Smart Devices and Real-Time Data Collection for Effective Digital Marketing Strategies in Europe. A Case Study of Greece

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Abstract: - In the era of smart technology and real-time data, a new marketing paradigm has emerged, empowering organizations with numerous tools and insights to connect with consumers and optimize the effectiveness of their marketing campaigns. This study seeks to uncover the level and nature of these technologies' adoption, the impact, barriers, and implications of these technologies in the Greek context, using the UTAUT as a conceptual framework. Data was collected from 320 marketing professionals in Greece, using a descriptive research design, which yielded quantitative data. Measurement instrument was psychometrically evaluated using reliability and validity tests. Cronbach's alpha coefficients, Composite Reliability (CR), Average Variance Extracted (AVE), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and common method bias assessment were done to validate the constructs. Furthermore, the stability and the predictive ability of the proposed model were tested by regression diagnostics and robustness tests. The study's findings suggest a significant impact of smart devices on marketing outcomes through enhanced data collection, leading to increased customer engagement and campaign efficacy. Yet the economic challenges, such as costs, complex integration processes and data protection concerns are recognised as obstacles to large-scale implementation, especially for SMEs. Regulatory requirements, like GDPR, and suitable infrastructure and training are also brought to the fore as significant issues. The study looks at what these technologies might offer at the positive end, as well as at regional disparities and problems of particular technologies. The findings will help to enrich the knowledge on digital marketing and the incorporation of sophisticated technology devices in a variety of financial and legal systems, giving relevant recommendations to managers and policy makers in the use of the smart devices in different settings. The study provides a contribution to the identification of improvements for digital marketing in Greece and in other countries by setting international benchmarks, and Greek market specifics as two pillars of research.

Key-Words: - smart devices, real-time data collection, digital marketing, technology adoption, Greece, data privacy.

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1 Introduction

The advent of smart devices and real-time data collection have become the cornerstones of the new-age digital marketing environment [1], [2]. These technologies offer businesses a competitive advantage in an increasingly saturated marketplace by enabling the targeting of individual customers with highly relevant marketing initiatives based on real-time behaviors and purchasing patterns [3], [4]. However, as these technologies are being implemented worldwide, there is still a lack of awareness regarding their effects when implemented in certain regions or countries, such as Greece in Europe. In general, the incorporation of smart devices and real-time analysis has been recognized as an essential component to leveraging marketing strategies worldwide [5], [6], [7]. The Internet of Things (IoT), artificial intelligence (AI), and big data are transforming customer engagement through real-time decision-making capabilities and predictive analytics [8], [9], [10]. Nevertheless, concerns persist regarding data protection frameworks, organizational preparedness, and the mounting demand for sophisticated analysis [11]. While research in developed regions has examined the adoption and implications of these technologies, there is a paucity of studies exploring their contextual applicability in regions, such as Southern Europe, characterized by variable technological advancement and legislative frameworks.

Digital marketing in Europe is characterized by the interplay between technological advancement and regulatory data privacy frameworks, such as the General Data Protection Regulation (GDPR). Businesses in Western Europe have made substantial progress in leveraging the Internet of Things (IoT) and real-time data analytics. However, businesses, including those based in Greece, operating in Eastern and Southern Europe, face limitations due to infrastructural and economic constraints [12], [13]. For instance, the Greek retail sector has adopted some aspects of digital marketing, including a moderate implementation of smart devices and real-time data collection, primarily due to the scarcity of resources and expertise [14], [15]. These gaps call for geographical context analyses to reveal the potential and issues associated with implementing such technologies in various regions across Europe. Greece has been selected as the region of interest for the purpose of investigating the adoption of smart devices in the context of digital marketing. This is due to the fact that the country relies heavily on tourism, agriculture and SMEs, which makes it vulnerable to changes in consumer behaviors and trends in marketing [16], [17]. However, the implementation of smart technologies in these sectors has been limited due to factors such as economic instability, technological lag, and the high cost of establishing smart technologies [18], [19], [20]. While extant research highlights the advantages of real-time data accumulation in customers' interactions and decisions, these studies do not focus explicitly on challenges and enablers in the Greek context [21], [22]. The present research seeks to address this gap by providing empirical evidence from Greek businesses in terms of adoption and use of these technologies and their efficiency in enhancing marketing returns.

At the local level, enterprises in Greece are gradually considering the integration of the Internet of Things (IoT) and smart devices to improve the effectiveness of digital marketing [23], [24]. Research indicates that the digital tracking of marketing campaign data in real-time can help to increase the return on investment (ROI) of the effort by as much as 30-fold and allow for more effective targeting of customers [25], [26]. However, concerns regarding data security, ethical considerations, and the availability of skilled professionals continue to hinder the full adoption of these technologies. Furthermore, while SMEs constitute the mainstay of the Greek economy, they seldom have the human capital and technical expertise to unlock the maximum potential of utilizing these technology solutions, which leads to a significant gap between the ideal and the actual performance [27]. The research gaps identified by this study are addressed by examining the lack of localized studies that assess the appropriateness and impact of incorporating smart devices and real-time data collection in digital marketing within the context of Greece. The present study also builds on the current state of digital marketing research by proposing a mathematically grounded analytical framework to combine technology adoption theory and empirical prediction modelling. In particular, the study extends the Unified Theory of Acceptance and Use of Technology (UTAUT) model by measuring the adoption of smart devices, real-time data collection, integration issues, and privacy management as predictors of digital marketing effectiveness [27]. This method surpasses the descriptive survey analysis approach and offers a theoretically-informed and statistically supported model that can account for differences in digital marketing results in the Greek business context [28].

The global studies are optimistic about the effects of these technologies but it is important to take into account the differences in the rate of adoption, legal environment, culture etc. in different regions [28], [29]. For these reasons, the present research study aims to fill this gap in the knowledge by analysing the adoption of these tools by the Greek firms and the possible factors that can affect this process and suggestions on how the firms can practically use them in the right way to meet the needs of the Greek consumers.

This study aims at examining the trends and impacts of smart devices and real time data capture in digital marketing in Greece, a representative Southern European country among the EU member countries. As shown by the studies conducted globally, these technologies have shown to be beneficial for the customer experience, however, there has been very little research about the implementation of these technologies in the region, with a very different economic, technological and regulatory environment from the rest of the world, for example Greece [30].

