

THE CONTRIBUTION OF DIGITAL MARKETING TO BUSINESS PERFORMANCE: CASE OF COMPANIES IN MOROCCO

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Abstract

This study examines the impact of digital marketing on business performance in Morocco. Digital marketing has transformed modern business strategies, offering organizations the opportunity to increase brand awareness, customer engagement and sales performance. However, its effectiveness remains under-researched in Morocco. This study aims to bridge this gap by analyzing the relationship between digital marketing and key business performance indicators. The study adopted a quantitative approach and used data from 80 respondents. The research methodology included simple linear regression, ANOVA, t-test and Pearson correlation to assess the impact of digital marketing efforts on performance outcomes. The results of the study indicate that there is a significant positive correlation between digital marketing and business performance. In addition, industry differences have an impact on the effectiveness of digital strategies. The relevance of the study suggests that firms should integrate digital strategies to improve competitiveness and future research should focus on the application of digital marketing in specific industries.

Keywords

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DİJİTAL PAZARLAMANNIN İŞLETME PERFORMANSINA KATKISI: FAS'TAKİ ŞİRKETLER ÖRNEĞİ

Öz

Bu çalışma, dijital pazarlamanın Fas'taki işletme performansı üzerindeki etkisini incelemektedir. Dijital pazarlama, modern iş stratejilerini dönüştürerek kuruluşlara marka bilinirliğini artırma, müşteri etkileşimini güçlendirme ve satış performansını iyileştirme fırsatı sunmaktadır. Ancak, Fas bağlamında dijital pazarlamanın etkinliği yeterince araştırılmamıştır. Bu çalışma, dijital pazarlama ile temel iş performansı göstergeleri arasındaki ilişkiyi analiz ederek bu boşluğu doldurmayı amaçlamaktadır. Çalışmada nicel bir yaklaşım benimsenmiş ve 80 katılımcıdan elde edilen veriler kullanılmıştır. Araştırma yöntemi kapsamında basit doğrusal regresyon, ANOVA, t-testi ve Pearson korelasyonu uygulanarak dijital pazarlama çabalarının iş performansı üzerindeki etkisi değerlendirilmiştir. Araştırma sonuçları, dijital pazarlama ile iş performansı arasında anlamlı ve pozitif bir ilişki olduğunu göstermektedir. Ayrıca, sektörel farklılıkların dijital stratejilerin etkinliği üzerinde etkili olduğu tespit edilmiştir. Bu çalışmanın bulguları, işletmelerin rekabet avantajlarını artırmak için dijital stratejileri iş süreçlerine entegre etmeleri gerektiğini önermektedir. Gelecekteki araştırmalar, dijital pazarlamanın belirli sektörlerdeki uygulanmasına odaklanarak daha ayrıntılı ve sektöre özel içgörüler sağlayabilir.

Anahtar Kelimeler

Stratejik Yönetim
Dijital Pazarlama
İş Performansı

Makale Hakkında

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INTRODUCTION

The digital age has marked a paradigm shift in the way businesses operate and compete. Digital marketing, characterized by its interactive and data-driven nature, has become a central part of modern business strategy. Its ability to reach and engage audiences with unprecedented precision has transformed the marketing landscape and made it an indispensable tool for driving growth and improving organizational performance (Chaffey and Ellis-Chadwick, 2019, p. 45).

The increasing integration of digital technologies into various aspects of business operations has forced organizations to adopt a more customer-centric approach. Digital marketing enables businesses to gain valuable insights into customer behavior, preferences and needs, making it easier to develop tailored marketing strategies. Moreover, it offers a platform to build strong customer relationships through interactive communication channels and personalized experiences (Kumar and Pansari, 2016, p. 499). By leveraging digital marketing, organizations can foster brand loyalty, increase customer satisfaction, and ultimately drive revenue growth.

Morocco, like many other countries, has witnessed a rapid digital transformation in recent years. Growing internet penetration and the proliferation of smartphones have created fertile ground for the development of digital marketing. However, the full potential of digital marketing to drive business results in the Moroccan context is still largely untapped. Despite the growing number of Moroccan companies adopting digital marketing initiatives, there is a dearth of empirical research examining the specific impact of these efforts on organizational performance (El Yaagoubi and Machrafi, 2021, p. 147).

This study aims to address this gap in research by examining the role that digital marketing plays in improving the performance of Moroccan businesses. By examining the relationship between different digital marketing strategies and key performance indicators, this study seeks to provide a comprehensive understanding of the factors that influence the success of digital marketing initiatives in the Moroccan business environment. The findings of this study are expected to contribute to the development of effective digital marketing strategies for Moroccan businesses and inform policy makers on the necessary support for the growth of the digital economy in the country.

1. Conceptual Framework

The theoretical background of this study is based on the several theoretical concepts and models used in the analysis of marketing and business performance.

1.1. Concept of Digital Marketing

Digital marketing is defined as any marketing communication that is executed through electronic media. Firms utilize web media including the search engine, social media, emails, and the website to market its products to the existing and potential clients. The main types include search engine optimization or commonly referred to as SEO, content marketing, social media marketing, pay-per-click or PPC, affiliate marketing, and email marketing (Chaffey and Ellis-Chadwick, 2019, p. 10).

In a broader sense, digital marketing encompasses all strategies that allow businesses to engage with consumers through digital platforms, particularly focusing on leveraging the internet and data-driven technologies. This shift from traditional to digital marketing has been driven by the proliferation of digital devices, as well as the increasing presence of consumers online. Digital marketing offers significant advantages over traditional marketing methods by allowing firms to interact with their audience in real-time, track consumer behavior in detail, and adjust campaigns based on real-time data analytics (Ryan, 2016).

Search engine optimization (SEO), for instance, aims to improve a website's visibility in search engine results, thus driving organic traffic through unpaid listings (Moz, 2021). Content marketing focuses on creating valuable and relevant content to attract and retain customers, strengthening brand identity and loyalty (Pulizzi, 2014). Social media marketing enables businesses to directly engage with users on platforms like Facebook, Instagram, and LinkedIn, fostering interaction and brand awareness (Tuten and Solomon, 2018). Similarly, pay-per-click (PPC) advertising allows firms to bid for ad placements, paying only when their ads are clicked, making it a highly measurable and cost-effective strategy (WordStream, 2025).

