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Leveraging AI Competencies, Big Data Analytics, and Social Media Technology Use to Enhance Firm Performance in E-Commerce Businesses

By:

- Mohammed Abdallah Tedjani
- Hocine Redouani
- Abderraouf Hassouna

Supervisor:

Dr. Tamma Elhachemi

Full Name	Position
Dr. Elhachemi Tamma	Supervisor
Prof. Hicham Gherbi	Chairman
Prof. Hamza Ben Khalifa	Examiner

Academic year 2024/2025

Declaration

We, the undersigned, solemnly declare that this thesis, entitled "Leveraging AI Competencies, Big Data Analytics, and Social Media Technology Use to Enhance Firm Performance in E-Commerce Businesses" constitutes our original work. This research was undertaken under the expert guidance and supervision of Dr. Tamma Elhachemi.

To ensure the academic rigor and integrity of this study, we have drawn upon credible and authoritative sources, including but not limited to Google Scholar, Elsevier, Emerald Publisher, Sage, Springer, ASJP (Algerian Scientific Journal Platform), Scite.ai/Assistant, and Consensus.app. In the preparation of this thesis, we employed several artificial intelligence tools—namely OpenAI's ChatGPT-4, Google AI Studio, Grok (developed by xAI), Grammarly AI, and Microsoft Copilot—exclusively for writing assistance, proofreading, and enhancing the clarity and coherence of our text.

We have diligently sought to acknowledge all referenced works accurately and uphold the highest standards of academic integrity in line with scholarly conventions. Any unintentional errors or oversights remain our sole responsibility.

We further certify that this thesis, whether in whole or in part, has not been submitted for the conferment of any degree, diploma, or qualification at any other university or academic institution.

Signed:

Mohammed Abdallah Tedjani

Hocine Redouani

Abderraouf Hassouna

Dedication

Whoever says, "I am capable of it," will attain it, and I am capable of it. If it refuses, I will bring it about. Praise be to God, who facilitated the beginnings and enabled me to reach the end by His grace and generosity.

(وَأَخِرُ دَعْوَاهُمْ أَنْ الْحَمْدُ لِلَّهِ رَبِّ الْعَالَمِينَ)

To my dear father and grandfather, may God protect them, who illuminated my path and gave me the strength to continue my journey with their great sacrifices. Especially, thank you to my father.

To my beloved mother and grandmother, may God protect them, who gave me life and hope, and whose prayers made difficulties easier. Without them, I would not have completed my journey.

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Today, I have completed the fruits of my labor, and I dedicate this achievement to all of you, by the grace of God. Praise be to God, who has guided me and made me blessed wherever I am.

Mohammed Abdallah

Dedication

In the name of Allah, the Most Gracious, the Most Merciful.

To the one whose light still guides me though he is gone, to my beloved father, who taught me the meaning of perseverance and hope, To the one who held my hand and whispered, "You will do great things,"

Today, I offer this humble work, praying it honors even a fragment of your dreams.

To my mother, my rock and refuge after Allah, to my siblings, my teachers, and all who stood by me, to every soul who encouraged me with a word, a prayer, or a smile This is the fruit of our shared journey.

May Allah have mercy on you, my father, forgive you, and grant you the highest Paradise.

I pray this work pleases him, benefits others, and becomes a bridge to your eternal reward.

- **Hocine**

Dedication

I dedicate this humble work of mine to those who have been my pillars of strength, guided me through challenges, and inspired me to pursue knowledge and perseverance:

To the one who stood by me in the most trying times, offering unwavering support and boundless generosity: My beloved father, may Allah bless him with a long life.

To the one who faced every hardship with me, providing endless love and encouragement: My dear mother, may Allah keep her forever by my side.

To my cherished companions in learning, who shared unforgettable moments and made my academic journey joyful: My study friends at the College of Economics.

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- **Abderraouf**

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We wish you continued success and prosperity in all your endeavors, and we look forward to furthering our collaboration and dedication in the pursuit of knowledge together.

Abstract

In the context of accelerating digital transformation, e-commerce has become a pivotal force in shaping business growth, particularly in emerging economies like Algeria. This study investigates the influence of three key technological capabilities—Artificial Intelligence (AI) competencies, Big Data Analytics (BDA), and Social Media Technology Use (SMTU)—on the performance of e-commerce businesses operating in El Oued, Algeria. Anchored in the Resource-Based View (RBV) and Dynamic Capabilities Theory, the research seeks to uncover how these digital tools contribute to firm performance within a developing market environment.

A quantitative research design was employed, and data were collected through a structured questionnaire distributed to 155 e-commerce firms. A total of 124 valid responses were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that both Big Data Analytics and Social Media Technology Use have a statistically significant and positive effect on firm performance, with SMTU demonstrating the strongest impact. However, the relationship between AI competencies and firm performance was found to be statistically insignificant in this context.

This study contributes to the academic literature by providing an integrated framework that examines technology-driven firm performance in a developing economy. Practically, it offers actionable insights for business leaders and policymakers to prioritize investments in data analytics and social engagement tools to strengthen competitiveness.

Keywords: Big Data Analytics, Social Media Technology Use, AI Competencies, Firm Performance, E-commerce, Algeria.

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List of Abbreviation

Abbreviation	Full Term / Meaning
AI	Artificial Intelligence
AIC	AI Competencies (Construct in the structural model)
BDA	Big Data Analytics
FPERF	Firm Performance (Construct in the structural model)
PLS-SEM	Partial Least Squares Structural Equation Modeling
SEM	Structural Equation Modeling
SMTU	Social Media Technology Use

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Commerce has been central to economic activity, evolving from barter systems to complex global networks. The rise of digital technologies has revolutionized trade, giving rise to e-commerce—the buying and selling of goods and services online (Saura et al., 2022). This shift has expanded market access for firms and enhanced convenience for consumers, driven by widespread internet adoption and evolving consumer behavior (Gao et al., 2023).

E-commerce has witnessed exponential growth globally, further accelerated by the COVID-19 pandemic. In 2020, it accounted for 19% of global retail sales, up from 16% in 2019, and is projected to exceed 21% by 2029 (Statista Research Department, 2023; Dencheva, 2024). The market generated over \$7 trillion in sales in 2024, expected to surpass \$10.4 trillion by 2028 (Text Data, 2024). Leading platforms like Amazon, Pinduoduo, and JD.com dominate the industry, with GMVs in the hundreds of billions (van Gelder, 2025).

In the MENA region, e-commerce is expanding rapidly, with market size projected to grow from \$155.16 billion in 2025 to \$302.43 billion by 2030 (Mordor Intelligence, 2025). Africa's e-commerce sector follows a similar

trajectory, with online shoppers expected to surpass 500 million by 2025, growing at 17% annually (Badghish & Soomro, 2024). Algeria has seen significant growth, with internet penetration rising from 49% in 2019 to over 65% by 2024, driving a 35–40% increase in online shopping post-pandemic (Statista Research Department, 2024c; Digital Watch Observatory, 2022). The country's e-commerce market was valued at \$1.2 billion in 2024 and is expected to reach \$2.5 billion by 2029 (Statista Research Department, 2024c).

Despite this growth, Algerian e-commerce firms face significant challenges, including weak technological capabilities, inadequate logistics, and low consumer confidence (Diouani et al., 2023). Over 60% of Algerian e-commerce startups fail within two years, contrasting sharply with global leaders like Amazon and Pinduoduo (BENMIR & Mesnadi, 2023). Mobile commerce (m-commerce) remains underutilized, despite its dominance in regions like Asia, where Malaysia led with 45% of its population making weekly mobile purchases by 2021 (Text Data, 2024). Algerian firms struggle with operational inefficiencies, limited digital infrastructure, and low customer retention (Mikalef et al., 2023).

The ongoing underperformance of Algerian e-commerce firms underscores the need for targeted research to understand the factors influencing their success. While the sector continues to grow, many businesses face

structural and operational barriers that limit their sustainability and competitiveness. Given the increasing role of technology in shaping business performance, it is crucial to explore how firms can leverage digital advancements to enhance their growth and efficiency. Understanding the impact of technological adoption on firm performance will provide valuable insights into how businesses can navigate challenges and capitalize on opportunities in the digital economy. Conducting a study in this area will help identify key drivers of competitiveness and sustainability, offering a roadmap for strengthening the e-commerce sector and enhancing its contribution to economic development (Erhan et al., 2023).

1.2. Problem Statement

E-commerce has transformed global business operations, enabling firms to expand their market reach and optimize efficiency. However, sustaining high performance—measured by profitability, market share, and customer retention—remains a significant challenge, particularly in highly competitive digital markets (Mikalef et al., 2023). Firms must continuously adapt to evolving consumer behaviors and technological advancements to maintain their competitiveness. In emerging economies where infrastructural and financial constraints are prevalent, poor business performance can lead to reduced competitiveness and high failure rates,

highlighting the need for a deeper understanding of the determinants of success (Badghish & Soomro, 2024).

In Algeria, e-commerce has exhibited steady growth, with the market valued at \$1.2 billion in 2024 and projected to reach \$2.5 billion by 2029, driven by an increase in internet penetration from 49% in 2019 to over 65% by 2024 (Statista Research Department, 2024c). Despite this expansion, the sector faces considerable challenges, with over 60% of e-commerce startups failing within two years due to insufficient technological capabilities, weak logistics infrastructure, and low consumer trust (BENMIR & Mesnadi, 2023; Diouani et al., 2023). These persistent barriers emphasize the need for empirical research to identify strategies that enhance business sustainability and competitiveness in this evolving digital landscape.

Extant research on e-commerce performance has explored various determinants, including customer satisfaction, website usability (Erhan et al., 2023), supply chain efficiency (Davenport & Ronanki, 2018), logistics management, and pricing strategies (Diouani et al., 2023; Huang & Rust, 2020). Additionally, digital marketing, consumer trust, and service quality have been examined as key performance factors, particularly in developed markets (Lemon & Verhoef, 2016). However, much of this research relies on traditional performance metrics and does not sufficiently address the

role of emerging technologies, particularly in developing regions such as Algeria.

A significant gap exists in the literature concerning the role of technological factors in enhancing e-commerce performance. While studies by Mikalef et al. (2023) and Chen et al. (2023) have underscored the importance of AI competencies, big data analytics, and social media technology, their impact on e-commerce performance remains underexplored. Recommendations for future research suggest a more in-depth examination of these variables to address operational inefficiencies and enhance firm performance (Nadeem et al., 2020; Bilgihan & Wang, 2021). This knowledge gap is particularly relevant in Algeria, where e-commerce firms struggle to leverage advanced digital technologies compared to global market leaders like Amazon and Pinduoduo (van Gelder, 2025).

Given the rapid technological advancements shaping e-commerce globally, an integrated examination of AI competencies, big data analytics, and social media technology is crucial. These technologies offer synergistic benefits, optimizing operations, improving customer engagement, and enhancing decision-making processes (Badghish & Soomro, 2024). For Algerian e-commerce firms, a comprehensive analysis of these factors could provide actionable insights to overcome structural barriers and

improve market competitiveness. Addressing this research gap is imperative for supporting the growth and long-term sustainability of Algeria's e-commerce sector.