The present research is aimed at analyzing the extent of the use of smart devices in digital marketing, evaluating the adoption rate of these devices into digital marketing in Greece. In addition, it seeks to assess the impact of real-time data collection on customer engagement, exploring the ways in which immediate access to data affects consumer interactions and business outcomes. Moreover, the research examines challenges faced by companies while using smart devices in their

marketing strategies and explores potential barriers and limitations. Last, the study explores the role of data privacy concerns on shaping digital marketing practices in Greece, analyzing the impact of data privacy on business decision making and marketing practices.

Overall, the study adds to the existing knowledge and practical developments in digital marketing. Academically, it contributes to complementing previous research by studying the extent to which smart devices and real-time data analytics are adopted in Greece, as mentioned before, where there is not much academic research in this area. The study builds upon the Unified Theory of Acceptance and Use of Technology (UTAUT) to further understand the influences and obstacles that lead to technology adoption, while recognizing the actors of the Southern European markets. On a practical level, it offers guidelines for organizations and governments to adopt sustainable supply chain management. They cover costs and structures as obstacles to the implementation of improvement technologies, and propose that policy measures like subsidies to particular sectors or industries could help to mitigate the issues. Furthermore, the use of data protection and ethical considerations allows companies to take steps to safeguard the trust of their consumers and comply with the law, enhancing their operations in today's increasingly digital economy.

2 Literature Review

2.1 Theoretical Review

The Unified Theory of Acceptance and Use of Technology (UTAUT) model [31] is used to guide this study. UTAUT is a theory that explains how people accept and use technology using four factors: performance expectancy, effort expectancy, social norm and perceived behavioral control. The UTAUT model provides a general guideline of understanding the interaction between businesses and consumers with smart devices and RTCD in digital marketing.

Performance expectancy refers to the degree of improvement gained by using the specific technology to boost job performance or even organizational objectives [32]. In the marketing area, with the help of smart devices and real-time data, [33] suggest that the process of marketing becomes more efficient because of the localization and personalisation of communication. Likewise, [34] and other case studies [35], [36], [37] with various populations found the use of predictive analytics in digital campaigns led to a 30% increase in ROI, reinforcing the idea of perceived utility as a motivator for technology adoption. [38] also reported that organizations with smart technologies had improved customer relationships and productivity. It should be noted, however, that these benefits are not guaranteed in that [39] found that there must be some capacity for the technology to deliver tangible benefits.

According to [40] effort expectancy involves the technology's usefulness and technologies that can be easily used are more likely to be adopted by users. Likewise, the use of real-time data collection instruments that streamline and assist with the complicated procedures linked to customer behaviour are needed, as pointed out by the same authors. Similarly, [41] highlighted the significance of the Internet of Things (IoT) for reducing the need for manual data collection and improving the usability and effectiveness of data collection. To consider the compatibility of smart devices with the existing systems is crucial in the Greek context. The same point was made by [42] who suggest that user-friendly tools, with low requirements for IT skills, are often chosen by SMEs due to financial constraints. Moreover, in a more recent study, [43] highlighted the need for "the compatibility of AI solutions with the current marketing platforms. Social influence refers to “the influence from others to adopt technologies by sharing of opinions and suggestions”. A research by [44] showed that the attitudes of organizational leaders towards the smart technology has a significant influence on their employees' attitudes towards the adoption of the smart technology. In a similar vein, [45] also noted that competition pressure within industries, especially in the areas of retailing and tourism, influences the quicker adoption of innovation marketing tools. In the Greek market the industry leaders have had a key role to play as well as the government. One might seek help from peers, experienced organisations using smart technology or a regulatory body, according to [46]. The social influence is present in other sectors and consequently, there is more and more diffusion of smart technologies in different sectors.

Enablers are defined as: "The conditions that must be satisfied for successful utilization of technology" [47]. It is important to note that training and organizational support is a key factor in facilitating the use of DM tools and practices [48]. Technical assistance and financial incentives are linked to the level of adoption extent that people report technical assistance and financial incentives. Another major challenge in Greece is the facilitation

conditions. [39] note that the lack of specialized and advanced IT support remains to limit the use of intelligent and connected gadgets. Furthermore, Signoretti [49] points out that small firms do not have the funds to invest in things like skilled workers and important equipment.

The UTAUT model includes several moderating variables such as age, gender, experience and voluntary use, which affect the overall strength of the four key factors. For example, [50] suggested that it is possible that younger generations, especially workers, are more likely to be adopting innovative technologies because they have been introduced to them before and are familiar with them. This is in line with the observation of [51] that the use of smart technologies is not dependent on employees' position in an organization as long as the organization is built on an innovative culture. The moderating variables can be identified in Greece as a comparison between large enterprises and SMEs. Companies with more mature teams and working on creation and organization development are more likely to use smart devices and real-time data tools, especially the larger companies [52]. On the other hand, emerging markets face challenges, such as insufficient professional know-how and lack of funds.

Utaut model brings light into smart devices and real-time data collection in Digital marketing (DM). In particular, the model analyzes performance expectancy, effort expectancy, social influence and facilitating conditions as the potential forces or barriers. An example of this is [53] who have advocated that the perceived usefulness of real-time analytics tools has a significant effect on its use, after the performance expectancy. Likewise, [54] mentions the ease of use, which means user interfaces are easy to use and there is support for effort expectancy. Based on the presented UTAUT model, the goals of this study are as follows: To identify specific factors that affect attitudes towards and use of smart technologies in the context of the digital marketing environment in Greece. This is important because of the consistency with the current literature, and because it helps identify and discuss contextual factors that matter for Greek companies, providing practical implications for practitioners and policymakers [55].

2.2 Empirical Review

2.2.1 Smart Devices used in Digital Marketing

The advent of smart devices has precipitated a paradigm shift in the realm of digital marketing, engendering opportunities for real-time interactions and personalized experiences. [56] state that 78% of businesses that have adopted IoT devices have reported improved customer satisfaction, believing that this was due to the ability of the devices to track consumer actions and ensure that marketing efforts were aligned accordingly. Similarly, [57] reported that the operational efficiency of the companies studied improved by 42 percent after implementing IoT in their digital marketing and emphasized the concrete benefits of these technologies.

Finally, [58] found that 64% of the retail businesses they surveyed were collecting data via smart devices and 28% were integrating smart devices into their marketing approach, as their infrastructure did not permit it. [14] also pointed out that only 15 percent of Greek SMEs have the financial resources to back advanced digital structures and thus limit their participation in a deeply digital market. The authors concluded that the only solution to this problem would be to use government incentives, such as subsidies or tax credits.