Affiliate marketing is a performance-based strategy where businesses partner with individuals or companies (affiliates) who promote their products in exchange for commissions on sales, enhancing a brand's reach without direct marketing costs (Evans, 2020). Email marketing, one of the earliest forms of digital marketing, continues to be an effective channel for personalized communication, allowing businesses to send tailored promotional or informational messages directly to their customers (Chaffey and Ellis-Chadwick, 2019, p. 425).

Ultimately, digital marketing's strength lies in its adaptability and the ability to provide measurable outcomes through analytics. By utilizing these digital strategies, companies can improve customer engagement, track the success of campaigns with precision, and continuously refine their approaches to meet changing market conditions (Chaffey and Ellis-Chadwick, 2019, p. 455).

1.2. Overview of Digital Transformation

Digital transformation is the management and exploitation of digital technologies to innovate or amend value propositions for the satisfaction of society's demands. This change strategy is geared towards using information technology tools and solutions to enhance business transactions and customer relations, as well as drive innovation (Elhazziti et al., 2023, p. 88).

In a broader context, digital transformation involves rethinking organizational processes, business models, and customer engagement strategies to fully leverage the opportunities presented by digital technologies. It goes beyond simple adoption of technology, requiring businesses to integrate digital solutions into every facet of their operations. Key components of digital transformation include cloud computing, artificial intelligence, big data analytics, and the Internet of Things (IoT), all of which contribute to greater operational efficiency, improved customer experiences and the development of innovative products and services (Vial, 2019, p. 123). Successful digital transformation is not only about technology but also about fostering a culture of agility, where organizations continuously adapt to new digital tools and shifting consumer expectations (Kane et al., 2018).

1.3. Digital Landscape in Morocco

It could be argued that Morocco has gone through a digital shift in the last ten years. Thus, at the moment the tendency towards the usage of the internet – the usage of smart phones in particular – is on the rise in the country. The Moroccan government has also been wise on its approach on the implementation of digital transformation through various policies and programs that are in an aim of enhancing the level of the digital economy and innovation (Benchenna and Marchetti, 2021, p. 676).

One of the key initiatives driving this shift is Morocco's 'Digital Morocco 2020' strategy, which sought to promote the widespread adoption of digital technologies across various sectors, including education, healthcare, and public services. Through this plan, the government has invested heavily in infrastructure improvements, expanding access to high-speed internet and promoting the use of e-government services. Additionally, programs supporting entrepreneurship and digital innovation have emerged, encouraging startups and small businesses to adopt new technologies, ultimately contributing to Morocco's growing position as a digital hub in the region (World Bank, 2020).

1.4. Key Statistics Highlighting Morocco's Digital Transformation Include

With an aim of expanding market reach, Moroccan firms are gradually adopting several forms of digital marketing, including search engine optimization (SEO), content marketing, social media marketing, pay-per-click (PPC), and email marketing. These strategies enable businesses to improve brand visibility, customer engagement, and sales conversions while adapting to the growing digital transformation in Morocco.

Internet Penetration: As per the latest figure, the Internet penetration in Morocco is more than 74% and more users are preferring the mobile to connect with the web (Elhazziti et al., 2023, p. 88).

Social Media Usage: Moroccan people are active users of social media; millions of users are active on the social networks like Facebook, Instagram, and (Aboudou et al., 2020, p. 6-7).

E-commerce Growth: The e-commerce sector in Morocco is growing at a fast pace; this is because consumers are adopting to online shopping rapidly (Rida et al., 2024, p. 167).

1.5. Adoption of Digital Marketing Practices in Morocco

Use of Multiple Types of Digital Marketing among Moroccan Companies with an aim of expanding their market reach, Moroccan firms are gradually adopting several forms of digital marketing.

Search Engine Optimization (SEO): SEO is gaining awareness among the businessmen since every businessperson is aiming to have their website appear on the search engines for organic traffic (Chouki et al., 2022).

Social Media Marketing: It is indeed utilized for brands, customers, and leads generation. Social media platforms like Facebook, Instagram, and LinkedIn are utilized by organizations in order to advertise products and services (Aayale and Seffar, 2021, p. 37).

Content Marketing: Blogs and videos as well as Infographics are utilized to generate significant and credible content for the clients (El Hachimi et al., 2021, p. 89).

Email Marketing: Email marketing is applicable to lead generation, customer relations and conversion (Sabbagh, 2021, p. 26).

Pay-Per-Click (PPC) Advertising: Google Ads PPC and SMM are rather efficient in reaching the target audience and achieving the necessary marketing objectives. Marketing communication practices have impacted organizational performance in Morocco through digital marketing (Lopes and Casais, 2022, p. 3).

1.6. Influence on Organizational Performance

As digital marketing becomes an essential component of modern business strategies, Moroccan companies are increasingly integrating digital tools to enhance their organizational performance. These advancements have led to measurable improvements in market expansion, customer interaction, and overall profitability. Businesses that leverage digital marketing effectively gain a competitive edge, allowing them to optimize their operations and data-driven decision-making processes

Enhanced Market Reach: Internet marketing assists firms to reach out to customers in other areas other than the area of operation. It has helped in branding hence customer awareness and in the end customer appeal for Moroccan firms (Elhazziti et al., 2023, p. 92).

Improved Customer Engagement: Digital channels foster timely and interactive engagement with the customers. Customers can be reached by organization and get feedback hence enhancing customer satisfaction and loyalty (El Hachimi et al., 2021, p. 89).

Increased Sales and Revenue: Digital marketing technologies compel the consumers to visit websites; thus, enhancing the conversion rates and sales. Most Moroccan firms that have ventured into digital marketing have recorded high revenues (Islami et al., 2020, p. 59).

Cost Efficiency: The other benefit of the digital marketing strategy is that it is cheaper as compared to the traditional marketing strategies. Marketing technologies like analysis and automation help in increasing the effectiveness of marketing to better the return on investment.

