studies show that effective content marketing boosts satisfaction, especially among millennials (Memari et al., 2013), enhances user experiences, and promotes content sharing (Mathew and Soliman, 2021; Dahiya and Gayatri, 2018). Customers' satisfaction is heavily influenced by their evaluation of digital content (Majeed et al., 2020).

H4: Content Marketing has a positive direct and indirect impact on Satisfaction.

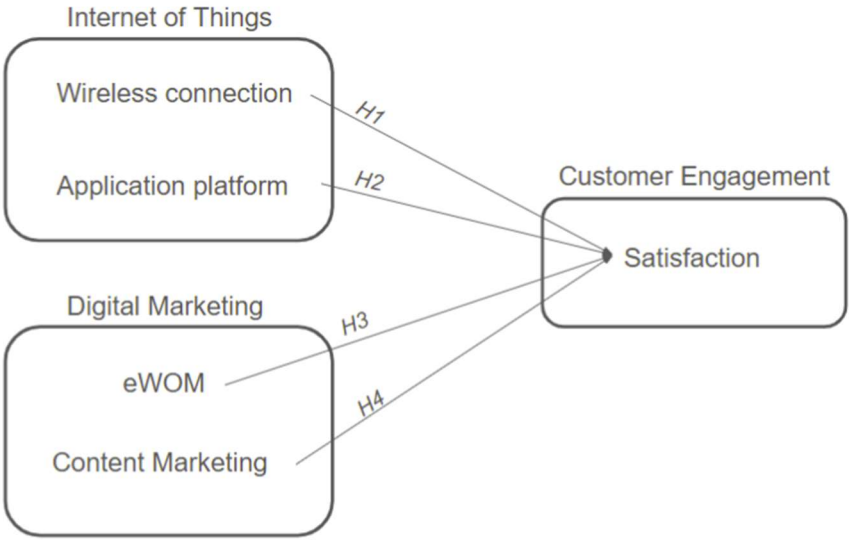

Figure 1*: The Conceptual Framework*

3. Methodology

3.1 Research design

This explanatory study aims to clarify the relationship between key variables. A quantitative approach was used, with data collected through an online questionnaire. This method allowed for the systematic analysis of the variables and provided empirical insights into their interactions.

3.2 Variables and Measurement

This research examines the impact of the Internet of Things (IoT) and Digital Marketing on customer engagement and satisfaction. IoT is measured through wireless connection and app platforms, while Digital Marketing is assessed via eWOM and content marketing. The study explores how these factors interact to enhance customer experiences in the real estate sector. By investigating these relationships, the research aims to offer insights into how technology and marketing drive customer satisfaction.

3.3 Population and Sample techniques

To ensure precision and reliability, the study applied Cochran's formula, introduced in 1942, to calculate the sample size with a 5% margin of error and 95% confidence level. This

approach accounted for population proportion, error margin, and confidence level, thereby enhancing the validity of the findings. Furthermore, a stratified random sampling method was used to ensure that various subgroups within the population were proportionally represented, adding robustness to the results.

3.4 Data Collection

A digital questionnaire was administered via Google Forms in Alexandria and Cairo. Based on Cochran's formula, 400 questionnaires were distributed, with 4 excluded, leaving 396 valid responses for analysis. The data were processed using SmartPLS, a software designed for partial least squares path modelling in variance-based structural equation modelling. Bootstrapping within Smart PLS was employed to evaluate the significance of path analysis and process coefficients. The questionnaire comprised three sections: an introductory part to select the appropriate sample, a main section covering the research variables, and a demographic section providing participant background information.

4. Data Analysis and Findings

4.1. Descriptive Statistics

The study involved surveying 392 Egyptian real estate customers, with a demographic breakdown of 58.3% female and 41.7% male respondents. The age distribution revealed that 15.2% were under 20 years old, 41.2% were between 21 and 30, 27.5% were between 31 and 40, and 16.2% were above 40. In terms of education, the majority (74.5%) held graduate degrees, while 17.2% were college students, and 8.3% had postgraduate qualifications. Geographically, the participants were mainly from Alexandria (54%) and Cairo (46%). Regarding household income, 19.4% earned less than 10,000 EGP, while 12.1% earned over 50,000 EGP, indicating a range of economic backgrounds among the respondents.

Table 1: Descriptive statistics (N=396)

Variables		**Mean**	**Standard Deviation**
Wireless connection	1	1.96	0.191
	2	1.98	0.149
	3	1.98	0.149
Application Platform	1	4.42	0.626
	2	2.07	1.162
	3	4.01	0.706
	4	3.99	0.662
	5	4.61	0.538

	6	4.63	0.582
Variables		**Mean**	**Standard Deviation**
eWOM	1	3.69	1.359
	2	3.70	1.365
	3	3.05	1.488
	4	2.75	1.608
	5	4.030	1.0811
	6	4.01	1.102
Content Marketing	1	4.33	0.808
	2	4.56	0.591
	3	3.89	0.919
	4	3.54	0.971
	5	4.28	0.820
	6	4.56	0.678
Satisfaction	1	4.51	0.634
	2	4.28	0.833
	3	4.54	0.687
	4	4.62	0.647
	5	4.78	0.476
	6	4.72	0.493