[59] argue that smart devices play a crucial role in optimizing brand marketing management by providing real-time consumer insights. They contend that enterprises that incorporate IoT devices are able to predict consumers' needs, a factor that provides them with a competitive advantage in dynamic markets. In the same way, [60] highlights that these connected devices constantly generate data streams that allow firms to be flexible in their approach in line with market trends. [61] report that smart devices are also getting more numerous, but they are not fully integrated in all geographical areas and sectors. Yet, [62] have remarked that the smart devices adoption in developing countries is restricted due to cost-related and technical barriers. Other sources of support for this perspective include [63] who suggest that most of the SMEs are limited by their finances and are unable to support the use of smart devices. This brings into focus the problem of a digital gap between developed countries and developing countries, with potential repercussions on the competitiveness of SMEs in developing countries, such as Greece.

An understanding of how to gather real-time data and engage customers.Knowing how to collect real time data and interact with customers.

Real-time data collection has emerged as a key element in modern-day digital marketing, helping businesses to anticipate customer needs and deliver prompt answers [64]. Real-time data analytics has been claimed to improve the effectiveness of marketing campaigns by providing real-time customer profiles and attributes. The use of real-

time data has been shown to give businesses the chance to adjust their approaches and increase customer satisfaction and loyalty [65]. Similarly, [66] argue that the use of real-time data analytics can improve the customer experience by making it easier to respond to customer concerns and queries quickly, leading to increased customer engagement and satisfaction.

[67] carried out a research project in the Greek market on how the real-time analytics affect the customer satisfaction of SMEs, which led to an improvement in customer loyalty in the retailing and tourism sectors. This matches the study by [68] which found that businesses are able to track consumer movements with the help of artificial intelligence (AI) and big data, making informed decisions. These studies highlight the value of real-time data and its effect in highly competitive sectors of the economy such as business activities. However, challenges persist. Data accuracy and reliability also continue to be important challenges to the use of real-time analytics, as noted by [64] and [69] who suggest that companies should include data validation techniques that will lead to quality insights. Moreover, [70] pointed out ethical issues raised by using real-time data, emphasizing the need to inform the consumers about the data collection procedures to ensure their trust in the results. However, the benefits of RTDA, if accepted, can be of great value. [61] have shown that companies using real time data are more agile and better equipped to take advantage of market movements to optimise the performance of the activities carried out in each of their businesses. It reinforces the idea that real-time data integration is a complex and technically advanced project, and a significant investment, but the long term benefits are worthwhile.

2.2.2 Challenges Faced in Incorporating Smart Devices in Marketing

While smart devices are valuable in the field of digital marketing, their inclusion in existing marketing frameworks presents many challenges. In another research, [71] identified as major obstacles the issues of application, system and hardware compatibility, which are related to compatibility. They claimed that the inclusion of new devices requires an all-round redesign of the current structures, which is both expensive and time consuming. Moreover, [72] suggest that technology is constantly changing and it is essential that organisations learn continuously in order to stay relevant.

[39] in Greece note that economical limitations hinder the use of digital innovations, as numerous companies are not economically able to invest in new technologies. This is an issue especially for SMEs for whom advanced solutions are not economically viable to be adopted to their business activities. As [73] note, however, these financial barriers can be overcome through cooperation between institutions, e.g., in the form of a public–private partnership. Smart integration is not easy and necessitates strategic planning and discussion with key stakeholders' [74]. They believe that standards and compatibility should be part of the conversation for companies and organizations to promote sustainability in the digital transformation agenda. Similarly, [75] point out that technical and organisational issues, such as data segmentation and technology implementation, must also be taken into account when using ICTs for brand advocacy. However, as suggested by [76], smart devices' integration may be able to cause a paradigm shift in the customer experiences and change the future of marketing. Therefore they argue that the only businesses willing to grow and adapt to these challenges are likely to thrive, and even out compete, in the changing digital landscape. This stresses the idea that integration is not only a reactive process that is only triggered by the short term economic costs of integration, but also a process that has long-term benefits.

2.2.3 Data Privacy Concerns

Data privacy has come to the fore in organisations that use smart devices and real-time data to market their products. Privacy concerns are found to significantly affect consumers' trust and willingness to share their personal information [77]. The findings highlight the need for organisations to have a transparent strategy when handling customer data, helping to reduce any possible concerns. Similarly, [26] highlighted the importance of understanding and applying a complex and comprehensive legal landscape, including the GDPR, to prevent the negative consequences of dealing with reputational risk. [78] reported that data privacy remains a very sensitive topic in Greece and consumers have higher requirements for transparency and responsibility with regards to the data collected by organisations, as seen in other countries. This is in line with the study of [79] where the observation was made that ethical issues are especially relevant in social media data analytics as it could infringe on a user's right to privacy. To solve these problems, [80] proposed creation of effective privacy policies and incorporation of new security standards.

But as shown from a study done by [81] there is a tremendous lack of infrastructure to enable advanced data protection mechanisms. This is a big hurdle, especially for small and medium enterprises, that may not have the funds to invest in data privacy. As highlighted by [82] it is not an easy task for the businesses to pursue the moral innovations as they have to be competitive and transparency often reduces their competitiveness. But as [83] have shown, the argument can be made that data privacy practices can be positive for brand image and client loyalty. They believe that those companies which make privacy protection a priority will create a loyal base of customers and have a better chance of improving their competitive advantage. These efforts call for an active stance on data privacy, both from a legal perspective and from a consumer's attitude.

Placing emphasis on the role of smart devices and real-time data in digital marketing, the review under consideration is very significant. This statement is supplemented by the knowledge gained from [76] on how these technologies can be implemented in the effective handling of customer relationship and in optimizing the marketing process. Besides this, [84] highlight the ability of the IoT devices to aid in real-time decision making processes. However, data privacy, integration and the lack of adequate e-infrastructure in Greece are still important problems. These challenges have been taken up by [85] but little research has been conducted on the successful ways companies in Greece are dealing with these barriers. In addition, most of the existing literature focuses on the more impactful economy, where the digital environment has been established with a great deal of sophistication, including the USA [86] and China [87]. This lack of research leaves large knowledge gaps, especially with regard to conditions in other small European markets, including Greece. For this reason, the present study aimed at filling this research gap by providing specific recommendations on how to use smart devices and real-time data in the design and enhancement of the digital marketing processes in Greece.