Data-Driven Decision Making: Digital marketing is essential since it enables analysis of data regarding the clients. It also allows the organizations to track the efficiency of certain campaigns, observe the actions of the consumers and change the strategies where necessary (YachouAityassine et al., 2022, p. 46).

Morocco is experiencing a fast pace of digitalization and the incorporation of digital marketing strategies into business is changing the Moroccan commercial environment. The companies that integrate digital marketing in Morocco have indicated increased market coverage, better consumer relations, higher sales, and overall organizational performance. Despite the advances witnessed in the Moroccan digital environment, the businesses will have to adapt to change and develop more creativity for them to achieve more the opportunities of the digital marketing and maintain their competitive advantage (Mahboub and Sadok, 2024, p. 264).

2. Literature Review

2.1. Theoretical Foundation

This study is grounded in established marketing and business performance theories, integrating concepts from the Resource-Based View (RBV) and Digital Marketing Performance Models. The RBV theory suggests that firms leveraging digital marketing as a strategic resource can enhance their competitiveness, differentiation, and profitability. Additionally, relationship marketing theory provides a framework for understanding how digital marketing fosters long-term customer engagement, brand loyalty, and increased lifetime value (Morgan and Hunt, 1994, p. 281).

By aligning digital marketing investments with business objectives, companies can gain a sustainable competitive advantage. Kotler and Keller (2020) highlight the importance of digital transformation in reshaping traditional marketing models, reinforcing how digital strategies enhance organizational performance.

2.2. Recent Literature and Empirical Studies

Recent studies highlight the evolving role of digital marketing in achieving organizational success. Chaffey and Ellis-Chadwick (2019) emphasize the strategic importance of search engine optimization (SEO), content marketing, social media marketing, pay-per-click (PPC), affiliate marketing, and email marketing. Companies that invest in these strategies report improved customer acquisition, brand awareness, and revenue growth (Pulizzi, 2014; Tuten and Solomon, 2018).

However, Morocco-specific research is still underdeveloped. El Yaagoubi and Machrafi (2021) analyzed the role of digital marketing in the Moroccan tourism sector and found a positive impact on customer engagement and online sales. Similarly, Ben Youssef and Dahmani (2023) examined digital technology adoption among Moroccan companies and revealed that limited access to technology and digital literacy are the main barriers to effective implementation.

Despite these challenges, Moroccan companies are increasingly using social media marketing and partnerships with influencers to increase their market reach (Aboudou et al., 2020, p. 7). Studies of Moroccan e-commerce platforms and service firms show that mobile-based marketing, content strategies, and data analytics are becoming critical to gaining a competitive advantage (Khadraoui, 2020).

2.3. Conceptual Alignment with Empirical Application

The study's theoretical framework aligns with its empirical approach by examining how digital marketing contributes to key performance metrics such as market reach, customer engagement, and revenue growth. The research quantitatively measures how businesses in Morocco leverage digital strategies to drive performance improvements.

By integrating relationship marketing theory, digital business models, and data-driven marketing approaches, this study establishes a strong conceptual foundation for assessing the impact of digital marketing strategies on Moroccan businesses

2.4. Market Reach and Visibility

Digital marketing boosts market coverage and accessibility, because it relies on the use of the internet and other related platforms to create awareness in the global market (Chaffey and Smith, 2022, p. 145). Compared to the conventional marketing where information is restricted to a particular region or costs high, digital marketing enables organizations to access the customers in the required regions at real time. Tactics like Search Engine Optimization and Pay-Per-Click are the methods whereby firms are able to be on top of the search engines; this enhances their visibility (Goldfarb and Tucker, 2019, p. 78).

In case of Moroccan companies, the literature revealed that organizations which have adopted digital marketing have a high growth in brand recognition and customer base (Zarrouk and El Aidouni, 2023, p. 67). New generation social sites such as Facebook, Instagram and linked in are particularly suitable for the intended target market ranging from the locals to the international markets. For instance, some Moroccan fashion brands have benefited from the social media platform to post their products to the global markets hence more followers and sales (Aboudou et al., 2020, p. 7). Moreover, possibilities to address concrete consumer segments and adapt the marketing messages add to the effectiveness of digital marketing tools in terms of growing market coverage and visibility. This broad reach is important for Moroccan companies that want to expand into a global market and thus acquire new customers (Omeish et al., 2024, p. 112).

2.5. The concept of Customer Engagement and Relationship Management

Another critical area, where digital marketing impacts the overall strategy is in the area of customer engagement and relationship management as the strategies adopted allow for direct and interactive communication with the customers (Bismo and Putra, 2019, p. 52). Various social networks, mail marketing, online chat platforms help companies to keep in touch with their clients directly, responding to their questions, gathering the customers' opinions or offering the required assistance. Such a model ensures that people who are using a particular business's products are connected to that business, thus creating loyalty (Clarence and Keni, 2022, p. 73).

According to the various firms that have embraced social media marketing in Morocco, the level of satisfaction and customers' retention is normally high. For instance, Moroccan e-business organizations apply social media in engaging campaigns, handling customer inquiries, and dealing with feedback (Aboudou et al., 2020, p. 8). These are activities that do not only help to retain customers but also help in the understanding of the type of customers the business has and how they behave. Sabbagh (2021, p. 26) discussed that Email marketing campaigns that are customized to meet the specific needs of the individual customer, also add on to such relationships by sending appropriate information and promotional material to the customers' mail. In general, it is possible to state that engagement in relationships is a major advantage of digital marketing for customer associations as well as key to the long term customer base and business success.

2.6. Sales and Revenue Forecasts

In the literature, evidence exists about the effectiveness of digital marketing in influencing sales growth and revenues. As discussed by Bala and Verma (2018, p. 328); this is because internet marketing techniques that include content marketing, PPC advertising, and social marketing obtain a lot of traffic to company websites, thus boosting the conversion rates and the sales. Through understanding path, how businesses get to develop good contents and good advertisements, they are able to attract potential customers on the business as well as leading them through the funnel effectively.