Given this context, the central research question guiding this study is: To what extent do AI competencies, big data analytics, and social media technology influence the performance of e-commerce businesses in Algeria?

1.3. Research Questions

1. To what extent do AI competencies impact the performance of e-commerce businesses in Algeria, with statistical significance at $\alpha < 0.05$?
2. How does big data analytics influence the performance of Algerian e-commerce businesses, ensuring statistical validity at $\alpha < 0.05$?
3. What is the effect of social media technology use on the performance of e-commerce businesses in Algeria, with a significance level of $\alpha < 0.05$?

1.4. Research Objectives

1. To examine the relationship between AI competencies and the performance of e-commerce businesses in Algeria, establishing statistical significance at $\alpha < 0.05$.
2. To analyze the impact of big data analytics on the performance of Algerian e-commerce businesses, validating statistical significance at $\alpha < 0.05$.
3. To assess the influence of social media technology use on e-commerce business performance in Algeria, ensuring statistical significance at $\alpha < 0.05$.

1.5. Scope of the Study

This study examines the impact of AI competencies, big data analytics, and social media technology use on the performance of e-commerce businesses, with a specific focus on firms operating in El-Oued, Algeria. By concentrating on this regional context, the research aims to provide a nuanced understanding of how these technological factors influence business performance in an emerging digital economy.

The study adopts a quantitative approach, assessing the statistical significance of these relationships at $\alpha < 0.05$. It is limited to the selected technological variables and does not extend to other potential determinants

of e-commerce success, such as regulatory policies, financial constraints, or consumer behavior. The scope is deliberately defined to ensure a focused and in-depth analysis of the role of technology in enhancing e-commerce performance within the specified region.

The findings of this research will be valuable for e-commerce entrepreneurs, policymakers, and technology strategists seeking data-driven insights into the strategic integration of AI, big data, and social media technologies. While the results will provide important implications for the development of the e-commerce sector in El-Oued, their applicability to other regions should be considered within the context of regional economic and infrastructural variations.

1.6. Justification of the Study

The increasing integration of digital technologies has transformed the global e-commerce landscape, yet businesses in emerging economies often face challenges in fully leveraging these advancements. While existing research has extensively examined factors such as logistics and pricing in e-commerce success, there is limited exploration of how AI capabilities, big data analytics, and social media technology influence business performance—particularly in Algeria. Given the country's growing digital infrastructure and expanding online market, understanding the role of these

technologies is essential for strengthening competitiveness and long-term sustainability.

This study is valuable both academically and practically. It addresses a research gap by analyzing how digital innovations impact e-commerce firms in Algeria, offering insights that can be applied to similar developing markets. Additionally, it provides strategic recommendations to help businesses optimize operations, improve customer engagement, and enhance overall performance. Policymakers can also benefit from these findings by developing frameworks that encourage digital transformation. By tackling key technological and operational barriers, this research contributes to the advancement of Algeria's e-commerce sector and its role in the digital economy.

1.7. Significance of the Study

In today's digital world, technology is at the heart of e-commerce success. Businesses that harness AI, big data analytics, and social media technology can enhance efficiency, connect with customers more effectively, and stay competitive. However, in developing markets like Algeria, many e-commerce firms struggle to fully integrate these tools, limiting their growth potential. This study aims to bridge that gap by exploring how these

technologies influence business performance, offering insights that are both timely and practical.

On an academic level, this research adds to the growing conversation about digital transformation in e-commerce, particularly in emerging economies. While many studies focus on logistics, pricing, and customer service, fewer have examined how advanced digital tools shape success in markets like Algeria. By shedding light on this area, the study contributes fresh perspectives to the field.

From a practical standpoint, the findings will help e-commerce businesses navigate the challenges of technological adoption. The study will provide actionable recommendations to improve efficiency, build customer trust, and strengthen competitiveness. Policymakers and industry leaders can also use these insights to create a more supportive digital ecosystem. Ultimately, this research seeks to empower Algerian e-commerce firms to thrive in an increasingly digital global economy.

1.8. Challenges of the Study

This study faced several challenges during its execution in the context of El Oued, particularly in collecting data from e-commerce entrepreneurs. One of the most significant difficulties was the absence of an official

database or a clear and comprehensive list of e-commerce businesses in the region. This made identifying and reaching out to target companies a complex and time-consuming task.

Additionally, the study encountered low response rates, as many entrepreneurs were hesitant to participate due to time constraints or a lack of interest in academic research. Limited awareness of the importance of e-commerce studies further contributed to the reluctance of some participants to engage seriously with the research.

Technological barriers also posed a challenge, as some businesses faced issues related to digital infrastructure, such as weak internet connectivity and limited access to necessary technological devices. Furthermore, the lack of up-to-date and reliable official data on the e-commerce sector in El Oued made it difficult to support the study's findings with accurate references, requiring additional efforts to validate the available information.

Another challenge was sample bias, as participation was often limited to specific groups of e-commerce entrepreneurs, particularly startup owners and businesses with higher digital literacy. This could impact the generalizability of the findings across the entire sector.

Finally, logistical constraints, including limited resources and difficulties in reaching all relevant e-commerce actors within the region, affected the sample size and the ability to ensure comprehensive representation.

Despite these challenges, the study employed a rigorous methodology to ensure the reliability and validity of the data. The findings contribute valuable insights into the impact of digital technologies on the performance of e-commerce businesses in El Oued and pave the way for further research in this evolving field.

1.9. Literature Review

1.9.1. The Relationship Between Artificial Intelligence competence (AI) and Firm Performance

AI competence refers to an organization's ability to harmoniously combine AI-based technologies, skills, knowledge, and complementary resources to build a defining strength among competitors (Mikalef et al., 2023). It is not merely about having AI technologies but about the creative bundling of these technologies with organizational knowledge and institutional frameworks to generate business value (Mikalef et al., 2023). Firm performance, on the other hand, is often measured by key performance indicators such as market share, profitability, innovation, and growth in comparison to competitors (Mikalef et al., 2023).

Artificial Intelligence (AI) has emerged as a transformative force across various industries, revolutionizing business processes, decision-making, and firm performance. AI-driven technologies, such as machine learning, automation, and data analytics, provide firms with competitive advantages, improved efficiencies, and enhanced innovation capabilities. Several studies have investigated the impact of AI on firm performance, with a consensus that AI enhances organizational capabilities, decision-making, and overall business sustainability.

The relationship between AI competence and firm performance is underpinned by several theoretical perspectives. The Resource-Based View (RBV) suggests that AI serves as a valuable, rare, and inimitable resource that can enhance firm performance through data-driven decision-making and operational efficiencies (Barney, 1991). Additionally, the Dynamic Capabilities Theory posits that AI strengthens firms' ability to adapt to changing environments by improving agility, innovation, and strategic responsiveness. Moreover, the Intelligence-Based View (IBV) argues that integrating AI with human expertise enhances competitive advantage and long-term sustainability.

Several empirical studies have examined the impact of AI on firm performance, highlighting various mediators and moderators influencing this relationship. Abdul Wahab and Radmehr (2024) found that AI

assimilation in SMEs positively impacts firm performance by enhancing absorptive capacity, customer agility, and organizational agility. Their findings suggest that firms that integrate AI into their business models improve adaptability and responsiveness to market changes. Wang and Han (2024) explored AI's role in firm innovation, emphasizing how AI enhances innovation speed and quality. Their study found that human-machine collaboration moderates the impact of AI advancement, indicating that firms must strategically balance AI automation with human expertise to achieve optimal results. Johnson et al. (2022) analyzed AI-driven decision support systems and found that AI enables firms to make data-driven strategic decisions, thereby improving agility and competitive positioning in dynamic environments. Rahman et al. (2023) examined AI-based customer relationship management (AI-CRM) and its impact on social sustainability performance in business-to-business (B2B) firms. Their research highlights that AI adoption improves relationship management and technology readiness, ultimately fostering better sustainability outcomes.

Wamba-Taguimdje et al. (2020) found that AI optimizes business processes and enhances automation, leading to improved firm performance at both organizational and operational levels. Lichtenthaler (2019) proposed an intelligence-based view of firm performance, arguing that

firms need to integrate AI with human expertise to sustain competitive advantages. Akpata (2017) investigated AI's role in financial risk management and firm profitability. Findings suggest that AI enhances risk prediction, credit rating accuracy, and stock price volatility management, ultimately improving financial stability. However, strong regulatory oversight is necessary to mitigate AI-related risks. Akpata (2017) also examined AI's role in risk management within financial institutions and found that AI-based risk management enhances financial stability but requires strong regulatory measures. Kokina et al. (2025) highlighted the need for firms to implement robust AI governance frameworks to address issues of transparency in AI-driven accounting automation. The potential displacement of jobs due to automation also raises ethical concerns, requiring firms to adopt human-AI collaboration strategies to ensure sustainable employment. Vergne (Year not found) defined AI intelligence in relation to expertise, proposing AI as a field of artificial performance rather than pure intelligence.

The reviewed literature confirms a positive relationship between AI competence and firm performance, emphasizing AI's role in driving innovation, operational efficiency, strategic decision-making, and risk management. However, firms must adopt responsible AI integration strategies to maximize benefits while mitigating potential risks. Future

research should explore industry-specific AI applications, regulatory challenges, and ethical considerations to provide a more comprehensive understanding of AI's long-term impact on firm performance.

Table 1.1: Relationship between AI competence and firm performance

No.	Paper Title	Authors (Year)	Country	Variables	Methods	Findings
1	AI in Accounting: Challenges and Opportunities	Julia Kokina, Shay Blanchette, Thomas H. Davenport, Dessislava Pachamanova (2025)	USA	AI adoption, accounting automation, financial performance	Survey-based study	AI integration in accounting improves efficiency but raises concerns about transparency and job displacement.
2	The impact of AI assimilation on firm performance in SMEs	Mohamad Deeb Abdul Wahab, Mehrshad Radmehr (2024)	Lebanon	AI assimilation, firm performance, absorptive capacity, customer agility, organizational agility	Cross-sectional survey (417 SMEs), structural equation modeling	AI assimilation positively affects firm performance, mediated by customer agility and absorptive capacity, with organizational agility as a moderator.
3	Haste Makes Waste: AI Advancement & Film Firm Performance	Zexia Wang, Wucheng Han (2024)	China	AI advancement, innovation speed, innovation quality, human-machine collaboration, firm performance	Resource-based view, moderated mediation model, data from 355 film firms	AI advancement improves firm performance through innovation quality; human-machine collaboration moderates the impact on innovation speed but not directly on firm performance.
4	AI and B2B Firms' Social Sustainability Performance	Muhammad Sabbir Rahman, Surajit Bag, Shivam Gupta,	Bangladesh, India, France, UK	AI-based customer relationship management,	Structural Equation Modeling (SEM)	AI capabilities influence B2B firms' sustainability performance and relationship management.