	7	4.59	0.656
	8	4.69	0.528

4.2 Reliability and Validity

This study assessed the reliability and discriminant validity of the measurement model to ensure the robustness and accuracy of the results. Reliability was evaluated using Cronbach's Alpha, which confirmed internal consistency across the variables, indicating that the items within each construct measured the same underlying concept. Discriminant validity was tested through the Fornell-Larcker Criterion, which showed that the constructs were distinct from each other, as the square root of the average variance extracted (AVE) for each construct was greater than its correlations with other constructs. Additionally, cross-loading assessments were conducted to ensure that each item loaded more strongly on its respective construct than on others, further validating the discriminant validity. Together, these evaluations confirmed that the constructs were both reliable and distinct, strengthening the study's findings.

Table 2: Reliability of Scales

Variables	**Number of Items**	**Composite Reliability**	**Cronbach's alpha**	**Average Variance Extracted (AVE)**
Wireless Connection	3	0.858	0.820	0.556
Application Platform	6	0.852	0.814	0.555
eWOM	6	0.888	0.839	0.563
Content Marketing	6	0.871	0.814	0.575
Satisfaction	8	0.917	0.895	0.582

Table 2 presents the reliability and validity measures for five variables in the study: Wireless Connection, Application Platform, eWOM, Content Marketing, and Satisfaction. It shows that all variables have a composite reliability (CR) and Cronbach's Alpha values above 0.7, indicating strong internal consistency. Additionally, the Average Variance Extracted (AVE) values for all variables are above 0.5, suggesting good convergent validity. These results demonstrate that the measurement model for all five variables is reliable and valid, confirming that the constructs are well-represented by their items and suitable for further analysis.

Table 3: Correlation

Variables	Wireless Connection	Application platform	eWOM	Content Marketing	Satisfaction
Wireless Connection	0.639	-0.012	0.017	0.234	0.148
Application platform	-0.012	0.711	0.362	0.465	0.445
eWOM	0.017	0.362	0.75	0.257	0.144
Content Marketing	0.234	0.465	0.257	0.758	0.577
Satisfaction	0.148	0.445	0.144	0.577	0.763

The correlation matrix, in table 3, reveals the relationships between various factors influencing customer satisfaction in the context of IoT and digital marketing in Egypt's real estate sector. Wireless Connection shows weak correlations with most variables, indicating it plays a minor role in customer satisfaction, except for a moderate connection with Content Marketing. Application Platform exhibits strong internal consistency (0.711) and moderate positive correlations with eWOM, Content Marketing, and Satisfaction, suggesting it is a key driver of engagement and satisfaction, especially when integrated with other strategies like digital marketing.

eWOM is strongly correlated with itself, emphasizing its role in customer engagement, but has weaker links with Satisfaction, implying that while important, it is not the sole determinant of satisfaction. Content Marketing shows a strong correlation with itself and a significant positive impact on Satisfaction, highlighting its central role in enhancing customer experiences. Finally, Satisfaction has moderate to strong positive correlations with Application Platform, Content Marketing, and Wireless Connection, indicating that these factors collectively influence satisfaction, with Content Marketing having the most consistent impact across the variables.

4.3 Model Fit

Table 4: Model fit and quality indices

Measurement	Degree	Acceptable if	Result
Average path coefficient (APC)	=0.243, P<0.001	P<=0.05	Accept
Average R-squared (ARS)	=0.499, P<0.001	P<=0.05	Accept
Average block VIF (AVIF)	=1.314	if <= 5, ideally <= 3.3	Accept
Average full collinearity VIF (AFVIF)	=1.425	if <= 5, ideally <= 3.3	Accept
R-squared contribution ratio (RSCR)	=0.978	if >= 0.9, ideally = 1	Accept

The key measurement results for evaluating the validity and reliability of the model, illustrated in table 4, showing the Average Path Coefficient (APC) of 0.243 with a p-value less than 0.001 indicates a statistically significant relationship between variables, meeting the

acceptable threshold of $P \leq 0.05$. The Average R-squared (ARS) value of 0.499, also with a p-value below 0.001, indicates a moderate model fit, which is considered acceptable. The Average Block VIF (AVIF) of 1.314 and Average Full Collinearity VIF (AFVIF) of 1.425 both fall below the threshold of 5, indicating no issues with multicollinearity. Finally, the R-squared Contribution Ratio (RSCR) of 0.978 is above the acceptable threshold of 0.9, suggesting that the model explains a significant portion of the variance. Overall, the results suggest that the model is valid and reliable for analysis.