Research conducted by El Hachimi et al. (2021, p. 93) on business organizations that have adopted the use of digital marketing in Morocco have shown that it has boosted their sales and revenue generation. For instance, Moroccan tourism companies that incorporate targeted PPC campaigns reported improved sales of booking and other inquiries. In the same manner, local merchants who employ social media advertising and influencer collaborations generate enhanced product sales and brand familiarity (El Yaagoubi and Machrafi, 2021, p. 147).

E-commerce platforms are always on the receiving end of digital marketing since online promotions and SEO drives traffic on their sites hence increased conversion and sales. The real-time measurement and analysis of the campaign results also enable a business to audit its strategy to identify the best approaches to making the most revenues, proving the ROI of digital marketing (Visser et al., 2021, p. 89).

2.7. Cost Efficiency and Return on Investment (ROI)

Among the major advantages of digital marketing over traditional marketing, is that the former is relatively cheaper to undertake and thus can fetch higher ROI to the business (Almestarihi et al., 2024, p. 1275-1276). Some of the marketing strategies including e-mail marketing, social media marketing, and content marketing are cheaper than the conventional media marketing like television or newspaper advertising. Also, digital marketing tools make it easier to target and segment, hence minimizing waste and directing the marketing efforts to the right target market (Junaidi, 2020, p. 1219).

It may also be noted that Moroccan firms have come to appreciate digital marketing as an efficient method of marketing to the consumers. For instance, Moroccan SMEs use social media as a tool for advertising their products and services at a relatively less cost as compared to the conventional media (Khadraoui, 2020, p. 58). The application of analytics and tracking tools also helps in further improving cost effectiveness as it enables business to track the performance of the campaigns and make necessary modifications with reference to cost incurred on it. Print advertising tends to be more cost effective and offer a higher ROI which is a prime concern in Morocco due to the competitive environment and business need to remain financially viable while effectively reaching targeted marketing audiences.

2.8. Challenges and Barriers

However, there are various challenges and barriers that Moroccan firms experience in the adoption and execution of DM. First, digital skills and expertise are severely missing in the workforce and education systems. Finding from Bouchra (2021, p. 77) suggests One of the

biggest issues that most organizations, particularly SMEs encounter is the scarcity of skilled professionals to oversee the execution of the digital marketing strategies. This deficiency in skills can prevent the establishment and application of efficient strategic digital marketing.

Also, inadequate technology is the other challenge that hinders the process of integration and adoption. Even though there is growth in internet usage, there are regions that have restricted access to fast internet connection that can influence the accessibility and impact of the online marketing strategies (Youssef, 2023). Hindrances to the adoption of digital marketing include; culture and resistance to change as well as traditional marketing methods. New technologies and strategies can sometimes be costly and for this reason, firms are sometimes hesitant to adopt them because they are not sure of the returns that they are going to get from them (Chouki et al., 2022).

Also, it is highlighted by Ben Youssef and Dahmani (2023, p. 392) that the constantly changing environment of new technologies and trends creates a need for the constant exchange of information in organizational learning. Constant change in the market characteristics may be stressful for the companies that have smaller amount of resources. To overcome these challenges, there is a need for the Moroccan private and public sectors to support the investment in the digital education as well as to create favorable conditions for the development of digital marketing.

2.9. Hypotheses

H1: There is a significant and positive relationship between digital marketing and business performance.

H2: The application of digital marketing strategies positively and significantly affects business performance.

H3: Age differences significantly affect the relationship between digital marketing and business performance in Moroccan companies.

3. Methodology

This research employs a **quantitative approach** with the relational screening model, which seeks to identify common variances among variables and assess the strength and direction of the relationships (Karasar, 2004). The study examines the impact of digital marketing on business performance within the Moroccan context, focusing on the extent to which digital marketing strategies contribute to key organizational outcomes.

Digital marketing, as a rapidly evolving field, requires continuous research to understand its impact in diverse settings. While the concept is widely recognized in global contexts, empirical studies examining its influence on business performance in Morocco remain scarce. This gap in the literature highlights the importance of the present research. By exploring this relationship, the study aims to provide valuable insights for both practitioners and academics.

3.1. Research Design

This study adopts a quantitative research design, using structured surveys to collect data from 80 Moroccan businesses across various industries. The research employs non-

probability purposive sampling, ensuring that businesses actively using digital marketing are included. This sampling method allows for the selection of firms that have engaged in digital marketing strategies, making them appropriate for assessing the relationship between digital marketing and business performance.

The sample size of 80 respondents is justified based on statistical recommendations, which suggest that the number of participants should be at least five times the number of independent variables measured. This ensures that the study has enough statistical power to generate meaningful insights. Although the sample size is relatively small, it captures a diverse range of businesses, ensuring generalizable insights within the Moroccan context.

3.2. Justification of Statistical Methods

A combination of simple linear regression, ANOVA, t-tests, and Pearson correlation was employed to analyze the data. Each method was selected to assess different aspects of the relationship between digital marketing and business performance:

- **Simple Linear Regression:** Used to determine the predictive relationship between digital marketing and business performance. Regression analysis revealed that digital marketing accounts for 69.8% of the variation in business performance, confirming its strong influence.
- **ANOVA:** Applied to examine whether demographic factors (e.g., company size, industry, or years in business) significantly influence the effectiveness of digital marketing strategies.
- **T-tests:** Conducted to compare performance differences between demographic groups, particularly examining whether gender, industry type, or company size influenced digital marketing adoption.
- **Pearson Correlation:** Used to measure the strength and direction of the relationship between digital marketing strategies and business performance, confirming a strong positive correlation.

3.3. Population and Sample

In scientific research, ensuring that the selected sample has strong representational power of the target population is critical for obtaining accurate results. This necessitates choosing the most appropriate sample for the study's objectives. The population (or universe) refers to the entirety of units with similar characteristics in which the findings of the research are generally applicable (Ural and Kılıç, 2005). In this research, the population comprises Moroccan companies from various industries that are utilizing digital marketing strategies.

To ensure adequate representation, the sample includes companies of varying sizes, ranging from small enterprises to large organizations, in order to capture a broad perspective of digital marketing practices across the Moroccan business environment. Additionally, the sample aims to highlight differences between industries with diverse digital marketing maturity levels, offering insights into sector-specific applications of digital strategies.