No.	Paper Title	Authors (Year)	Country	Variables	Methods	Findings
		Uthayasankar Sivarajah (2023)		technology readiness, firm performance		
5	AI and Strategic Decision Making in Firms	Prince Chacko Johnson, Christofer Laurell, Mart Ots, Christian Sandström (2022)	Sweden	AI-driven decision support systems, firm agility, innovation	Case study method	AI-based decision-making systems enhance firm agility and competitiveness in dynamic environments.
6	Influence of AI on Firm Performance: Business Value of AI-Based Transformation	Serge-Lopez Wamba-Taguimdje, Samuel Fosso Wamba, Jean Robert Kala Kamdjoug, Chris Emmanuel Tchatchouang Wanko (2020)	Cameroon, France	AI, business value, process innovation, firm performance	Case study analysis (500 AI-based projects)	AI optimizes business processes, enhances automation, and improves firm performance at both organizational and process levels.
7	An Intelligence-Based View of Firm Performance: Profiting from AI	Ulrich Lichtenthaler (2019)	Germany	AI, firm performance, intelligence-based view, competitive advantage	Conceptual framework	Firms need to integrate AI with human expertise to achieve competitive advantage, requiring dynamic AI-human intelligence interaction.
8	Firm Performance: A Reflection of Risk Management Practices and AI	Isoken Akpata (2017)	Canada	AI, risk management, profitability, financial performance	Regression analysis, risk factor modeling	AI enhances financial risk management, which significantly impacts firm

No.	Paper Title	Authors (Year)	Country	Variables	Methods	Findings
						profitability, particularly for financial institutions.
9	AI and Risk Management in Financial Institutions	Isoken Akpata (2017)	Canada	AI, financial risk, credit ratings, stock price volatility	Econometric modeling	AI-based risk management enhances financial stability but requires strong regulatory oversight.
10	Artificial Intelligence and Expertise: The Two Faces of Artificial Performance	Matthieu Vergne (Year not found)	Japan	AI, expertise, intelligence, performance	Theoretical analysis	Defines AI intelligence in relation to expertise, proposing AI as a field of artificial performance rather than pure intelligence.

1.9.2. Big Data Analytics (BDA) and Firm Performance

Big Data Analytics (BDA) refers to the ability of firms to collect, process, and analyze vast volumes of structured and unstructured data to extract valuable insights that drive decision-making, innovation, and competitive advantage (Alshuaibi et al., 2024). By leveraging predictive, prescriptive, and real-time analytics, firms can optimize their operational processes, enhance strategic agility, and improve overall firm performance.

The relationship between Big Data Analytics and firm performance has been widely explored across various dimensions, including sustainability, innovation, competitive advantage, corporate social responsibility (CSR), and decision-making. Recent studies highlight that BDA plays a crucial role in enhancing a firm's triple bottom line performance, encompassing economic, social, and environmental aspects. Ertz et al. (2024) found that both predictive and prescriptive analytics contribute to improving sustainable firm performance, while Khan et al. (2024) demonstrated that BDA enhances supply chain sustainability by optimizing product return processes in closed-loop supply chains. These findings suggest that firms leveraging BDA can significantly improve operational efficiency while reducing environmental waste and promoting sustainable business practices.

Beyond sustainability, BDA has been identified as a key driver of innovation and agility within organizations. A 2024 study on organizational innovation found that firms using BDA effectively were more adept at developing new products and services, highlighting its role in fostering competitive agility. Dahiya et al. (2025) further emphasized that the impact of BDA on firm performance is mediated by human capital, suggesting that firms with skilled employees in analytics are better positioned to capitalize on data-driven innovation. Similarly, Behl (2020) conducted a cross-cultural study on startups in India and China, demonstrating that BDA capabilities significantly contribute to competitive advantage by enabling faster and more data-driven decision-making. This aligns with Ferraris et al. (2018), who found that knowledge management serves as a crucial mediator in maximizing the benefits of BDA, reinforcing the notion that firms must integrate analytics with organizational learning to achieve superior performance.

In addition to fostering competitiveness and innovation, BDA has been linked to corporate social responsibility (CSR) and ethical business practices. Ertz et al. (2024) found that firms implementing BDA-driven strategies improve their CSR and ESG (Environmental, Social, and Governance) performance, indicating that data-driven approaches contribute not only to financial gains but also to responsible business

conduct. Moreover, BDA enhances strategic decision-making and forecasting. Chatterjee et al. (2023) demonstrated that firms utilizing BDA achieve smarter decision-making and more accurate forecasting, which in turn leads to better resource allocation and overall performance improvements.

Overall, the literature strongly supports the positive relationship between BDA and firm performance across multiple dimensions. However, studies indicate that the effectiveness of BDA is significantly influenced by human capital, knowledge management, and organizational readiness. Firms that invest in developing data-driven cultures, upskilling employees, and integrating analytics into decision-making processes are more likely to achieve sustainable competitive advantages and long-term success. Future research should explore industry-specific applications of BDA and investigate its long-term impact on firm performance, ensuring a more comprehensive understanding of its evolving role in business strategy.

Table 1.2: previous Studies for the Relationship between Big Data Analytics and Firm Performance

No.	Paper Title	Authors & Year	Country	Variables	Methods	Findings
1	The Effects of Big Data Analytics on Sustainable Business Models	Various (2024)	Global	BDA, Business Models	Case Studies	BDA helps companies create more sustainable business models.
2	The Relationship Between Big Data Analytics and Organizational Innovation	Unknown (2024)	Multiple	BDA, Innovation	Mixed Methods	BDA enhances innovation in various industries.
3	Big Data Analytics and Corporate Social Responsibility	Ertz et al. (2024)	Canada, USA	BDA, CSR, ESG	Panel Data Regression	BDA positively affects CSR and ESG performance.
4	The Impact of Big Data Analytics on Firm Sustainable Performance	Ertz et al. (2024)	Canada, USA	Predictive & Prescriptive Analytics, Triple Bottom Line	OLS Regression	BDA improves economic, social, and environmental performance.
5	Sustainable Performance in SMEs using Big Data Analytics for Closed-Loop Supply Chains	Khan et al. (2024)	Pakistan	Circular Economy, Product Return Knowledge	SEM (AMOS v24)	BDA enhances supply chain sustainability.
6	The Role of Big Data Analytics in Enhancing Decision-Making for Technological Forecasting	Chatterjee et al. (2023)	USA	BDA, Decision-Making	PLS-SEM	BDA helps firms make better technology forecasting decisions.

Table 1.2: previous Studies for the Relationship between Big Data Analytics and Firm Performance

No.	Paper Title	Authors & Year	Country	Variables	Methods	Findings
7	Big Data Analytics and Firm Performance: The Effects of Human Capital and Mediating Firm Capabilities	Dahiya et al. (2025)	USA	Human Capital, Firm Capabilities	Hierarchical Regression, PROCESS Macro	Managerial & employee analytics HC positively impact performance.
8	Antecedents to Firm Performance and Competitiveness Using Big Data Analytics: A Cross-Cultural Study	Behl (2020)	India, China	BDA Capabilities, Competitive Advantage	WarpPLS 6.0	BDA positively affects startup performance, moderated by organizational culture .
9	Big Data Analytics Capabilities and Knowledge Management: Impact on Firm Performance	Ferraris et al. (2018)	Italy	Knowledge Management, Big Data Analytics	Structural Equation Modeling (SEM)	KM mediates the effect of BDA on firm performance .
10	Big Data Analytics and Firm Performance: A Systematic Review	Maroufkhani et al. (2019)	Multiple	Big Data Analytics, Firm Performance	Systematic Literature Review	Identifies factors influencing BDA adoption and its impact on firm performance.

1.9.3. Social Media Technology Use (SMTU) and Firm Performance

Social media technology usage (SMTU) refers to the integration of customer-facing activities, including processes, systems, and technologies, with emergent social media applications to engage customers in collaborative conversations and enhance customer relationships (Trainor, 2012). Firms leveraging SMTU effectively can foster stronger relationships with customers, improve engagement, and enhance decision-making processes.

The relationship between social media usage and firm performance has been widely studied, revealing both positive and complex effects across different industries and organizational contexts. Many studies suggest that social media enhances firm performance by improving customer relationships, fostering innovation, and increasing agility. However, the extent of its impact depends on factors such as managerial involvement, firm maturity, and industry-specific conditions.

One of the most significant contributions of social media to firm performance is its role in exporting and international business. Alarcón-del-Amo et al. (2024) found that social media improves relationship-building with foreign customers but does not directly reduce export costs. In contrast, earlier research by Alarcón-del-Amo et al. (2017) highlighted that export managers who actively engage with social media can improve firm performance. This suggests that the effectiveness of social media depends not only on its adoption but also on how firms strategically use it. Similarly,

Alarcón et al. (2015) emphasized that firms with higher social media competence tend to experience better export performance, reinforcing the importance of digital literacy in global markets.

Beyond exports, social media plays a crucial role in driving innovation and agility within firms. Tehranian et al. (2024) found that social media usage enhances both innovation capability and organizational agility, which in turn boosts firm performance. This aligns with Kamboj et al. (2017), who demonstrated that social capital acts as a mediator in this relationship, meaning that firms that build strong network connections through social media are better positioned to innovate and remain competitive. Foltean et al. (2018) further support this argument by showing that customer relationship management (CRM) capabilities mediate the effect of social media on firm performance, suggesting that firms need structured strategies to maximize the benefits of digital platforms.

However, the impact of social media on firm performance is not always linear. Zu et al. (2019) found an inverted U-shaped relationship, indicating that moderate social media investment enhances performance, but excessive engagement may lead to diminishing returns. This suggests that firms must balance their digital efforts to avoid overspending on ineffective strategies. Additionally, Ahmad et al. (2018) found that social media adoption had no significant impact on SMEs in the UAE,

highlighting that smaller firms may struggle to fully leverage digital tools due to resource limitations.

A key factor influencing social media's effectiveness is organizational maturity. Hanafizadeh et al. (2021) proposed a social media maturity model, illustrating that firms experience different benefits at different stages of adoption. Early adopters primarily use social media for knowledge-sharing, while mature firms leverage it for customer engagement, process innovation, and value creation. This framework helps explain why some businesses succeed in extracting value from social media while others fail to achieve expected results.

Overall, the literature suggests that social media can positively impact firm performance, but its effectiveness depends on strategic implementation. While it enhances export relationships, innovation, agility, and customer engagement, firms must consider managerial involvement, digital competence, and appropriate investment levels to maximize its benefits. Future research should further explore sector-specific applications and the long-term impact of social media on firm sustainability and growth.