4.4 Hypotheses Testing

Table 5: Hypotheses Testing

Hypothesis	Path	Path coefficient	P value
H1	Wireless connection => Satisfaction	0.232	0.000
H2	Application Platform=> Satisfaction	0.494	0.000
H3	eWOM=> Satisfaction	0.374	0.000
H4	Content Marketing=> Satisfaction	0.671	0.000

Table 5 presents the results of the hypotheses testing, showing the path coefficients and p-values for each relationship. For Hypothesis 1 (Wireless Connection → Satisfaction), the path coefficient is 0.232, and the p-value is 0.000, indicating a significant positive effect of wireless connection on satisfaction. Hypothesis 2 (Application Platform → Satisfaction) has a path coefficient of 0.494 with a p-value of 0.000, suggesting a strong and statistically significant positive relationship between application platforms and satisfaction. Hypothesis 3 (eWOM → Satisfaction) shows a path coefficient of 0.374 and a p-value of 0.000, also indicating a significant positive effect of electronic word-of-mouth on satisfaction. Finally, Hypothesis 4 (Content Marketing → Satisfaction) has the highest path coefficient of 0.671 and a p-value of 0.000, suggesting a very strong positive relationship between content marketing and customer satisfaction. All p-values being less than 0.05 indicate that all hypotheses are supported and statistically significant.

5. Discussion and conclusion

This study investigates the impact of the Internet of Things (IoT) and digital marketing on customer engagement and satisfaction in Egypt's real estate sector. It reveals that both IoT and digital marketing significantly enhance customer experiences by improving property functionality with smart home solutions and fostering personalized interactions through targeted marketing strategies. The research focuses on Cairo and Alexandria, where early adoption of these technologies is most prominent. These findings demonstrate that IoT and digital marketing are crucial in meeting modern consumer expectations, positioning real estate businesses to lead in a competitive market.

The results align with existing studies on the role of technology in enhancing customer satisfaction. However, they also contrast with findings from Roy (2013), who reported no significant relationship between technology and satisfaction in other industries, suggesting that industry-specific and cultural factors play a role in shaping these outcomes. Additionally, the study emphasizes the importance of electronic word-of-mouth (eWOM) in boosting engagement, in line with the work of Konuk (2019) and Kim et al. (2015). It also highlights the critical role of content

marketing, confirming findings by Baltes (2015) and Memari et al. (2013) that digital content significantly impacts customer satisfaction. Overall, the study reinforces the transformative potential of IoT and digital marketing in the real estate sector.

The integration of IoT and digital marketing in Egypt's real estate sector has proven to significantly enhance customer engagement and satisfaction, particularly in urban centers like Cairo and Alexandria. By leveraging smart home technologies and personalized marketing strategies, real estate businesses can better align with modern consumer expectations, offering improved customer experiences. The findings support existing research on the positive impact of technology on satisfaction while highlighting the importance of eWOM and content marketing in fostering customer trust and loyalty. Additionally, the study underscores the role of industry-specific and cultural factors in shaping the adoption and effectiveness of these technologies, providing important insights for future developments in the sector.

6. Contributions, Future research, and Limitations

6.1 Academic Contribution

This research explores the relationship between IoT, digital marketing, and customer engagement in Egypt's real estate sector, an area that has been underexplored in developing economies. It highlights how emerging technologies can drive customer-centric strategies in a traditionally conservative industry. By integrating established theories of customer satisfaction, engagement, and technology adoption into a model tailored to Egypt's market, the study provides insights into the early adoption of IoT. Additionally, it examines the role of digital marketing in enhancing customer satisfaction, contributing to the broader understanding of technology and marketing adoption in emerging markets.

6.2 Practical Contribution

The study emphasized the role of IoT and digital marketing in improving customer engagement and satisfaction within Egypt’s real estate sector. IoT technologies, like smart home solutions, enhanced property functionality and market positioning, while personalized digital marketing strategies helped build trust and loyalty. These tools met evolving consumer expectations and contributed to long-term success in a competitive market. Additionally, the research highlighted the need for IoT infrastructure investments and smart city initiatives to foster innovation. It also showed that smaller firms could benefit from scalable technologies and cost-effective marketing strategies to drive industry growth and enhance customer support systems.

6.3 Limitations

This research faced several limitations that suggest avenues for future exploration. The geographic focus on Cairo and Alexandria restricted the findings’ applicability to rural areas, where technology access and consumer behaviors may differ. Excluding younger demographics, such as teenagers, overlooked their unique perspectives on IoT and digital engagement. Additionally, the study reflects an early stage of IoT adoption in Egypt, leaving its long-term impacts unexplored. The industry-specific focus on real estate limits generalizability to other sectors, while reliance on survey data introduced potential biases from varying participant interpretations. Despite stratified sampling ensuring subgroup representation, it may not fully capture the diversity of Egypt’s population. Furthermore, external factors like economic or technological changes were not considered, emphasizing the need for longitudinal studies to assess evolving dynamics.

6.4 Further research

Future research could explore the impact of IoT and digital marketing in less developed regions beyond Cairo and Alexandria, assess long-term effects through longitudinal studies, and examine advanced strategies like AI and AR to enhance engagement. Investigating privacy concerns, customer psychographics, and the role of social media could offer deeper insights into customer trust and satisfaction. Comparative studies across industries and evaluations of ROI for IoT and digital marketing initiatives would provide practical guidance for businesses to optimize strategies and justify technological investments.

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