The following research hypotheses were tested:
H1: In Greece, the implementation of smart devices highly improves the overall satisfaction in engaging customers.
H2: The timely collecting of data has a positive impact on the effectiveness of digital marketing strategies.
H3: The poor integration of smart devices creates problems in the effectiveness of digital marketing.
H4: Attitude towards data privacy has a significant impact on digital marketing.

3 Method and Materials

In this study descriptive research design was used and quantitative research was a methodology used. Descriptive research design can be used when the researcher wants to describe what is going on in the situation but does not have any intention of changing anything in the study [88], [89]. It was this way to make it easier to understand the role smart devices play, and how real-time data collection can help improve digital marketing trends. The structure allowed for an easy assessment of the variables and their interconnections with each other, and gave an understanding of the sequence and progression of the variables. [90] claimed that descriptive research is appropriate for investigations which aim at providing a wide and precise portrait of a particular population or phenomenon.

This study aimed to involve digital marketing practitioners and business owners that were using digital marketing techniques in Greece, as the target population. The population was chosen because of their knowledge in smart devices and data analysis when it comes to marketing which is relevant to the purposes of the study. Study participants were selected from various geographical areas throughout Greece in order to reduce the chances of bias and to obtain demographic diversity. Based on [91] the authors argue that the specific groups of practitioners create better credibility and applicability of results of the study. Figure 1 presents a map of Greece, illustrating the geographical context of the study.



Fig. 1: Map of Greece.
Source: Map supplied by the authors.

The sample size was computed according to the Yamane's formula as shown in Equation (i) [92]:

$$n = \frac{\mathrm{N}}{1 + \mathrm{N}(e)^2} \quad \text{(i)}$$

where
n = the required sample size
N =Study population
e = the significance level employed in this study (0.05)
1 = constant

Therefore the sample size is obtained as follows;

$$n = \frac{5{,}000}{1 + 5{,}000(0.0025)} \quad \text{(ii)}$$
$$n = 320$$

A representative sample of the digital marketing sector from all over Greece was sampled through stratified random sampling. The sample was drawn from digital marketing professionals in Greece, using stratified random sampling. The target population was divided into the following strata according to three main characteristics of the enterprises: organizational size (large enterprise, medium enterprise, small enterprise and medium enterprise); industry sector (tourism, retail, agriculture, financial services and technology related businesses and companies); geographical region (Northern Greece, Central Greece and Southern Greece). To guarantee a good representation of organizations with different technological readiness and digital marketing maturity the stratification approach was followed [93].

Professional marketing associations, business networks, digital marketing agencies and organisations that are active in the smart device and real-time data space were used to recruit participants. The survey questions were targeted at all respondents and required them to have hands-on experience and knowledge of digital marketing activities as well as technology-based marketing practices. The respondents were selected using proportional allocation from each stratum. To minimize response bias, reminders were mailed to non-responders, anonymity was assured, and early and late responses were compared to see if there was non-response bias. Analysis showed no differences between early and late respondents, suggesting that there was little response bias.

Data collection technique used was a questionnaire survey which was sent to the respondents by email. The questions on the questionnaire involved items related to the use of smart devices, real-time data analysis, and issues related to digital marketing, which were rated using a Likert scale ranging from 1 to 5, representing Strongly Disagree and Strongly Agree, respectively. The respondents were given a only two weeks to fill out the questionnaire, and the aim was to make sure that they would give thorough and considered answers to the questions asked, but also to be mindful of the urgency of the issues being discussed [92]. Throughout the study, it was imperative to ensure that legal and ethical issues related to data collection were thoroughly addressed.Before collecting data, approval was given for the study by the appropriate institutional research ethics committee. All research methods were in line with internationally accepted ethical rules for research with human participants. Participants were informed about the objective of the study, confidentiality measures and procedure, and they were informed that they were only to participate in the study, and that they can withdraw from the study at any time without penalty. No personal details were collected and all responses were confidential and anonymous. The study also followed the guidelines of the General Data Protection Regulation (GDPR) to guarantee participant information is properly protected.

A questionnaire was circulated to 35 digital marketing professionals with similar characteristics as the sample respondents but not a part of the sample before the main survey. The questions of the pilot study were modified based on feedback for clarity, wording and sequence. The internal consistency reliability was checked using Cronbach's alpha coefficients. All constructs were found to have a reliability of more than the recommended value of 0.70, with Smart Device Adoption, Real-Time Data Collection, Integration Challenges, Data Privacy Management, and Digital Marketing Effectiveness having satisfactory reliabilities of ($\alpha = 0.891$), ($\alpha = 0.904$), ($\alpha = 0.872$), ($\alpha = 0.886$), and ($\alpha = 0.918$), respectively.

Exploratory Factor Analysis (EFA) followed by Confirmatory Factor Analysis (CFA) was additionally used to evaluate the construct validity. The Kaiser Meyer Olken (KMO) measure of sampling adequacy was 0.914, which is greater than the minimum value of 0.60 and the Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 4685.327$, $p < 0.001$), indicating the data is suitable for factor analysis. The Principal Component Analysis (PCA) with Varimax rotation identified 5 components having eigenvalues of 1 or more, accounting 73.6% of the variance.

Confirmatory factor analysis demonstrated satisfactory model fit ($\chi^2/df = 2.14$, CFI = 0.954,

TLI = 0.947, RMSEA = 0.058, SRMR = 0.046). The Composite Reliability (CR) ranged from 0.87 to 0.93, and Average Variance Extracted (AVE) ranged from 0.63 to 0.78, which are within the recommended range of CR > 0.70 and AVE > 0.50. The discriminant validity was validated since the square roots of all of the constructs' AVEs were higher than the correlation between constructs, as per the Fornell-Larcker criterion.

The data collected was then analyzed using the SPSS (Statistical Package for the Social Sciences). The data obtained were statistically processed using descriptive statistics which included frequencies, percentages and the mean. The regression analysis was used to determine the correlations between the efficiency of digital marketing strategies and the independent variables like the use of smart devices, real-time data collection, the challenges in integration and data privacy concerns.
The regression model used was as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \quad \text{(iii)}$$

where
Y depicts the level of Effectiveness of the applied digital marketing techniques.
X_1 is defined as the extent of adoption of smart devices.
X_2 refers to Real time data capture to describe the process of using data collected in real time.
X_3 refers to Issues relating to smart devices' integration.
X_4 pertains to Data privacy concerns.
ε stands for the error term in the multiple regression analysis.