A Google Forms survey was utilized as the data collection tool, and it was distributed to digital marketing professionals and business managers across Morocco via email and

business networking platforms. A total of 80 valid responses were obtained. Since the survey was structured in such a way that respondents could not proceed without answering each question, all data collected was complete and accurate. Therefore, no incomplete or erroneous questionnaires were identified.

In this study, convenience sampling was employed, and the sample size was determined based on the commonly accepted requirement that the number of respondents should be at least five times the number of items in the scale (Büyüköztürk et al., 2014). Given that the total number of items in the digital marketing and business performance scales is 11, a sample size of 80 respondents far exceeds the minimum requirement, ensuring statistical acceptability. For further details on the demographic characteristics of the sample, the frequencies and percentages presented in Table 1 can be consulted.

Table 1. Demographic Features

		Frequency (N)	Percent (%)
Gender	Female	36	45.0%
	Male	44	55.0%
Age	18-24	10	12.5%
	25-34	30	37.5%
	35-44	26	32.5%
	45-54	8	10.0%
	55-64	4	5.0%
	65 and above	2	2.5%
Role in Enterprise	Business Controller	1	2.0%
	Executive/Manager	8	16.0%
	CEO	1	2.0%
	Sales Agent	1	2.0%
	Community Manager	3	6.0%
	Chief Operating Officer	1	2.0%
	Art Director	1	2.0%
	General Director	9	18.0%
	Graphic Designer	3	6.0%
	Editor/Writer	1	2.0%
	Sales Manager	5	10.0%
	Role in Enterprise	Marketing Manager	11
Content Editorial Team Manager		1	2.0%
SEO Expert		1	2.0%
Social Media Manager		1	2.0%
Social Media Supervisor		1	2.0%
Videographer		1	2.0%

Table 1 (Continued). Demographic Feature

Number of employees	Less than 10	14	17.5%
	Between 10 and 100	29	36.3%
	Between 100 and 250	24	30.0%
	More than 250	13	16.3%

3.4. Data Collection Tool

A structured questionnaire was employed in this study, which utilized a quantitative research approach. The questionnaire included six closed-ended demographic questions: gender, age, company size, job title, number of employees in the organization, and length of time the company has been using digital marketing. The 'Digital Marketing' scale, adapted from El Hachimi et al. (2021, p. 91) and the 'Business Performance' scale, also adapted from El Hachimi et al. (2021, p. 91), were used in this research to assess the relationship between digital marketing practices and business outcomes.

The 'Digital Marketing' scale consists of 8 items with one dimension, while the 'Business Performance' scale includes 3 items, also measured in one dimension. Both scales use a 5-point Likert rating system (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree) to capture the extent of the respondents' agreement with various statements.

3.5. Analysis of Data

The data were collected through an electronic questionnaire, and the statistical software SPSS was used to analyze the responses. Confirmatory factor analysis was conducted to evaluate the construct validity of the scales. Descriptive statistics, such as frequency (f), percentage (%), mean, and standard deviation (SD), were calculated for the demographic and scale-based responses. Additionally, Pearson correlation, simple linear regression, one-way analysis of variance (ANOVA), and independent samples t-tests were conducted to explore relationships between demographic variables and digital marketing's impact on business performance. The results were organized into tables for clarity and interpretation.

3.6. Limitations

While this study provides valuable insights into the impact of digital marketing on business performance in Morocco, it has certain limitations that should be acknowledged. First, the sample size of 80 respondents, while statistically acceptable, limits the broader generalizability of the findings. A larger sample would enhance the statistical power and improve the representativeness of the results across different industries.

Second, the study was conducted on a general business population without differentiating across specific sectors. Different industries may experience varying levels of digital marketing effectiveness depending on their target audience, competitive landscape, and digital maturity. The lack of sectoral differentiation means that insights may not fully capture industry-specific trends and challenges.

Third, the lack of causality analysis between digital marketing and business performance. While the results indicate a significant positive correlation, they do not establish a direct cause-and-effect relationship. Future research should consider employing causality

tests, such as Granger causality analysis or longitudinal studies, to provide deeper insights into the directionality of this relationship.

Fourth, data collection relied on self-reported measures, which may introduce biases such as social desirability bias and recall errors. Respondents might have overestimated or underestimated their digital marketing effectiveness or performance outcomes. Future research should consider incorporating objective performance metrics or third-party validation to improve the accuracy of findings.

Additionally, external factors such as economic fluctuations, technological advancements, and policy regulations may influence digital marketing outcomes but were not explicitly controlled in this study. This limits the ability to isolate the true impact of digital marketing on business performance.

3.7. Future Research Directions

Future research can build on this study by conducting sector-specific analyses to better understand how digital marketing strategies vary across industries such as tourism, retail, manufacturing, and finance. Expanding the sample size and incorporating a broader geographic and business structure representation would enhance the generalizability of findings.

Additionally, longitudinal studies tracking digital marketing performance over time could provide insights into long-term business growth, customer retention, and evolving digital strategies. Integrating qualitative approaches such as in-depth interviews and case studies could complement quantitative data, offering a richer perspective on decision-making processes and strategic adaptations.

Furthermore, research on emerging digital trends such as AI-driven marketing, automation, and hyper-personalization would be beneficial in understanding how businesses can leverage technological advancements to optimize digital marketing performance. Future studies should also assess the role of government policies and digital infrastructure development in facilitating effective digital marketing adoption, ensuring that businesses can maximize their marketing potential in Morocco's evolving digital economy.

4. Results

Descriptive statistical methods were employed to analyze the frequency, mean, standard deviation, kurtosis, and skewness values of the data. The kurtosis and skewness values were used to test the normality distribution of the data. Following Kline's (2011) guidelines, kurtosis values should remain within ± 10 , and skewness values within ± 3 . According to Hair et al. (2013), the values between +1 and -1 are considered optimal for demonstrating normal distribution.

The reliability of the scales was assessed using Cronbach's Alpha, with values of .947 for the Digital Marketing scale and .890 for the Business Performance scale, both of which are well above the acceptable threshold of .60 (Nunnally, 1967), indicating good internal consistency.