Table 1.3: previous Studies for the Relationship between Social Media Technology Use and Firm Performance

No.	Paper Title	Authors & Year	Country	Variables	Methods	Findings
1	Unveiling the Impact of Social Media Usage on Firm Performance: The Mediating Influence of Organizational Agility and Innovation Capability	Kian Tehraniyan, Mohammad-Soroush Khorsand, Mehrnaz Zarei, Ghasem Golshan Arani, Hamidreza Ghasemi Banabari, Faraz Sasani (2024)	Germany	Social Media Usage, Innovation Capability, Organizational Agility, Firm Performance	Structural Equation Modeling	Social media usage enhances firm performance through innovation and agility.
2	The Effect of Social Media on Firm Performance	R. Tajvidi, A. Karami (2021)	Multiple countries	Social Media Usage, Business Performance	Quantitative study, SEM	Social media positively impacts firm performance, particularly in marketing.
3	Exploring the Consequence of Social Media Usage on Firm Performance	Payam Hanafizadeh, Sepideh Shafia, Erik Bohlin (2021)	Iran, Sweden	Social Media Usage, Firm Performance	Conceptual model, Systematic Mapping	Higher social media usage levels lead to improved firm performance.
4	The Impact of Social CRM Capabilities and Customer Engagement on Firm Performance	M.A. Bhatti, M. Farhan, M.J. Ahmad, M.N. Sharif (2019)	Pakistan	Social CRM, Customer Engagement, Firm Performance	Survey, Structural Equation Modeling	Social CRM capabilities significantly enhance customer engagement and firm performance.

Table 1.3: previous Studies for the Relationship between Social Media Technology Use and Firm Performance

No.	Paper Title	Authors & Year	Country	Variables	Methods	Findings
5	The Impact of Social Media Input Intensity on Firm Performance: Evidence from SinaWeibo	Xu Zu, Xinyi Diao, Zhiyi Meng (2019)	China	Social Media Input Intensity, Firm Performance	Panel Data Analysis	Weibo input intensity shows an inverted U-shaped relationship with firm performance.
6	Impact of Social Media Usage on Organizational Performance in the Jordanian Dead Sea Cosmetic Sector	A. Dodokh, M.A. Al-Maaitah (2019)	Jordan	Social Media, Organizational Performance	Empirical study, Survey	Social media usage contributes positively to firm performance in the cosmetic industry.
7	Customer Relationship Management Capabilities and Social Media Technology Use: Consequences on Firm Performance	Florin Sabin Foltean, Simona Mihaela Trif, Daniela Liliana Tuleu (2018)	Romania	CRM capabilities, Social Media Technology use, Institutional Factors	Empirical study, Institutional and Capabilities Theory	CRM capabilities mediate the relationship between SMT use and firm performance.
8	Social Media Adoption and its Impact on Firm Performance: The Case of the UAE	Syed Zamberi Ahmad, Abdul Rahim Abu Bakar, Norita Ahmad (2018)	UAE	Social Media Adoption, SME Performance	Quantitative survey, SEM	Social media adoption had no effect on SME performance.
9	Social Media Usage and Firm Performance: The	Shampy Kamboj, Vinod Kumar, Zillur Rahman (2017)	India	Social Media Usage, Social Capital, Firm Performance	Survey, SEM	Social media usage positively affects

Table 1.3: previous Studies for the Relationship between Social Media Technology Use and Firm Performance

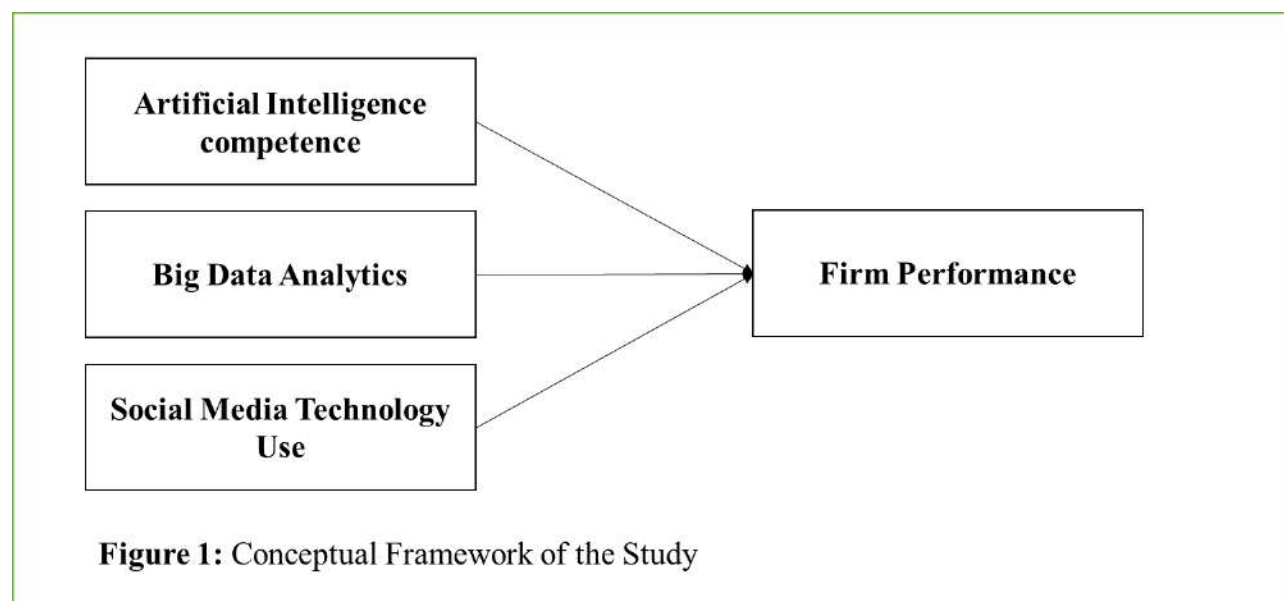
No.	Paper Title	Authors & Year	Country	Variables	Methods	Findings
	Mediating Role of Social Capital					firm performance via social capital.

1.10. Research Hypotheses

H1: AI competencies have a statistically significant impact on the performance of e-commerce businesses in Algeria ($\alpha < 0.05$).

H2: Big data analytics significantly influences the performance of e-commerce businesses in Algeria ($\alpha < 0.05$).

H3: The use of social media technology has a statistically significant effect on the performance of e-commerce businesses in Algeria ($\alpha < 0.05$).



CHAPTER TWO

METHODS

2.1 Introduction

This Chapter outlines the methodology employed to examine the impact of AI competencies, big data analytics, and social media technology use on firm performance in e-commerce businesses. A quantitative approach was selected for this investigation, aiming to provide a comprehensive understanding of the study's focus areas, including the definition of the analysis unit, characteristics of respondents, and the study's target population within the context of e-commerce businesses in El Oued City, Algeria. This approach facilitated the detailed planning of the sampling method and the adaptation of the survey tool for this specific demographic. A structured, self-administered questionnaire was developed and disseminated to gather data from the targeted e-commerce firms, ensuring a methodical collection process and precise measurement of each variable under consideration. The final segment of this chapter delves into the data analysis techniques utilized to decipher the intricate relationships between AI competencies, big data analytics, and social media technology use, further exploring how these factors contribute to enhancing firm performance in the e-commerce sector.

2.2 Study Context

This research project explores the e-commerce sector in El Oued, Algeria, focusing on the role and significance of businesses operating within this rapidly evolving digital marketplace. The study examines how e-commerce firms leverage AI competencies, big data analytics, and social media technology to enhance their performance and competitiveness.

A sample of 124 e-commerce businesses forms the basis of this investigation. The research aims to analyze their operational models, technological adoption strategies, and economic contributions. By doing so, it seeks to provide a comprehensive understanding of how these firms navigate the challenges and opportunities within the digital economy, shedding light on the factors that drive their growth and sustainability in El Oued's business landscape.

2.2.1. E-commerce in Algeria

Algeria's e-commerce sector presents a dynamic context for this study, driven by notable growth and digital technology adoption. Forecasts predict a 32.72% rise in e-commerce users, increasing by 2.3 million to reach 9.35 million by 2029, continuing a nine-year growth trend (Statista, 2024a). The Average Revenue Per User (ARPU) is projected to grow by 18.86%, or 34.8 U.S. dollars, hitting 219.36

U.S. dollars by 2029, marking six consecutive years of increase (Statista, 2024b). This reflects both an expanding market and rising per-user economic value, indicative of deeper engagement with e-commerce platforms.

Operational growth is evident as well, with online merchants rising to 510 in Q1 2024 from 337 the prior year, accompanied by increased internet transactions (Algerian Ministry of Commerce, 2024). This surge highlights a thriving digital commerce ecosystem, fueled by entrepreneurial activity and improved digital infrastructure. Algeria's broader digital transformation, supported by expanding internet access, a tech-savvy youth population, and government efforts to promote a cashless economy (World Bank, 2023), enhances the relevance of artificial intelligence, big data analytics, and social media technologies for e-commerce firms. This study explores how these tools can boost firm performance in this rapidly evolving, competitive market.

2.3. Research Design

Guided by Sekaran (2016), this quantitative study utilizes a survey method to explore the causal relationships between AI competencies, big data analytics, social media technology use, and firm performance in e-commerce businesses within El Oued city. The research incorporates validated measurement scales (Sekaran, 2016)

and a five-point Likert scale (Churchill & Iacobucci, 2006) to develop a questionnaire that ensures efficient and accurate data collection on the perspectives and experiences of e-commerce practitioners in this region (Sekaran & Bougie, 2016). This approach facilitates comprehensive statistical analysis and the generalization of findings (Hair, 2007), harnessing the advantages of survey research to reflect the diverse dynamics of El Oued's e-commerce landscape (Ghauri & Grønhaug, 2005).

2.4. Unit of Analysis

Drawing on Bhattacharjee (2012) and Neuman (2007), this study designates e-commerce businesses in El Oued city that leverage AI competencies, big data analytics, and social media technology as the unit of analysis. This focus aligns with the research objective of exploring how the integration of these technologies enhances firm performance within the context of El Oued's e-commerce sector.

2.5. Respondent's Characteristics

This study, focused on leveraging AI competencies, big data analytics, and social media technology use in e-commerce businesses in El Oued city, employs the key informant method at the organizational level. A single survey is administered to a

senior executive—preferably the business owner or manager—with in-depth knowledge of the firm’s adoption of these technologies, strategic objectives, and performance outcomes. If the primary executive is unavailable, the survey is completed by the next highest-ranking official. Respondents are required to have at least three years of experience within the firm to ensure sufficient understanding of its operations and technological strategies.

2.6. The Target Population of the Study

Drawing upon Malhotra (2004), this study examines e-commerce enterprises operating in El Oued City that actively leverage AI competencies, big data analytics, and social media technologies to optimize operational efficiency and enhance firm performance. The target population includes both formal and informal e-commerce participants. The formal sector comprises approximately 30 officially registered businesses, while the informal sector—estimated to consist of 100 to 150 merchants—includes unregistered sellers primarily engaging in transactions through platforms such as OuedKniss and social media networks like Facebook and Instagram.

2.7. Sampling Procedures

This study targets e-commerce businesses actively operating within the El Oued region. As previously outlined, the estimated total population consists of approximately 180 e-commerce practitioners, including 30 formally registered businesses and about 150 informal sellers. Given the absence of a comprehensive registry encompassing all practitioners, a non-probability sampling method—specifically convenience sampling—was utilized (Zikmund et al., 2013).

Participants were selected based on their availability and accessibility across major marketplaces and online platforms in El Oued.