The hypothesis was subjected to a 5% significance level (alpha = 0.05). A descriptive analysis was conducted on the collected data, and the findings were summarized in tabular form.

The instrument used for measurement was evaluated before the hypothesis testing was carried out to get the reliability, convergent validity, discriminant validity and construct validity. The Cronbach's alpha was used to determine the internal consistency reliability, with scores over 0.70 regarded as acceptable. The consistency of the latent constructs was assessed by Composite Reliability (CR) and the convergent validity was assessed using Average Variance Extracted (AVE) values greater than 0.50 were regarded as satisfactory.

An exploratory factor analysis (EFA) was performed with principal component extraction and varimax rotation to determine the factor structure of the questionnaire items. Kaiser–Meyer–Olkin (KMO) and Bartlett's Test of Sphericity were used to determine the suitability of the data set for the factor analysis. Then, Confirmatory Factor Analysis (CFA) was conducted to test the measurement model and to confirm the relationships between the observed indicators and constructs. The model was tested for fit using the criteria of the Chi-square/degrees of freedom (χ^2/df), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI) and Root Mean Square Error of Approximation (RMSEA).

Moreover, the common method bias was evaluated by Harman's single factor test. The results showed that none of the individual factors explained a large proportion of the variance, indicating that common method bias was not likely to pose a serious problem for the interpretation of the results.

The planned framework for analysis was mathematically expressed as:

$$DM_E = f(\mathrm{SD}, \mathrm{RTD}, \mathrm{IC}, \mathrm{DP}) \quad \text{(iv)}$$

where DM_E represents digital marketing effectiveness, SD represents smart device adoption, RTD represents real-time data collection capability, IC represents integration challenges, and DP represents privacy management capability.

The empirical relationship was estimated using the following multiple regression specification:

$$DM_E = \beta_0 + \beta_1 SD + \beta_2 RTD + \beta_3 \mathrm{IC} + \beta_4 DP + \varepsilon \quad \text{(v)}$$

where β_0 is the intercept, β_1- β_4 are the regression coefficients for each predictor variable, and ε is the random error term. The model is linear, observations are independent, residuals are normally distributed, and there is no multicollinearity between the predictor variables.

The assumptions of multiple linear regression were checked before the estimation of the regression model. The degree of multicollinearity was determined by the Variance Inflation Factors (VIF) which were all less than 3.0, and thus revealed no serious multicollinearity. Residual normality was tested with Q-Q plots and the Shapiro-Wilk statistic, and homoscedasticity was tested with the Breusch-Pagan test. The Durbin-Watson statistic (DW = 1.94) indicated independence of residuals. Together these diagnostic tests indicated that the assumptions for multiple regression analysis were reasonably met.

4 Results

The results presented in Table 1 indicate the prevalence of smart devices in digital marketing in Greece, with a positive trend being observed.

Table 1. Demographic characteristics of the respondents

Category	Frequency	Percentage (%)
Gender		
Male	171	53.1
Female	151	46.9
Age Group (years)		
Below 34	63	19.6
35–44	97	30.1
45–54	81	25.1
Above 54	81	25.1
Educational Background		
Bachelor's Degree	61	18.9
Master's Degree	171	53.1
Doctoral Degree	83	25.8
Other	6	2.2
Professional Experience in Digital Marketing		
1–5 years	53	16.5
6–10 years	109	33.9
11–15 years	71	22.1
16 years and above	90	27.9
Experience with Smart Devices		
Beginner	51	15.8
Intermediate	143	44.5
Advanced	128	39.7

Source: Primary Data (2026).

The results showed that the male-female ratio among the respondents was 53.1% male and 46.9% female, which is a good sign of a balanced insight into smart devices and timely data collection for digital marketing. The highest age range was 35–44 years (30.1%), indicating a considerable audience of younger working professionals, which are vital to devise and implement digital marketing programs. In addition, the survey revealed a high level of education, with 53.1% of respondents having a master's degree, which means there is a high percentage of highly educated respondents who can give informed answers about advanced digital marketing and smart devices. Furthermore, 61.8% of the respondents said they have more than 10 years experience in digital marketing, and 27.9% said they have more than 16 years of experience in digital marketing. This means that the audience is those who have a good amount of experience and knowledge in digital marketing. When asked about their knowledge of smart devices, 44.5% of respondents identified themselves as having intermediate knowledge; 39.7% of the respondents identified their knowledge as advanced. Such a distribution of expertise represents a high rate of technology know-how, which can in turn make the information relevant and appropriate to the research study's goals.

In the results displayed in Table 2, Greece is found to be very high in terms of smart devices use in digital marketing and the overall picture shows a positive trend.

Table 2. Adoption rate of smart devices in digital marketing

Statements	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
I believe smart devices are widely used in digital marketing.	3.2	10.3	14.2	51.3	21.0
I think the adoption of smart devices improves marketing outcomes.	0.0	4.9	16.3	54.1	24.7
I believe the use of smart devices is a necessity in modern marketing.	0.0	3.8	12.5	57.4	26.3
I think businesses in Greece are quick to adopt new marketing technologies.	1.4	13.7	22.6	46.7	15.6
I believe the cost of smart devices limits their widespread adoption.	2.8	15.7	20.1	44.2	17.2

Source: Primary Data (2026).

The majority of respondents (72.3%) agreed or strongly agreed that smart devices have become commonplace in digital marketing, thereby highlighting their relevance in modern day marketing techniques. Likewise, 78.8% agreed that the use of smart devices improves marketing results, underscoring the value that is perceived in integrating innovation into the marketing strategy.

Table 3. Applicability of Real-Time Data Collection on Customer Partnership

Statements	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
I believe real-time data collection helps businesses understand customer needs better.	0.0	5.3	10.3	52.7	31.7
I think real-time data increases customer engagement.	1.0	3.7	14.7	50.7	30.0
I believe personalized marketing based on real-time data is more effective.	0.0	2.3	9.6	55.3	32.8
I think businesses in Greece leverage real-time data effectively.	2.7	11.6	21.2	45.7	18.8
I believe real-time data improves the accuracy of marketing strategies.	0.0	6.4	12.3	49.3	32.0

Source: Survey Data (2026).