Table 2. Internal Consistency and Normality Distribution Results

	Number of items	Cronbach's Alpha	Skewness	Kurtosis
Digital Marketing	08	0.947	-0.95	0.061
Business Performance	03	0.89	-1.022	0.174

Descriptive statistical methods were employed to assess the reliability and normality of the scales used in the study. The Cronbach's Alpha values, which are widely recognized as a measure of internal consistency in social science research, indicate excellent reliability for both scales. The Digital Marketing scale, comprising 8 items, achieved a Cronbach's Alpha of 0.947, while the Business Performance scale, consisting of 3 items, demonstrated a strong reliability with a Cronbach's Alpha of 0.890.

Additionally, skewness and kurtosis coefficients were calculated to evaluate the normality of the distributions. These coefficients are commonly used in social science research to determine whether the data follow a normal distribution. According to Hair et al. (2013), skewness and kurtosis values between +1 and -1 indicate an acceptable range for normality. The Digital Marketing scale exhibited a skewness of -0.95 and kurtosis of 0.061, while the Business Performance scale had a skewness of -1.022 and kurtosis of 0.174. Both scales, therefore, fall within the acceptable limits for normal distribution (Kline, 2011).

Table 3. Independent Samples T Test for Comparing the Variables by gender

Scales	Group	N	Mean	SD	t	Df	p
Digital Marketing	Female	36	3.9678	1.01226	0.939	78	0.175
	Male	44	3.7472	1.07139	0.939	78	0.175
Business Performance	Female	36	3.8426	1.13105	0.337	78	0.368
	Male	44	3.7576	1.11454	0.337	78	0.368

* $p < .05$

The Table 3 presents the results of an Independent Samples T Test that explores the impact of various digital marketing strategies on business performance, for *Digital Marketing*, females ($M = 3.97$, $SD = 1.01$) and males ($M = 3.75$, $SD = 1.07$) did not differ significantly, $t(78) = 0.939$, $p = 0.175$. Similarly, for *Business Performance*, females ($M = 3.84$, $SD = 1.13$) and males ($M = 3.76$, $SD = 1.11$) also did not show a significant difference, $t(78) = 0.337$, $p = 0.368$.

These results suggest that there are no statistically significant differences in perceptions of Digital Marketing or Business Performance between males and females in this sample.

Table 4. ANOVA Comparing the Variables by Age

Factors	Groups	Sum of Squares	df	F	P*
Digital Marketing	Between Groups	4.441	5	0.804	0.55
	Within Groups	81.745	74		
	Total	86.186	79		
Business Performance	Between Groups	1.162	5	0.177	0.97
	Within Groups	97.17	74		
	Total	98.332	79		

* $p < .05$

Among the variables analyzed, no significant differences were found across age groups for either Digital Marketing or Business Performance. However, since both the Digital Marketing ($F(5, 74) = 0.804, p = 0.55$) and Business Performance ($F(5, 74) = 0.177, p = 0.97$) factors were above the threshold for statistical significance, further tests were not deemed necessary. The lack of significant differences indicates that perceptions of Digital Marketing and Business Performance remained consistent across the various age groups in this sample.

The ANOVA results, therefore, suggest that age did not have a significant impact on participants' perceptions of either Digital Marketing or Business Performance.

Table 5. Correlation Coefficients, Mean and Standard Deviation Values of The Dimensions of The Scales

Variables	M	SD	Digital Marketing	Business Performance
Digital Marketing	3.85	1.04	--	
Business Performance	3.8	1.12	.835**	--

Note: N = 80. *** $p < .001$ (2-tailed).

The results show a strong, positive correlation between Digital Marketing ($M = 3.85, SD = 1.04$) and Business Performance ($M = 3.80, SD = 1.12$), with a Pearson correlation coefficient of $r = .835, p < .001$. This significant correlation indicates that higher levels of digital marketing usage are associated with better business performance outcomes in this sample of 80 participants.

Table 6. Regression Analysis Predicting Business Performance from Digital Marketing

Variables	B	Standardized β	Std. Error	F	R	R ²	p
Digital Marketing	0.892	0.835	0.066	180.223	R = 0.835	R ² = 0.698	< .001

* $p < .05$

As a result of the simple linear regression analysis conducted to examine the impact of digital marketing on business performance, a significant relationship was found between these two variables. The analysis revealed that digital marketing is a significant predictor of business performance ($R = 0.835, R^2 = 0.698$), explaining 69.8% of the variance in business performance levels. The overall model was significant ($F(1, 78) = 180.22, p < 0.001$). The standardized coefficient ($\beta = 0.835$) also indicates that digital marketing has a strong positive effect on business performance, with each unit increase in digital marketing resulting in a 0.892-unit increase in business performance.

Additionally, the significance test of the coefficient for the predictor variable ($B = 0.892$) confirms that digital marketing is a significant and positive predictor of business performance ($p < 0.001$).

Based on these results, it was concluded that digital marketing strategies have a substantial and positive effect on improving business performance within the sample.

According to the findings:

- *H1*: There is a significant and positive relationship between digital marketing and business performance. ACCEPT

• *H2*: The application of digital marketing strategies positively and significantly affects business performance. ACCEPT

• *H3*: In the context of the relationship between digital marketing and business performance in Moroccan companies, there is a significant difference in the results based on age. REJECT

CONCLUSION, DISCUSSION AND RECOMMENDATIONS

This study aimed to investigate the relationship between digital marketing efforts and business performance among companies in Morocco. The literature on digital marketing, business performance, and related concepts was reviewed extensively to provide a comprehensive background. While previous studies (Bala and Verma, 2018, p. 337; Chaffey and Ellis-Chadwick, 2019) have explored the broader impacts of digital marketing, there has been limited empirical research specifically examining this relationship in the Moroccan context. Therefore, this study contributes uniquely by assessing the direct influence of digital marketing strategies on business performance, with demographic characteristics also playing a role.

Digital marketing, as a relatively recent and evolving field, exhibits distinct characteristics that differentiate it from traditional marketing methods. Its real-time engagement, data-driven approach, and adaptability make it crucial in the modern business landscape (Kumar and Pansari, 2016, p. 500). The results of this study provide robust evidence that digital marketing plays a significant role in improving key performance indicators such as market coverage, customer engagement, and revenue generation in Moroccan companies.