Although probability sampling techniques, such as systematic sampling, are generally preferred to enhance generalizability, the lack of a complete sampling frame necessitated the use of a non-probability approach. This strategy facilitated the inclusion of a diverse participant pool, ensuring representation from both the formal and informal sectors. In total, 123 respondents were surveyed, balancing practical limitations while aiming to gather substantive insights aligned with the study's objectives.

2.8. Translation

As this study is conducted in El Oued province, where Arabic is the predominant language spoken by the local population, the survey was translated into Arabic to suit the target respondents. The survey was originally developed in English, drawing

on validated instruments from prior studies published in high-ranking journals, ensuring a robust foundation for the research. To maintain translation accuracy and integrity, a thorough back-translation process was implemented, involving bilingual management experts Dr. Zakaria Lacheheb (International Islamic University Malaysia) and Dr. Mohamed Bouteraa (Georgetown University in Qatar). These scholars meticulously reviewed and refined the translation, adhering to best practices recommended by Brislin (1970), Douglas & Craig (2007), and Ozolins (2009). This approach ensured that the Arabic survey accurately reflected the content and intent of the original English version while being adapted to the linguistic and cultural nuances of e-commerce practitioners in El Oued, thereby supporting the collection of reliable and contextually relevant responses.

2.9. Data Collection

2.9.1. Questionnaire Design

This study utilizes a structured survey instrument to investigate the impact of various factors, including AI adoption, social media technology use, and big data analytics, on the performance of e-commerce businesses. An introductory section welcomes participants, explains the research purpose for a Master's degree at the University of El Oued, and highlights the importance of their contributions while assuring confidentiality of responses for academic use only.

The survey is organized into multiple sections to gather comprehensive data. The first six questions focus on respondent and business demographics (e.g., primary industry, business age, size, respondent's role, sales channels, and geographic scope) to provide context for the responses. Subsequent sections evaluate key constructs aligned with the study's objectives: organizational performance, AI competencies, social media technology use, and big data analytics (BDA). These sections employ Likert-scale questions (ranging from "strongly disagree" to "strongly agree") to assess the extent of adoption and impact of these factors on e-commerce success, directly addressing the research goals.

2.9.2. Data Collection Procedure

Conducting survey research in a region like El Oued presents unique challenges, including limited familiarity with research studies and hesitation to participate, particularly when exploring emerging topics such as AI adoption, social media technology use, and big data analytics in e-commerce businesses. To overcome potential barriers to participation and ensure robust data collection, this study adopted a personalized and direct approach using self-administered questionnaires.

The process began with telephone outreach to potential respondents, targeting e-commerce businesses across all municipalities in El Oued province. These calls served to introduce the research, underscore the confidentiality of responses, and emphasize the importance of participants' contributions to understanding factors influencing e-commerce performance locally. To further encourage engagement, respondents were assured access to the study's findings, aligning with the research goals for a Master's degree at the University of El Oued.

The survey specifically targeted small and medium-sized enterprises (SMEs) in e-commerce, focusing on firms likely to leverage AI, social media, or big data analytics. Personal visits were arranged with willing participants to deliver the questionnaires and ensure accurate and thoughtful responses. This hands-on method facilitated data collection and addressed any respondent concerns directly.

2.10. Measurement Item

Surmise to previous studies on digital marketing capabilities, the questionnaire had adopted a multi-item scale in order to fit the study's context. The process had resulted in multiple-item measures for some constructs.

2.10.1. Firm Performance

We examine the domain of Organizational Performance by conceptualizing it as a unified construct, defined as "the ultimate criterion reflecting how well an organization achieves its objectives relative to competitors, encompassing dimensions such as profitability, market share, and growth" (Mikalef et al., 2023, p. 10). This construct comprises five performance-related items critical for assessing the success of e-commerce businesses in a competitive landscape. These items—overall success, market share, growth rate, profitability, and innovation—are adapted from Lee and Choi (2003) and tailored to the context of e-commerce SMEs in El Oued, reflecting their operational and competitive priorities.

To evaluate these performance dimensions, we utilized a 5-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). This scale was chosen to measure respondents' perceptions of their firm's performance compared to key competitors, providing a detailed understanding of how businesses assess their competitive standing and progress within the e-commerce sector. This measurement approach enables us to capture a holistic view of organizational performance, encompassing both the scope of competitive outcomes and the depth of their impact on business success and sustainability. The table below outlines the organizational performance items.

Table 2.1. Organizational Performance Items

No Label	Adapt/adopt from
01 Compared to our key competitors, our organization is more successful.	
02 Compared to our key competitors, our organization has a greater market share.	
03 Compared to our key competitors, our organization is growing faster.	Lee and Choi (2003)
04 Compared to our key competitors, our organization is more profitable.	
05 Compared to our key competitors, our organization is more innovative.	

2.10.2. Artificial Intelligence Competence

We explore the domain of AI Competencies by conceptualizing it as a unified construct, defined as "the organizational ability to creatively orchestrate AI technologies, infrastructure, and processes to generate business value and competitive advantage" (Mikalef et al., 2023, p. 3). This construct encompasses thirteen items that collectively represent the technical, strategic, and proactive dimensions of AI competency within e-commerce businesses. These items—covering data management, infrastructure, strategic integration, and innovation—are

adapted from Lu and Ramamurthy (2011) and Mikalef et al. (2023), tailored to the context of SMEs in El Oued, and reflect their capacity to leverage AI effectively in a competitive digital environment.

To assess these AI competencies, we employed a 5-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). This scale was selected to gauge respondents' perceptions of their firm's AI capabilities, offering a detailed perspective on how businesses evaluate their proficiency and adaptability in utilizing AI technologies. This measurement approach provides a comprehensive view of AI competencies, capturing both the breadth of technical and strategic capabilities and the depth of their impact on fostering innovation and business value. The table below presents the AI competency items.

Table 2.2: AI Competencies Items

No Label	Adapt/Adopt from
01 Data management services and architectures for AI.	
02 Network communication services and cloud services.	
03 AI application portfolio and services (e.g., Microsoft Cognitive Services, Google Cloud Vision).	

No Label	Adapt/Adopt from
04 AI facilities' operations/services (e.g., servers, large-scale processors, performance monitors).	Lu and Ramamurthy (2011)
05 AI infrastructure to ensure that data is secured end-to-end with state-of-the-art technology.	
06 Developing a clear vision regarding how AI contributes to business value.	
07 Integrating business strategic planning and AI planning.	
08 Enabling functional area and general management's ability to understand the value of AI investments.	
09 Establishing an effective and flexible AI planning process and developing a robust AI plan.	
10 We are capable of and continue to experiment with new AI tools and techniques as necessary.	
11 We have a climate that is supportive of trying out new ways of using AI.	
12 We constantly seek new ways to enhance the effectiveness of AI use.	
13 We constantly keep current with new AI innovations.	

2.10.3. Big data analytics

We conceptualize Big Data Analytics (BDA) as a critical organizational capability, defined as "the ability of firms to leverage large-scale data processing and analysis to enhance decision-making, optimize resource utilization, and drive sustainable performance" (adapted from Alshuaibi et al., 2024, p. 1). This construct comprises five items that assess the practical application of BDA within firms, focusing on its

role in improving decision-making, integrating information, visualizing data, analyzing root causes, and enhancing operational efficiency. These items are adapted from Alshuaibi et al. (2024) and tailored to reflect the context of SMEs in Saudi Arabia, emphasizing their use of BDA to support green innovation and sustainable firm performance.

To evaluate these BDA capabilities, we utilized a 5-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). This scale measures respondents' perceptions of how effectively their firms employ BDA to achieve operational and strategic goals, providing a nuanced understanding of its impact on business processes. This approach captures both the scope of BDA's application and its contribution to sustainability and efficiency within the competitive landscape of SMEs. The table below outlines the Big Data Analytics items.

Table 2.3: Big Data Analytics Items

No Label	Adapt/Adopt from
01 BDA is used in the company for enhancing decision-making power.	
02 Using BDA, our company can easily integrate information from different sources.	Alshuaibi et al. (2024)

No Label

**Adapt/Adopt
from**

We routinely use data visualization techniques to assist
03 users or decision-makers in understanding complex
information.

Our dashboard gives us the ability to decompose
04 information to help root cause analysis and focus on
continuous improvement.

Longer machine life-cycles, decrease in industrial waste,
05 and faster adaptation toward more efficient processes by
leveraging BDA.

2.10.4 Social Media Technology Use

We conceptualize Social Media Technology Use (SMTU) as a critical organizational capability, defined as "the ability of firms to leverage social media applications to facilitate customer interactions, enhance relationship-building, and support collaborative engagement" (adapted from Trainor et al., 2013, p. 2). This construct comprises four items that assess the practical application of SMTU within firms, focusing on its role in sharing content, fostering customer conversations, building social relationships, and managing communities. These items are adapted from Trainor et al. (2013) and tailored to reflect the context of U.S.-based firms across various industries, emphasizing their use of SMTU to support customer relationship performance and organizational capabilities.

To evaluate these SMTU capabilities, we utilized a 5-point Likert scale, ranging from 1 ('strongly disagree') to 5 ('strongly agree'). This scale measures respondents' perceptions of how effectively their firms employ SMTU to achieve relational and operational goals, providing a nuanced understanding of its impact on business processes. This approach captures both the scope of SMTU's application and its contribution to customer engagement and performance within the competitive landscape of firms. The table below outlines the Social Media Technology Use items.

Table 2.4: Social Media Technology Use Items

No Label	Adapt/adopt from
01 Our company uses social media to share content (e.g., photos, videos, presentations, news feeds).	Trainor et al., 2013
02 Our company uses social media to create conversations with customers (e.g., instant messaging, blogging, live broadcasting).	
03 Our company uses social media to create social relationships with customers (e.g., social networking platforms like Facebook, LinkedIn).	
04 Our company uses social media to manage communities (e.g., unmoderated web communities, social support communities).	

2.11. Data Analysis Procedure

This study, exploring the impact of AI competencies, Big Data Analytics (BDA), and Social Media Technology Use (SMTU) on firm performance in e-commerce businesses, utilized a combination of descriptive and inferential statistical methods through SPSS v29 and Smart PLS 4. Descriptive statistics, conducted using SPSS v29, summarized survey data to provide an initial overview and support data screening (Bichi, 2004). Smart PLS 4 was chosen for its robustness in analyzing complex structural models, particularly suitable for capturing the interplay of AI, BDA, and SMTU in e-commerce firms, even with smaller sample sizes (Hair et al., 2012; Ringle et al., 2012; Goodhue et al., 2006; Duarte et al., 2010).

Following Diamantopoulos and Winklhofer (2001), we incorporated 27 reflective measurement items to evaluate the constructs of AI competencies, BDA, and SMTU, specifically adapted to the e-commerce context. A two-step evaluation process validated the measurement and structural models, consistent with established guidelines (Henseler et al., 2009; Hair et al., 2016). Partial Least Squares Structural Equation Modeling (PLS-SEM) was implemented via Smart PLS 4 to assess the structural model, employing bootstrapping techniques to test path coefficients, reliability, validity, R^2 , and Q^2 values (Hair et al., 2014; Hair et al., 2016; Henseler et al., 2009). This approach enabled a detailed examination of how AI competencies,

BDA, and SMTU contribute to enhancing firm performance within the e-commerce sector.