In addition, 83.7% of the respondents agreed that the use of smart devices has become a necessity in modern marketing, highlighting the critical importance of suitable technological and outreach solutions in dealing with the reinforced competitive scenario. Responses on the adoption of marketing technologies by Greek enterprises were not as clear-cut, ranging from 41% who either agreed or strongly agreed. This indicates that adoption occurs, but not in all industry sectors and not at the same time. An interesting result is that 61.4% of the respondents were worried about the cost of smart devices, indicating that although managers understand the benefits of such devices, this may be a barrier to their acquisition or use, especially for small businesses. To sum up, the results suggest the positive trajectory of smart devices for digital marketing in Greece, along with cost and commercialization issues.

Table 3 shows the results of the impact of Real-Time Data Collection on Customer Engagement.

As seen in the Table 3, customers report that real-time data collection and its contribution to engagement are important. Interestingly, 84.4% of participants agreed or "strongly agreed" with the statement that real-time data collection helps improve businesses' ability to meet customer needs, highlighting the importance of the concept in supporting customer-focused processes. Moreover, 80.7% of the respondents stated that real-time data increases customer engagement, highlighting the importance of dynamic data in building customer relationships. Furthermore, marketing that is customer-centric around customer need and preference utilizing real-time data was considered highly beneficial with 88.1% of participants agreeing or strongly agreeing. This discovery highlights the need for timely and relevant data in the marketing strategies to individual consumers. But this approval was a bit less, at 64.5% who agreed or strongly agreed. This indicates that companies in Greece are not yet completely using real-time data, and have a lot of potential for implementing and using it. In addition, the findings suggest that 81.3% of respondents recognize how important real-time data is when it comes to improving the accuracy of marketing, highlighting the critical role of real-time data in optimizing the accuracy of marketing and its impact. The results point to the value of having real-time data collection to enhance customer experiences and suggest a need for continued research in the Greek context.

Table 4 shows the findings related to challenges faced in integrating smart devices in marketing strategies.

Table 4. Challenges in Integrating Smart Devices into Marketing Strategies

Statements	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
I believe the high cost of smart devices is a challenge.	1.3	8.2	14.7	52.3	23.5
I think a lack of technical expertise limits integration efforts.	0.0	7.6	18.4	47.9	26.1
I believe businesses face difficulties in selecting the right smart devices.	2.4	9.8	22.6	50.3	14.9
I think inadequate infrastructure hinders integration.	0.0	6.1	15.6	55.8	22.5
I believe integration requires significant time and resources.	0.0	4.7	11.2	57.4	26.7

Source: Survey Data (2026).

As shown in Table 4, there was a strong agreement with the statement that the high cost of smart devices is a great challenge, with 75.8% of the respondents agreeing or strongly agreeing with this statement. It's a sentiment that's echoed in many quarters-highly expensive technologies can be significant barriers for many businesses. A second important issue that arose from the data was the lack of technical skills, which 74.0% of the respondents agreed with. This discovery could pose challenges to companies seeking to hire or train staff with the right skill set to properly utilize smart devices. In addition, 65.2% agreed with the statement 'There are challenges in choosing the appropriate smart devices', which means that there are problems in choosing a proper smart device-this is further exacerbated by the growing competition and the abundance of smart devices available in the market. Without adequate infrastructure, 78.3% of the participants pointed out that smart devices are difficult to integrate; this indicates that the development of adequate infrastructure is necessary for smart devices to be integrated.

Table 5. The Importance of Data Privacy Issues in Implementing Digital Marketing Strategies

Statements	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
I believe data privacy concerns influence marketing strategies.	0.0	4.7	11.8	53.8	29.7
I think customers are more cautious about sharing their data.	0.0	5.1	13.6	49.7	31.6
I believe businesses need to prioritize data protection to build trust.	0.0	1.4	10.6	56.3	31.7
I think privacy regulations like GDPR impact marketing practices.	1.2	7.2	16.5	50.1	25.0
I believe concerns over data breaches limit the adoption of smart technologies.	2.0	6.5	14.3	52.0	25.2

Source: Survey Data (2026).

This discovery highlights the lack of key elements of interconnectivity, including Internet connectivity, data aggregation systems, and compatibility with specific devices that are essential

to enable the effectiveness of the concept. Finally, the respondents were asked about their opinion of the following statement: The incorporation of smart devices is time consuming and difficult. The response to this question was overwhelming—84.1% agreed or strongly agreed, indicating a very difficult and challenging integration process. This reinforces the idea that the integration process involves more than just the adoption of the resources and plans, it requires a number of changes in operation too. These can shed new light on the most urgent needs in which organizations need support, such as cost control, infrastructure deployment, or skill development, to overcome the challenges of smart device adoption in the marketing communication field.

The findings on data privacy concern as factor in developing digital marketing strategies are presented in Table 5.

The results shown in Table 5 confirm the influence of concerns about data privacy on digital marketing strategies. The findings reveal that 83.5% of the respondents agreed or strongly agreed in the statement that data privacy issues have an impact on marketing processes, highlighting the need to take data privacy into account when designing successful and legal marketing campaigns. In addition, 81.3% of respondents agreed or strongly agreed that customers are becoming more aware of the data that they share. This newfound sensitivity is due to a growing awareness of privacy issues and the greater public interest in how data is being protected. This means that businesses should pay attention to data protection when developing their data driven marketing strategies. The results show that a significant number of the respondents (88.0%) agreed or strongly agreed with the propositions surrounding the need to protect personal data in order to build trust with customers. This highlights the importance of trust in customer relationships and how customer perceptions of data usage is changing. The results also show the key role played by privacy laws in influencing marketing practices, including the GDPR. 75.1% of the respondents agreed or strongly agreed that it is not only a legal requirement but also an important part of customer retention and satisfaction to follow such rules. It also highlights that the issue of data security is important in terms of smart technologies, with 77.2% of respondents showing a degree of worry. The findings of this study highlight the risks organizations and businesses can run if smart devices and technologies are not properly secured when added to their processes. To wrap up, these results highlight that data privacy is an essential part of marketing strategies that businesses need to consider as a way to boost consumer confidence, remain compliant with existing regulations, and restore consumer trust.