Additionally, the findings emphasize the role of demographic differences in digital marketing effectiveness. Service-based industries (e.g., tourism and consulting) benefit more from digital marketing than manufacturing firms, highlighting the need for sector-specific digital strategies. Younger entrepreneurs (25–34 years old) are more inclined towards social media marketing, influencer collaborations, and digital ads, while older business owners (45+) favor traditional marketing approaches, which may limit digital adoption. Furthermore, company size impacts digital strategy effectiveness, as larger firms (>250 employees) leverage a diverse range of digital tools (SEO, PPC, and automation), while smaller businesses (<10 employees) primarily focus on SEO and social media marketing due to limited resources.

From a theoretical standpoint, these findings support the Resource-Based View (RBV), reinforcing that digital marketing serves as a strategic asset that enhances business competitiveness and performance. The results also align with relationship marketing theory, confirming that strong digital engagement fosters customer loyalty and long-term business success. Additionally, the findings validate previous research (Chaffey and Ellis-Chadwick, 2019; Pulizzi, 2014) by demonstrating that personalized, data-driven marketing approaches drive business growth.

Practically, businesses should prioritize targeted digital marketing strategies based on their industry and demographic profiles. Companies should also invest in data analytics and automation tools to improve marketing efficiency and customer segmentation. Furthermore,

firms that proactively adapt to emerging digital trends are more likely to remain competitive in Morocco's evolving digital economy.

Although our findings confirm a strong correlation between digital marketing and business performance, the study does not explicitly test for causal relationships. Future research should explore causality through advanced econometric techniques, such as panel data analysis or experimental approaches, to validate whether digital marketing initiatives directly drive business growth.

Ethical Principles and Publication Policy

We declare that we have obtained the data, information and documents we have presented in this study within the framework of academic and ethical rules, that we have presented all information, documents, evaluations and results in accordance with scientific ethics and ethical rules, that we have referred to and cited all studies we have used in the study, and that the study is original. Otherwise, we declare that we accept any loss of rights that may arise against me.

Ethics Committee Permission

Ethics committee permission for this research was obtained with the decision of Istanbul Aydın University Social and Human Sciences Ethics Committee dated 20.09.2024 and numbered 2024/09.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCE

- Aayale, J. and Seffar, M. (2021). A step towards an inclusive digital transformation of the public administration in a developing country: Evidence from Morocco. *Journal of Public Administration and Governance*, 11(2), 331–356. <https://doi.org/10.1051/10.5296/jpag.v11i2.18598>
- Aboudou, S., Ichraq, H. and Youssef, M. (2020). The behavior of connected consumers following communication by social media: Exploratory study on Moroccan ready-to-wear brands. *Studies of Applied Economics*, 38(4), 1-9. <https://doi.org/10.1051/10.25115/eea.v38i4.3968>
- Almestarihi, R., Ahmad, A. Y. A. B., Frangieh, R., Abu-ALSondos, I., Nser, K. and Ziani, A. (2024). Measuring the ROI of paid advertising campaigns in digital marketing and its effect on business profitability. *Uncertain Supply Chain Management*, 12(2), 1275–1284.
- Bala, M. and Verma, D. (2018). A critical review of digital marketing. *International Journal of Management IT and Engineering*, 8(10), 321-339.
- Ben-Youssef, A. and Dahmani, M. (2023). Examining the drivers of e-commerce adoption by Moroccan firms: A multi-model analysis. *Information*, 14(7), 378-397. DOI:10.3390/info14070378

- Benchenna, A. and Marchetti, D. (2021). Writing between the 'red lines': Morocco's digital media landscape. *Media, Culture and Society*, 43(4), 664-681. <https://doi.org/10.1051/10.1177/0163443720972316>
- Bismo, A. and Putra, S. (2019, August). *Application of digital marketing (social media and email marketing) and its impact on customer engagement in purchase intention: A case study at PT. Soltius Indonesia* [Oral presentation]. 2019 International Conference on Information Management and Technology (ICIMTech), Jakarta/Bali, Indonesia. <https://doi.org/10.1051/10.1109/ICIMTech.2019.8843763>
- Bouchra, O. (2021). *The impact of digital marketing and artificial intelligence on the sales growth of Moroccan companies* [Doctoral dissertation]. Université Internationale de Rabat. <https://doi.org/10.1051/10.13140/RG.2.2.21070.18241>
- Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş. and Demirel, F. (2014). *Bilimsel araştırma yöntemleri*. Pegem Akademi. <https://doi.org/10.1051/10.14527/9789944919289>
- Chaffey, D. and Ellis-Chadwick, F. (2019). *Digital marketing*. Pearson UK.
- Chaffey, D. and Smith, P. R. (2022). *Digital marketing excellence: Planning, optimizing and integrating online marketing*. Routledge. <https://doi.org/10.1051/10.4324/9781003009498>
- Chouki, M., Khadrouf, O., Talea, M. and Okar, C. (2022). What are the barriers to information technology adoption in Moroccan SMEs? An empirical investigation using structural equation modelling. *International Journal of Business Innovation and Research*, 29(1), 66-89. <https://doi.org/10.1051/10.1504/IJBIR.2022.125672>
- Clarence, C. and Keni, K. (2022, May, 11). *The prediction of purchase intention is based on digital marketing, customer engagement and brand preference*. Tenth International Conference on Entrepreneurship and Business Management 2021 (ICEBM 2021). <https://doi.org/10.1051/10.2991/aebmr.k.220501.073>
- El , I., Ait Lhassan, I. and Belamhitou, M. (2021). The contribution of digital marketing to business performance: The case of companies in the Northern region of Morocco. *European Scientific Journal ESJ*, 17(8), 82-99. <https://doi.org/10.1051/10.19044/esj.2021.v17n8p82>
- El Hachimi, I., Lhassan, I. A., & Belamhitou, M. (2021). The Contribution of Digital Marketing to Business Performance: The Case of Companies in the Northern Region of Morocco. *European Scientific Journal, ESJ*, 17(8), 82-105. <https://doi.org/10.19044/esj.2021.v17n8p82>
- Elhazziti, M. A., Ferraz, D. A. C., Elazzouzi, E., Master, M. and Gomes, J. S. (2023). Digital transformation in Morocco: Challenges and perspectives. *Journal of US-China Public Administration*, 20(2), 83-97.
- El Yaagoubi, W. L. and Machrafi, M. (2021, March, 26-27). *Social media influencers, digital marketing and tourism in Morocco*. Economic and Social Development: Book of Proceedings, Rabat, Morocco.
- Evans, D. (2020). *Affiliate marketing for beginners: A complete guide to passive income*. Business Press.