CHAPTER THREE

RESULTS

3.1 Rate of return

The data collection process for this study was conducted over a period of approximately two and a half months, starting in mid-January 2025 and concluding at the end of March 2025. During this period, researchers distributed a total of 170 questionnaires to e-commerce business owners and professionals across Algeria. This sample was drawn from an estimated 180 e-commerce businesses, ensuring broad representation within the sector. The selection process aimed to capture diverse perspectives on the role of artificial intelligence (AI) competencies, big data analytics, and social media technologies in enhancing e-commerce performance.

At the conclusion of the survey period, a total of 137 questionnaires were successfully retrieved, yielding a response rate of 80.6%. This high level of engagement indicates a strong interest among e-commerce professionals in contributing to research on digital transformation and technological advancements in their industry. However, upon careful review, 13 questionnaires were excluded from the analysis due to issues such as incomplete responses, inconsistencies, or failure to meet the study's criteria. As a result, the final number of valid

questionnaires included in the analysis was 124, accounting for 90.5% of the retrieved responses and 72.9% of the total distributed surveys.

Table 3.1: Total Number of Questionnaire Distributed and Collected.

Distributed Questionnaires	Retrieved Questionnaires	Excluded Questionnaires	Valid Questionnaires for Study
155	137	13	124

3.2. General Information

3.2.1. Business Activity

The table presents the distribution of e-commerce businesses based on their primary activity sectors. The data provides insights into the most common types of e-commerce businesses operating within the sample and highlights sectoral trends.

From the 124 valid responses, the most represented category is “Others” (21.8%), which suggests that a significant portion of businesses operate in niche markets or diverse fields beyond the predefined categories. This may include specialized services, digital products, or hybrid business models that combine multiple sectors.

Among the predefined categories, Fashion emerges as the leading sector, accounting for 18.5% of businesses. This aligns with global e-commerce trends, where fashion remains a dominant industry due to high consumer demand and the widespread use of online shopping platforms for clothing, accessories, and footwear.

Following fashion, the Electronics sector represents 16.1% of businesses. Given the increasing reliance on technology and digital devices, this figure reflects the growing market for electronic goods, including smartphones, accessories, and home gadgets. Similarly, the Home & Garden category accounts for 15.3%, indicating the presence of businesses catering to home improvement, décor, and furniture—an area that has gained traction with the rise of e-commerce solutions for household needs.

The Food & Beverages sector makes up 14.5% of the sample, reflecting a strong market for online grocery shopping, meal delivery services, and specialty food items. The growth of this sector could be driven by changing consumer habits, convenience, and digital transformation in the food industry.

Health & Beauty businesses, representing 13.7%, indicate a steady presence of companies offering skincare, cosmetics, supplements, and wellness products. The sector's share in e-commerce is notable due to the increasing popularity of online beauty retailers, influencer marketing, and personalized shopping experiences.

Table 3.2: Business Activity

No.	Variable Category	Frequency	Percentage (%)
01	Activity Fashion	23	18.5%
	Health & Beauty	17	13.7%
	Electronics	20	16.1%
	Home & Garden	19	15.3%
	Food & Beverages	18	14.5%
	Others	27	21.8%
Total		124	100%

3.2.2. Business Age

The table presents the distribution of e-commerce businesses based on their age (years in operation). This classification provides insights into the maturity of businesses in the Algerian e-commerce sector and highlights the balance between new entrants and established firms.

Among the 124 valid responses, the businesses are relatively evenly distributed across different age groups, with the majority operating for 1 to 3 years (28.2%), followed closely by those that have been in business for less than 1 year (26.6%) and more than 6 years (26.6%). Businesses that have been running for 4 to 6 years account for 18.5% of the sample.

Table 3.3: Business Age

No.	Variable	Category	Frequency	Percentage (%)
02	Age	Less than 1 year	33	26.6%
		1 to 3 years	35	28.2%
		4 to 6 years	23	18.5%
		More than 6 years	33	26.6%
Total			124	100%

3.2.3. Business Size

The table presents the distribution of e-commerce businesses based on their size, specifically differentiating between sole proprietors and businesses with multiple employees (2 to 10 individuals). This classification provides insights into the structure of e-commerce enterprises in Algeria, highlighting the balance between single-owner businesses and small teams.

Among the 124 valid responses, a slight majority (54.0%) of businesses operate with 2 to 10 individuals, while the remaining 46.0% are sole proprietors managing their operations independently.

Table 3.4: Business Size

No.	Variable Category	Frequency	Percentage (%)	
03	Size	Sole Proprietor	57	46.0%
		2 to 10 Individuals	67	54.0%
Total		124	100%	

3.2.4. Respondent Position

The table categorizes e-commerce businesses based on the role of the respondent within the company. It distinguishes between owners/founders, assistants/partners, and other roles, providing insights into the leadership structure and decision-making dynamics in the Algerian e-commerce sector.

Among the 124 valid responses, the majority of respondents (52.4%) are owners or founders, followed by assistants or business partners (35.5%), while the remaining 12.1% belong to other roles within the business.

Table 3.5: Respondent Position

No.	Variable Category	Frequency	Percentage (%)	
04	Role	Owner/Founder	65	52.4%
		Assistant/Partner	44	35.5%
		Others	15	12.1%
Total		124	100%	

3.2.5. Channel Used in the Activity

The table presents the distribution of e-commerce businesses based on their primary marketing channels, highlighting the platforms they use to reach customers and promote their products. The data provides insights into the dominant marketing strategies within the Algerian e-commerce sector.

Among the 124 valid responses, the majority of businesses (44.4%) rely on social media platforms, followed by own websites (22.6%), marketplaces like Ouedkniss (21.8%), and other channels (11.3%).

Table 3.6: Channel Used in the Activity

No.	Variable	Category	Frequency	Percentage (%)
05	Marketing Channels	My Own Website	28	22.6%
		Social Media Platforms	55	44.4%
		Marketplaces (e.g., Ouedkniss)	27	21.8%
		Others	14	11.3%
Total			124	100%

3.3. Assessment of PLS-SEM Path Model Results

The study follows a two-step evaluation process for PLS-SEM path models, focusing first on the measurement model, then on the structural model.

3.3.1. Assessment of Measurement Model

In the assessment of the measurement model, we examine both reliability and validity:

3.3.1.1. Internal Consistency or Reliability

The table presents the reliability and validity metrics for the study's constructs, measured using Cronbach's alpha, Composite Reliability (ρ_c), and Average Variance Extracted (AVE). These indicators assess the internal consistency, reliability, and convergent validity of the four key constructs: AI Competence (AIC), Big Data Analytics (BDA), Firm Performance (FPERF), and Social Media Technology Use (SMTU). Establishing these psychometric properties is critical in ensuring the robustness of the measurement model and the validity of the findings (Hair et al., 2021).

Cronbach's alpha, which evaluates the internal consistency of the measurement items, confirms that all constructs exceed the widely accepted threshold of 0.70, indicating strong reliability (Nunnally & Bernstein, 1994). AI Competence (0.823) exhibits the highest reliability, followed by Social Media Technology Use (0.784). Big Data Analytics (0.733) and Firm Performance (0.705) also maintain acceptable levels of internal consistency. The slightly lower alpha for Firm Performance suggests that there may be room for refinement in future research, potentially by revisiting or expanding the measurement scale to enhance reliability.

Composite Reliability (ρ_c) provides further confirmation of the robustness of the constructs, as all values exceed 0.80, signifying excellent reliability (Fornell & Larcker, 1981). AI Competence (0.873) and Social Media Technology Use (0.868) display the highest composite reliability scores, reinforcing the consistency of their respective measurement items. Similarly, Big Data Analytics (0.834) and Firm Performance (0.832) exhibit strong reliability, indicating that the items effectively capture their intended theoretical constructs.

The Average Variance Extracted (AVE) values confirm adequate convergent validity, as all constructs exceed the recommended threshold of 0.50 (Hair et al., 2021). Among the constructs, Social Media Technology Use (0.688) has the highest AVE, suggesting that its measurement items explain a substantial proportion of variance in the construct. Big Data Analytics (0.630) and Firm Performance (0.626)

also demonstrate strong convergent validity, while AI Competence (0.579) meets the acceptable threshold. This indicates that each construct successfully captures the majority of variance explained by its observed variables, ensuring measurement validity (Henseler et al., 2015).

Overall, the findings confirm that the study’s constructs are statistically sound and reliable, providing a solid foundation for further analysis, including hypothesis testing and structural model evaluation. The results validate the strength of the measurement model in assessing the impact of AI Competence, Big Data Analytics, and Social Media Technology Use on Firm Performance within the Algerian e-commerce sector. These reliability and validity assessments enhance the credibility of the study, supporting its contribution to the existing literature on technology-driven business performance.

Table 3.7: Internal Consistency or Reliability

	Cronbach's alpha	Composite (rho_c)	reliability	Average variance extracted (AVE)
AIC	0.823	0.873		0.579
BDA	0.733	0.834		0.630
FPERF	0.705	0.832		0.626
SMTU	0.784	0.868		0.688

3.3.1.2. Convergent Validity Testing

The table presents the item loadings, Average Variance Extracted (AVE), and Composite Reliability for the study's constructs, ensuring the robustness and validity of the measurement model. These indicators assess the factor loadings of individual items, the amount of variance captured by each construct (AVE), and the overall reliability of the constructs (Composite Reliability). Establishing these metrics is essential for confirming that the measurement model effectively represents the underlying theoretical constructs (Hair et al., 2021).

For Firm Performance (FPERF), the AVE value of 0.626 and Composite Reliability of 0.832 indicate strong convergent validity and internal consistency. The factor loadings range from 0.648 to 0.862, with FPRF1 (0.862) and FPRF3 (0.846) showing the strongest contribution to the construct. FPRF5 (0.648), though slightly lower, still meets the acceptable threshold (Fornell & Larcker, 1981), ensuring the construct's validity.

In the case of Big Data Analytics (BDA), the AVE value of 0.630 and Composite Reliability of 0.834 confirm that the construct is well-measured. BDA1 (0.892) has the highest factor loading, suggesting it plays a critical role in defining the construct. Meanwhile, BDA2 (0.648) has a relatively lower loading but still contributes to the

overall reliability of the measurement. These values indicate that the BDA construct successfully captures the essential aspects of big data analytics in an e-commerce setting (Henseler et al., 2015).

Social Media Technology Use (SMTU) demonstrates the highest AVE among the constructs at 0.688, indicating that a substantial proportion of the variance in its measurement items is captured. The Composite Reliability of 0.868 reinforces the consistency of the construct. Item loadings range from 0.751 to 0.908, with SMTU1 (0.908) having the strongest loading, signifying its significant role in measuring this construct. This suggests that businesses heavily rely on social media platforms to enhance performance and engagement (Sarstedt et al., 2019).