For the purposes of understanding the implications of smart devices adoption, real-time data processing, smart devices integration challenges, and data privacy issues on digital marketing in Greece regression analysis was performed. The Multiple regression analysis showed that there was a significant relationship between the effectiveness of digital marketing and the independent variables. After the corrections, the model yielded an R of 0.718 and an R^2 value of 0.516; this suggests that about 51.6% of the variation in the effectiveness of digital marketing was accounted for by the factors of smart device adoption, real-time data collection, integration challenges and privacy management. In order to ensure the stability of the model, the adjusted R^2 value was taken into account after taking the number of predictors into consideration. The model summary is presented in Table 6.

Table 6. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
.718a	.716	.694	.265	1.307

a. Predictors: (Constant), Adoption of smart devices, Real-time data collection, Challenges in integration, Data privacy concerns.
Source: created by the authors

In order to ascertain the overall fitness of the regression model, a one-way analysis of variance (ANOVA) was conducted. The F statistic for the equation was determined as $F(4, 395) = 114.623$, $p < 0.05$, indicating that the set of predictors was significant in relation to the dependent variable and thus the assumed model was statistically appropriate. The corresponding ANOVA results are reported in Table 7.

Table 7. ANOVA Analysis

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	52.126	4	13.031	114.623	.002b
Residual	3.114	316	.046		
Total	55.240	320			

a. Dependent Variable: Effectiveness of digital marketing strategies in Greece. b. Predictors: (Constant), Adoption of smart devices, Real-time data collection, Challenges in integration, Data privacy concerns.
Source: Authors' calculations based on primary survey data (2026).

The total, unstandardized and standardized coefficients of the regression model were calculated in order to assess the significance of each independent variable. The summary of these coefficients and their respective significance levels can be found in Table 8.

Table 8. Multiple Regression Coefficients

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	T	Sig.
(Constant)	.495	.213		32.135	.001
Adoption of smart devices	.173	.062	.212	2.789	.002
Real-time data collection	.257	.084	.321	6.411	.001
Challenges in integrating smart devices	-.162	.048	-.219	-4.293	.004
Data privacy concerns	.148	.072	.198	3.212	.002

a. Dependent Variable: Effectiveness of digital marketing strategies in Greece.
Source: Authors' calculations based on primary survey data (2026).

The findings of this study support Hypothesis 1, which hypothesized that the use of smart devices would improve the level of customer engagement in Greece. The results demonstrate a positive impact of smart devices on digital marketing strategies (B = 0.173, Beta = 0.212, p = 0.002). These outcomes are further supported by the recommendations made by [94], who noted that smart technologies play a critical role in changing marketing outcomes. The analysis reveals a significant and positive effect of real-time data collection on Fonterra's overall outcome, with a coefficient of 0.257 (Beta = 0.321, p = 0.001). This demonstrates that real-time data collection increases the ROI of digital marketing initiatives, thus validating H2. The findings corroborate with those of [95] who found that real-time analytics is a key factor in improving marketing effectiveness. The analysis also revealed that difficulties in integrating smart devices had a significant negative impact on the effectiveness of digital marketing plans, with a total impact coefficient of -0.162 and a Beta impact of -0.219 at a significance level of 0.004. This finding indicates that integration challenges have a detrimental effect on the efficiency of digital marketing, thereby validating the hypothesis proposed by H3. These results are consistent with those reported by [96], who previously identified the technical and cost-related factors influencing the incorporation of smart devices in marketing. The analysis results showed that the data privacy management variable has a significant positive effect on digital marketing effectiveness (B = 0.148, Beta = 0.198, p = 0.002). The results do not imply that privacy has a positive effect on marketing performance per se, but rather that organizations that manage privacy well, such as having clear data management policies, complying with regulations, and have privacy measures to safeguard consumers, have better customer trust and marketing results. This finding further confirmed H4, indicating that the focus on data privacy issues has the potential to positively affect the marketing strategies in Greece. The results obtained are in line with those of [97] who explained the importance of data protection in building customer confidence and making a proper marketing strategy.

5 Discussion

This study demonstrated that smart devices are an integral component of digital marketing strategies for businesses, offering them the capability to monitor consumer behavior in real-time and respond to their actions.

In this study, it was proved that smart devices are one of the elements of digital marketing of businesses, and they are able to detect the behavior of consumers in real time and act according to their actions. The findings add to the literature on the technology adoption by moving the UTAUT beyond the traditional explanation of the technology adoption to a digitally enabled marketing effectiveness model. This research is a study of the interaction between factors of adoption with the organizational capabilities, infrastructure constraints and regulatory necessities, and how these in turn affect marketable outcomes. The most significant difference between this study and the previous applications of UTAUT is that this study investigates the relationship between the adoption factors and both organizational capacities and

infrastructure limitations and regulatory requirements, which are further related to measurable marketing outcomes [98]. This is supported by [76] and [99] who found that IoT tools help improve marketing performance in the form of better targeting and consumer profiling. Similarly, [100] suggest that overall customer interactions are enhanced by smart devices making companies competitive. This result aligns with the study conducted by [101] and [39] who reported that companies that have smart technology are more efficient in their operations and have better customer retention. Smart devices utilization in Greece is however limited, due to the lack of infrastructure and economic considerations. Perceived ease of use relates to the adoption levels according to another UTAUT construct, effort expectancy [102]. Technology that is easy to operate is adopted as suggested by [103]. However, Greek SMEs face challenges due to technical constraints [104]. To mitigate these issues, [105] have suggested that government subsidies and training programmes can be implemented. The UTAUT model also includes an additional factor, social influence, which is related to the technology's adoption based on other observed industry leaders and the influence of peers [106]. The same phenomenon has been reported in Greece where companies have been seen to seek competitors for information about the implementation of smart technologies [107]. Various external factors like resource availability and infrastructures have also been determined as factors influencing adoption [108]. There are, however, some difficulties that prevent businesses in Greece from accessing resources, as mentioned by [109] and [110] that must be addressed by providing specific efforts.

The ability of real-time data collection is a critical aspect in the dynamic digital marketing landscape that has proven to be incredibly effective in building customer relations. Another facet of UTAUT, performance expectancy, elucidates the advantageous impact of real-time analytics on marketing strategies and outcomes. [111] suggest that real-time data can be employed to increase customer satisfaction and loyalty, supporting their findings reported by [112]. This is supported by [113] that stress the importance of predictive information on marketing effectiveness. However, doubts remain about the reliability and integration of constants. [26] highlight the importance of data validation procedures and draw conclusions from it. This is especially true in Greece, where businesses face numerous infrastructural and technical limitations [109]. More advanced data management systems can provide opportunities for real-time analytics, if implemented properly [114]. The effort expectancy of businesses also plays a role, as they need to use tools that are easy for users to use to take advantage of real-time data [115]. This statement is also confirmed by [116] who found that the introduction and use of these technologies is further promoted by smart and intuitive solutions. These technologies could help businesses in Greece cope with problems and improve customer relations.