- Goldfarb, A. and Tucker, C. (2019). Digital marketing. *Handbook of the Economics of Marketing 1*, 259-290. <https://doi.org/10.1051/10.1016/bs.hem.2019.04.004>
- Hair, J. F., Black, W. C., Babin, B. J. and Anderson, R. E. (2013). *Multivariate data analysis* (7th ed.). Pearson Education.
- Islami, N. N., Wahyuni, S. and Tiara, T. (2020). The effect of digital marketing on organizational performance through intellectual capital and perceived quality in micro, small, and medium enterprises. *Jurnal Organisasi dan Manajemen*, 16(1), 59-70. <https://doi.org/10.1051/10.33830/jom.v16i1.718.2020>
- Junaidi, J. (2020). Impact of digital marketing on the growth of e-service sales. *International Journal of Psychosocial Rehabilitation*, 24(01), 1219-1229. <https://doi.org/10.61841/x261sn69>
- Kane, G. C., Palmer, D., Nguyen Phillips, A., Kiron, D. and Buckley, N. (2018). *Coming of age digitally: Learning, leadership and legacy*. MIT Sloan Management Review and Deloitte Insight.
- Karasar, N. (2004). *Bilimsel araştırma yöntemi: Kavramlar, ilkeler, teknikler* (13th ed.). Nobel Yayın Dağıtım.
- Khadraoui, S. (2020). Effects of social media on new businesses in the US and Morocco. *Journal of Business and Social Media Studies*, 12(3), 45–67.
- Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). Guilford Press.
- Kumar, V. and Pansari, A. (2016). Competitive advantage through engagement. *Journal of Marketing Research*, 53(4), 497–514. <https://doi.org/10.1051/10.1509/jmr.15.0044>
- Lopes, A. R. and Casais, B. (2022). Digital content marketing: Conceptual review and recommendations for practitioners. *Academy of Strategic Management Journal*, 21(2), 1–17.
- Mahboub, H. M. and Sadok, H. (2024). Barriers to digital transformation: The case of Moroccan companies. *Journal of Telecommunications and the Digital Economy*, 12(1), 261–276. <https://doi.org/10.1051/10.18080/jtde.v12n1.814>
- Morgan, R. M., & Hunt, S. (1999). Relationship-based competitive advantage: the role of relationship marketing in marketing strategy. *Journal of business research*, 46(3), 281-290. [https://doi.org/10.1016/S0148-2963\(98\)00035-6](https://doi.org/10.1016/S0148-2963(98)00035-6)
- Nunnally, J. C. (1967). *Psychometric theory*. McGraw-Hill. <https://doi.org/10.1017/S0033312300004567>
- Omeish, F., Alrousan, M., Alghizzawi, M., Aqqad, A. and Daboub, R. (2024). Social media marketing elements, purchase intentions, and cultural moderators in fast fashion: Evidence from Jordan, Morocco and Spain. *International Journal of Data and Network Science*, 8(3), 1613–1624. <https://doi.org/10.1051/10.5267/j.ijdns.2024.3.005>
- Pulizzi, J. (2014). *Epic content marketing: How to tell a different story, break through the clutter and win more customers by marketing less*. McGraw-Hill Education.
- Rida, O., Nafidi, A., and Achchab, B. (2024). Modelling and Forecasting Individuals Using the Internet (% of Population) in Morocco. In *Applied Mathematics and Modelling in Finance*,

- Marketing and Economics* (1st ed., pp. 165-178). Springer Nature. https://doi.org/10.1007/978-3-031-42847-0_14
- Ryan, D. (2016). *Understanding digital marketing: Marketing strategies for engaging the digital generation* (4th ed.). Kogan Page.
- Sabbagh, F. (2021). Email marketing: The most important advantages and disadvantages. *Journal of Economics and Technology Research*, 2(3), 14–29. <https://doi.org/10.1051/10.22158/jetr.v2n3p14>
- Tuten, T. L. and Solomon, M. R. (2018). *Social media marketing* (3rd ed.). SAGE Publications.
- Ural, A. and Kılıç, İ. (2005). *Bilimsel araştırma süreci ve SPSS ile veri analizi*. Detay Yayıncılık.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 28(2), 118–144. <https://doi.org/10.1051/10.1016/j.jsis.2019.01.003>
- Visser, M., Sikkenga, B. and Berry, M. (2021). *Digital marketing fundamentals: From strategy to ROI*. Taylor and Francis.
- World Bank. (2020, June 22). World Bank Approves \$US500 Million to support Morocco's financial and digital inclusion reforms. <https://www.worldbank.org/en/news/press-release/2020/06/22/world-bank-approves-us500-million-to-support-morocco-financial-and-digital-inclusion-reforms>
- WordStream. (2025). What Is PPC? Learn the Basics of Pay-Per-Click (PPC) Marketing. <https://www.wordstream.com/ppc>
- YachouAityassine, F. L., Al-Ajlouni, M. M. and Mohammad, A. A. S. (2022). The effect of digital marketing strategy on customer and organizational outcomes. *Marketing I Menedžment Inovacij*, 13(4), 45–54. <https://doi.org/10.1051/10.21272/mmi.2022.4-05>
- Youssef, A. B. (2023). Determinants of adoption of online commercial activities by Moroccan firms. *Economic Research Forum Working Paper Series*, (1639).
- Zarrouk, I. and El Aidouni, A. (2023). The digital marketing practiced by the Moroccan tourism sector: National-scale communication actions and environmental management. *E3S Web of Conferences*, 412, 1–6. <https://doi.org/10.1051/e3sconf/202341201035>