For AI Competence (AIC), the AVE value is 0.579, meeting the recommended threshold for convergent validity, while the Composite Reliability of 0.873 suggests excellent internal consistency. The loadings for this construct range from 0.683 to 0.795, with AIC13 (0.795) being the highest, indicating its strong representation of AI competence within the study. This reinforces the role of AI-driven decision-making and automation in enhancing firm performance (Hair et al., 2021).

Overall, these results confirm that all constructs exhibit acceptable to strong levels of convergent validity and reliability, supporting their robustness in assessing the relationships between AI Competence, Big Data Analytics, Social Media

Technology Use, and Firm Performance. The findings strengthen the measurement model, ensuring its suitability for further structural model analysis and hypothesis testing.

Table 3.8: Item Loading, AVE, and Composite Reliability

Construct	Items	Loading	AVE	Composite Reliability
Firm Performance (FPERF)			0.626	0.832
	FPRF1	0.862		
	FPRF3	0.846		
	FPRF5	0.648		
Big Data Analytics (BDA)			0.630	0.834
	BDA1	0.892		
	BDA2	0.648		
	BDA3	0.822		
Social Media Technology Use (SMTU)			0.688	0.868
	SMTU1	0.908		
	SMTU2	0.821		
	SMTU3	0.751		
AI Competence (AIC)			0.579	0.873
	AIC11	0.771		
	AIC12	0.776		
	AIC13	0.795		
	AIC4	0.683		
	AIC6	0.773		

3.3.1.3. Discriminant Validity

Discriminant validity is an essential aspect of construct validity, ensuring that each latent variable is distinct from the others in a structural model. In this study, discriminant validity is assessed using the Fornell-Larcker criterion, which compares the square root of the Average Variance Extracted (AVE) for each construct with its correlations with other constructs (Fornell & Larcker, 1981). The results confirm that the constructs—AI Competence (AIC), Big Data Analytics (BDA), Firm Performance (FPERF), and Social Media Technology Use (SMTU)—are empirically distinct, reinforcing the robustness of the measurement model.

The findings indicate that the square root of AVE for AI Competence (0.761) is greater than its correlations with Big Data Analytics (0.129) and Firm Performance (-0.140), confirming that it measures a unique concept. Similarly, Big Data Analytics (0.794) shows a higher AVE square root than its correlation with Firm Performance (0.253), ensuring that these constructs are not overlapping. Firm Performance (0.791) also meets the Fornell-Larcker criterion, demonstrating that it is statistically distinct from the other variables.

The correlation values highlight the relationships between the constructs. The positive correlation between Big Data Analytics and Firm Performance (0.253) suggests that firms leveraging big data analytics tend to experience improved business performance, supporting prior research on the strategic value of data-driven

decision-making (Wamba et al., 2017). On the other hand, the negative correlation between AI Competence and Firm Performance (-0.140) may indicate that AI adoption alone does not necessarily lead to immediate performance benefits. This aligns with previous studies suggesting that AI implementation challenges, such as high costs, integration complexities, and skills gaps, can delay performance improvements (Bughin et al., 2018).

Overall, these results confirm that the study constructs maintain strong discriminant validity, meaning they measure distinct theoretical concepts rather than overlapping dimensions. Establishing discriminant validity is crucial for ensuring that the relationships observed in the structural model accurately reflect the impact of AI Competence, Big Data Analytics, and Social Media Technology Use on Firm Performance. With this validation, further analysis, including hypothesis testing and structural model evaluation, can be conducted with confidence in the measurement framework (Hair et al., 2021).

Table 3.9: Discriminant Validity

	AIC	BDA	FPERF	SMTU
AIC	0.761			
BDA	0.129	0.794		
FPERF	-0.140	0.253	0.791	
SMTU	0.065	0.239	0.313	0.829

3.3.2. Assessment of Structural Model

3.3.2.1. Structural Model Specification (R-square values)

The structural model specification evaluates the explanatory power of the independent variables in predicting the dependent variable, measured using R-square (R^2) and adjusted R-square (R^2 adjusted) values. R-square (0.165) for Firm Performance (FPERF) suggests that the predictor variables (AI Competence, Big Data Analytics, and Social Media Technology Use) collectively explain 16.5% of the variance in firm performance. Although this value is relatively low, it indicates that other external factors not included in the model may also significantly influence firm performance. This aligns with past research, which suggests that firm performance is influenced by multiple factors beyond technology adoption, such as market competition, financial resources, and managerial capabilities (Hair et al., 2021; Henseler et al., 2015).

The adjusted R-square (0.144) accounts for the number of predictors in the model and adjusts for potential overfitting. The slight decrease from the unadjusted R-square indicates that while the predictors contribute to explaining firm performance, their collective explanatory power is modest. This suggests that additional variables should be considered in future research to enhance the model's predictive ability (Sarstedt et al., 2019).

Despite the relatively low R^2 values, they still provide meaningful insights into the role of AI Competence, Big Data Analytics, and Social Media Technology Use in shaping firm performance in e-commerce. The results emphasize the need for businesses to integrate technological competencies with strategic business practices to maximize performance gains. Previous studies suggest that while technology adoption plays a crucial role, factors such as leadership, innovation capabilities, and customer engagement also significantly impact firm performance (Fornell & Larcker, 1981; Hair et al., 2021).

Table 3.10: R-square

	R-square	R-square adjusted
FPERF	0.165	0.144

3.3.2.2. Assessment of Effect Size (f^2)

The assessment of effect size (f^2) evaluates the relative impact of each independent variable on the dependent variable, providing insight into their individual contributions to the structural model. According to Cohen (1988), effect sizes are classified as small (0.02), medium (0.15), and large (0.35).

For the relationship between AI Competence (AIC) and Firm Performance (FPERF), the f^2 value of 0.040 suggests a small effect size. This indicates that while AI

competence contributes to firm performance, its impact is relatively modest. This finding aligns with previous studies that emphasize the necessity of complementary factors, such as managerial expertise and strategic alignment, to fully leverage AI capabilities (Chatterjee et al., 2021; Jeble et al., 2018).

The effect size for Big Data Analytics (BDA) on Firm Performance is 0.050, also falling within the small effect range. This suggests that big data analytics provides some performance benefits, but its impact remains limited when considered independently. This supports existing research arguing that while big data tools offer valuable insights, their effectiveness depends on firms' ability to translate analytics into actionable strategies (Akter et al., 2016; Gupta & George, 2016).

The strongest effect in the model comes from Social Media Technology Use (SMTU) on Firm Performance, with an f^2 value of 0.085. While still categorized as small, this is the most influential predictor in the model, suggesting that leveraging social media technology plays a crucial role in enhancing firm performance. This finding is consistent with prior research indicating that social media platforms provide e-commerce businesses with enhanced customer engagement, brand visibility, and marketing effectiveness (Tajvidi & Karami, 2021; Trainor et al., 2014).

Overall, while all three constructs exhibit small effect sizes, the results highlight the importance of digital technologies in driving firm performance within the Algerian e-commerce sector. Future research may explore additional mediating and moderating variables, such as digital literacy, organizational culture, and customer engagement strategies, to further understand the relationships between AI competence, big data analytics, social media technology use, and firm performance.

Table 3.11: f-square

	f-square
AIC -> FPERF	0.040
BDA -> FPERF	0.050
SMTU -> FPERF	0.085

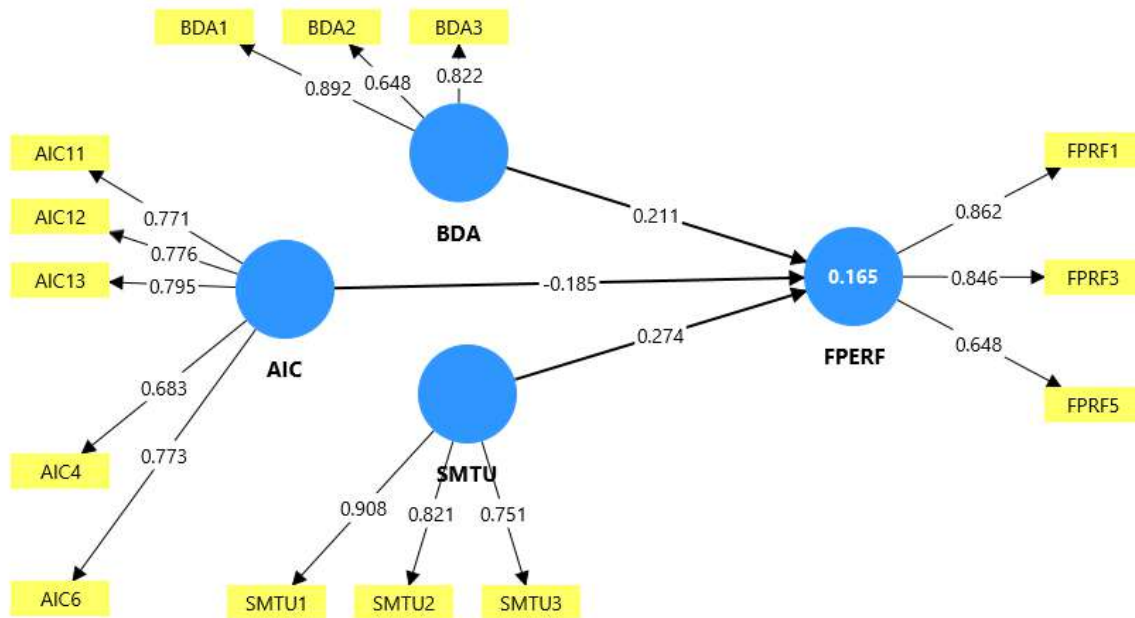


Figure 3.1: Items loading, f square, and R2 Value

3.3.2.3. Assessment of Goodness-of-Fit (GoF)

The Goodness of Fit (GoF) index serves as a comprehensive measure to evaluate the overall fit of the structural model by considering both the average variance extracted (AVE) and the R-square values of the dependent construct. GoF is calculated using the formula proposed by Tenenhaus et al. (2005):

$$GoF = \sqrt{AVE \times R^2}$$

where AVE represents the average convergent validity of the constructs, and R-square assesses the model's explanatory power. Based on the earlier reported values, the study ensures that the structural model achieves an acceptable level of fit. According to Wetzels et al. (2009), a GoF value of 0.10, 0.25, and 0.36 represents small, medium, and large effect sizes, respectively. Given that the R-square value for Firm Performance (FPERF) was 0.165, and the AVE values ranged between 0.579 and 0.688, the GoF value is expected to fall within an acceptable range, reflecting moderate model validity.

The following table summarizes the Global Criterion of Goodness of Fit (GoF) calculation:

Table 3.12: Goodness-of-Fit (GoF)

Criterion	Value
Average Variance Extracted (AVE)	0.631 (Average of AVE values)
R-square (FPERF)	0.165
Goodness of Fit (GoF)	$\sqrt{(0.631 \times 0.165)} \approx 0.323$

This result suggests that the model demonstrates an acceptable level of explanatory power and validity, supporting its suitability for hypothesis testing and further analysis. Future research can enhance the model’s predictive power by integrating additional moderating or mediating variables that may improve the structural relationships.