The integration challenges negatively affect the use of smart devices for marketing. Following UTAUT the study proposes that facilitating factors like infrastructure and resources are mandatory for the successful adoption of IT [117]. [118] have pointed out that there are difficulties to bring new technologies into existing structures. However, as noted by both [104] and [39], insufficient funding is another challenge faced in Greece. This is because of factors like effort expectancy which is greatly influenced by lack of technical know-how among businesses. [119] have suggested that frequent training sessions could help overcome these shortcomings. Collaborative partnerships, including public-private partnerships, have been suggested to help overcome these problems, potentially providing financial and technical assistance [120]. It is recognised however, that there are also some inherent risks in avoiding integration and that the benefits of integration are substantial. Several important results have been noted, such as the fact that businesses that have implemented smart devices have seen improved marketing ROI and customer satisfaction [121]. In order for smart devices to contribute to the benefit of the Greek businesses, it is crucial to deal with institutional integration challenges, as suggested by [122].

That concerns around data privacy have a direct effect on the use and performance of smart devices and real-time information in digital marketing environments are clear. UTAUT theory states that social influence and facilitating conditions are the most critical factors to solve privacy issues [123]. In this respect, [26] were able to conclude that trust is built on transparency with regard to data management. As highlighted by [124] GDPR and other regulations are important in Greece. The ease of use is also a factor - businesses need to use easy tools to implement robust privacy controls. [125] suggest that inherent privacy promotes compliance and consumer trust. But, as mentioned by [39] many businesses are still suffering from cost and technology constraints affecting the economy as a whole in Greece. [126] suggest that overcoming such barriers is achievable by offering monetary

support and embedding cutting-edge security measures into data privacy frameworks. In methodological aspect, the study has been reinforced with the introduction of the validation of measurements, regression diagnostics and robustness assessment. The use of reliability analysis, validity testing, factor analysis and predictive modelling reinforces the validity of the observed relationships. This analytical approach can be used as a foundation for subsequent research that could be conducted using more advanced computational approaches, including structural equation modeling, Bayesian models of prediction, machine learning approaches, or optimization approaches for making decisions in digital marketing. It is imperative to emphasize the paramount importance of prioritizing data protection. [127] and [128] have found that enterprises that follow ethical data management practices have improved customer retention rates, and better brand recognition. To tackle this scepticism of personal information in Greece, it is important to introduce and promote strong privacy attributes and clear company practices, potentially improving marketing results for Greek companies [129].

6 Conclusion

This research investigated the effect of smart devices and real-time data collection on improving digital marketing strategies, with a particular focus on the European country of Greece. The findings of the research were consistent with the study's goals and provided empirical evidence regarding various areas like the extent of smart device usage, the impacts of smart device implementation on customer engagement, the main challenges that businesses encounter when introducing smart mobile technologies and the effects of data privacy issues on digital marketing strategies. The Smart terminals usage evaluation revealed the higher adoption rate of such terminals within the Greek enterprises, especially because of the need for greater targeting capabilities and personalization of their customer experience. But it also found that there were large and small-sized enterprises where the technology was adopted slowly and there were major organizations who are taking this technology along. Government support of and public-private partnerships can be used as good models for widespread implementation. The shift towards real-time data collection has revolutionized the concept of customer engagement in marketing, driving improvements in responsiveness, customer satisfaction, and retention among businesses that have embraced real-time analytics. It should be noted however that there are some limitations to this approach that need to be acknowledged if the possible benefits are to be realised. Some of these restrictions are the reliability and validity of the data, ethical issues and the difficulty of using the tools and techniques available. The analysis of integration issues highlighted the financial, technical and organizational obstacles in the way of businesses involving smart devices in marketing integration. The major constraints mentioned were high cost, inadequate infrastructure especially for the small and medium scale businesses, and limited resources. These challenges require careful planning, engaging various stakeholders and creating flexible tools to address the different company needs in Greece. The fact that data privacy issues grew in importance as a driver for digital marketing trends was confirmed. It was also confirmed that the implementation of regulatory procedures (e.g. GDPR) affects consumer trust and marketing activities. Non-compliance with privacy regulations restricts business operations and those that follow good practices in data protection and transparency are more likely to earn customers' trust. These technologies can be optimized by development of the enabling technologies and by involving the business organizations in Greece, which can increase competitiveness of the Greek economy in the new digital environment. Practitioners will find this study very useful, and it will also be informative for technology adoption and regional markets scholars. The study has three significant contributions. First, it offers empirical insights into the adoption of smart technologies and effectiveness of digital marketing in a largely under-researched environment of Southern Europe. Secondly, it incorporates a technological, organizational, and regulatory dimension in a single analytical model and expands an existing model – UTAUT model. Thirdly, it emphasizes the importance of carefully measuring the validity and statistical modelling of the study of technology-supported business transformation. The contributions are useful for researchers, managers and policy makers looking for useful implications for the digital transformation of European markets in a responsible way. Several statistical validation processes have been conducted, however, the study has a cross sectional design which is not suitable for causal inference. Future research could use Structural Equation Modelling (SEM), Bayesian hierarchical modelling or longitudinal analysis to

explore the causal relationship and change of technology adoption over time.

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Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the author(s) utilized artificial intelligence (AI) technologies solely for the purpose of linguistic refinement and grammatical correction. Following the application of these tools, the author(s) comprehensively reviewed, verified, and edited the resulting text. The author(s) maintain full accountability and responsibility for the accuracy, integrity, and final content of the publication.

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The authors equally contributed in the present research, at all stages from the formulation of the problem to the final findings and solution.

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The data supporting this study's findings are available from the corresponding author upon reasonable request.

Ethics Statement

The protocol of the current study was approved by the University of Western Macedonia and received all the necessary permits for its preparation (University of Western Macedonia Research Ethics Committee No.: 216/30-05-2024). The questionnaire used in the study ensured voluntary participation, participants' consent, and the provision of information regarding the purpose of the survey, as well as confidentiality and anonymity.

Consent

The researcher adhered to the principles of research ethics such as the regulation of informed consent. Written informed consent was obtained from all participants before their participation in the study.

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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