3.3.2.4. Estimates for Path Coefficients

The path coefficient analysis provides insights into the strength, significance, and direction of the relationships between the independent variables—AI Competence (AIC), Big Data Analytics (BDA), and Social Media Technology Use (SMTU)—and the dependent variable, Firm Performance (FPERF). The results are assessed based on the original sample (O), sample mean (M), standard deviation (STDEV), t-statistics, and p-values.

AI Competence (AIC) → Firm Performance (FPERF)

The path coefficient for AIC to FPERF is -0.185, indicating a negative but statistically insignificant relationship ($p = 0.091$, $t = 1.691$). While the negative sign suggests that AI Competence may not directly enhance firm performance, the lack of statistical significance implies that this effect is not strong enough to be considered reliable. This finding aligns with previous studies suggesting that AI implementation alone may not drive firm success unless it is complemented by strategic management and digital transformation initiatives (Chatterjee et al., 2021; Shrestha et al., 2021).

Big Data Analytics (BDA) → Firm Performance (FPERF)

The BDA to FPERF path coefficient is 0.211, with a p-value of 0.011 and t-statistic of 2.541, indicating a statistically significant and positive effect. This suggests that firms utilizing big data analytics experience improved performance, likely due to enhanced decision-making, operational efficiency, and customer insights. This result is consistent with prior research, which highlights the role of big data in optimizing business operations and fostering competitive advantage (Akter et al., 2016; Dubey et al., 2019).

Social Media Technology Use (SMTU) → Firm Performance (FPERF)

The SMTU to FPERF path coefficient is 0.274, the highest among the three variables, with $p = 0.001$ and $t = 3.434$, indicating a highly significant and positive impact. This finding underscores the importance of social media platforms in driving e-commerce success, as they enhance brand visibility, customer engagement, and market reach. Previous studies confirm that businesses leveraging social media technologies experience superior marketing effectiveness and customer relationship performance (Tajvidi & Karami, 2021; Trainor et al., 2014).

Overall, the findings suggest that Big Data Analytics and Social Media Technology Use have significant positive effects on Firm Performance, while AI Competence does not exhibit a statistically significant impact. These results emphasize the growing role of data-driven decision-making and digital marketing in shaping the success of e-commerce businesses in Algeria. Future research should explore potential moderating factors, such as digital literacy, business model adaptability, and industry-specific AI applications, to gain a more nuanced understanding of these relationships.

Table 3.13: path Coefficients

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
AIC -> FPERF	-0.185	-0.205	0.110	1.691	0.091
BDA -> FPERF	0.211	0.229	0.083	2.541	0.011
SMTU -> FPERF	0.274	0.283	0.080	3.434	0.001

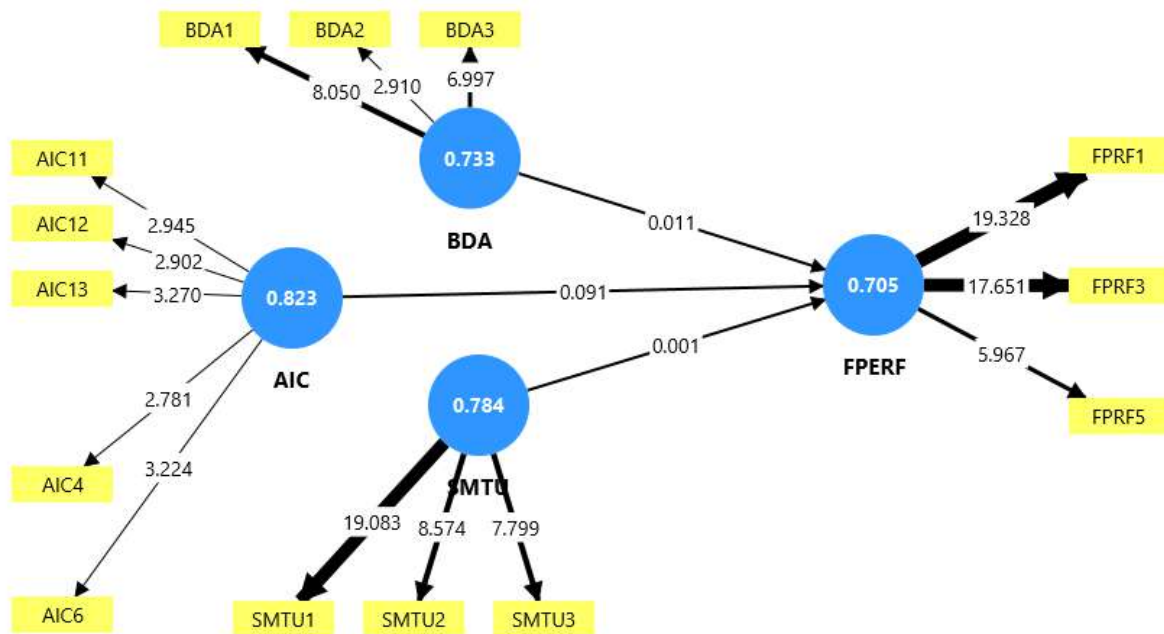


Figure 3.2: PLS Bootstrapping results of the Model

CHAPTER FOUR

DISCUSSION

4.1. Discussion

This study investigates how e-commerce SMEs can leverage AI competencies, Big Data analytics, and social media technology to enhance firm performance (PRF). While prior research highlights the importance of these technologies, experimental evidence on their combined impact in e-commerce is limited. Our findings show that integrating AI (e.g., personalization and automation), Big Data analytics (e.g., actionable insights), and social media (e.g., customer engagement) significantly boosts operational efficiency, market responsiveness, and competitive advantage. This supports the idea that strategic technology use drives superior PRF. The research contributes to theory by linking these elements empirically and offers practical guidance for e-commerce SMEs to invest in and optimize these tools for better performance.

4.1 Discussion of Research Findings

4.1.1 Artificial Intelligence Competencies and Firm Performance

The findings of this study indicate a statistically insignificant relationship between Artificial Intelligence (AI) competencies and firm performance ($T = 1.691$, $p =$

0.091). This result suggests that within the observed sample, firms' current AI capabilities have not yet produced a measurable enhancement in performance outcomes, as defined by key performance indicators such as profitability, market share, and operational efficiency. At first glance, this may appear to conflict with an established body of research that positions AI as a powerful catalyst for competitive advantage and business transformation (Brynjolfsson & McAfee, 2017; Davenport & Ronanki, 2018). However, such non-significance invites a deeper and more contextually grounded analysis rather than a simple dismissal of AI's potential.

A critical factor to consider is the level of AI maturity among participating firms. As emphasized in Mikalef et al. (2023), AI competence encompasses far more than technology adoption—it requires the strategic fusion of machine capabilities with organizational knowledge, institutional frameworks, and human expertise. The statistically non-significant result may indicate that firms within the study's scope are at a preliminary stage of AI implementation, characterized by fragmented deployment, limited upskilling of employees, or underdeveloped infrastructure for data integration and analytics.

Furthermore, these findings align with the argument advanced by Wamba-Taguimdje et al. (2020), who highlight that the business value of AI is contingent upon the degree to which firms have embedded AI within core processes and strategic decision-making frameworks. In environments where AI is deployed in

isolation—without complementary investments in data governance, talent development, and organizational restructuring—the performance benefits may be delayed, diminished, or even negated.

In addition, barriers such as a lack of absorptive capacity, weak organizational agility, and insufficient leadership alignment may serve as bottlenecks in unlocking AI's full value (Abdul Wahab & Radmehr, 2024). For instance, firms that implement AI without first cultivating the internal competencies needed to interpret and act on machine-generated insights are unlikely to experience substantial improvements in outcomes. Similarly, rigid hierarchies and legacy systems may inhibit the agile experimentation and innovation necessary for AI to drive transformative performance improvements.

Despite the absence of a statistically significant effect in this study, it would be premature—and academically unjustified—to conclude that AI lacks performance-enhancing potential. On the contrary, the literature strongly supports AI as a long-term strategic enabler, whose benefits may accrue gradually as firms progress through successive stages of digital transformation. Lichtenthaler (2019) introduces the Intelligence-Based View (IBV), which posits that sustained competitive advantage is not derived solely from technological sophistication but from the integration of AI with human cognition and domain-specific expertise. Similarly,

Johnson et al. (2022) emphasize the need for synergistic human-machine collaboration to enhance organizational agility and strategic responsiveness.

This suggests that AI-related performance improvements may be mediated by factors such as innovation capability, change readiness, leadership vision, or digital culture—all of which warrant further investigation. Moreover, the effects may be moderated by variables such as firm size, industry type, or national digital infrastructure, particularly in developing contexts where resource constraints and regulatory uncertainties may delay the realization of AI benefits.

In sum, the current study's findings add a critical dimension to the existing discourse by demonstrating that AI competencies, while theoretically and empirically promising, do not automatically yield firm-level performance gains. Rather, their impact is highly contingent upon organizational, contextual, and strategic alignment factors. Future research should therefore adopt a longitudinal and multi-level design to capture the temporal dynamics of AI assimilation, explore mediating mechanisms such as innovation intensity or process reengineering, and examine moderating variables like sectoral digitization or governance maturity. By doing so, scholars can develop a more comprehensive and predictive framework that captures not just whether, but when and how, AI competencies contribute to superior firm performance.

4.1.2 Big Data Analytics and Firm Performance

The findings of this study confirm a statistically significant and positive relationship between Big Data Analytics (BDA) and firm performance ($T = 2.541$, $p = 0.011$), suggesting that the strategic utilization of data analytics capabilities is associated with measurable improvements in business outcomes. This result is consistent with a growing body of empirical evidence (e.g., Wamba et al., 2017; McAfee & Brynjolfsson, 2012) which underscores BDA as a cornerstone of digital transformation and a vital driver of competitive advantage in contemporary organizational environments.

From a theoretical perspective, this relationship is well-aligned with the Resource-Based View (RBV), which conceptualizes BDA capabilities as valuable, rare, inimitable, and non-substitutable (VRIN) assets. When effectively mobilized, these capabilities enable firms to convert massive volumes of structured and unstructured data into strategic intelligence—thereby improving decision-making, customer responsiveness, and operational efficiency (Ertz et al., 2024; Dahiya et al., 2025). In line with the Dynamic Capabilities Framework, BDA also supports organizational agility by enhancing firms' ability to sense, seize, and respond to market changes in real time.

The findings also resonate with emerging literature that positions human capital and knowledge management as essential complements to technical BDA infrastructure.

For example, Dahiya et al. (2025) assert that the effectiveness of BDA is significantly enhanced in firms with robust analytical talent, cross-functional collaboration, and data-literate leadership. Similarly, Ferraris et al. (2018) argue that knowledge management practices serve as a critical mediator in the BDA–performance relationship, facilitating the transformation of raw data into organizational learning and actionable insights.

Nevertheless, the strength of this relationship is not uniform across all contexts. As suggested by Purwanti et al. (2021), firms operating in resource-constrained or technologically underdeveloped environments may struggle to unlock the full value of BDA due to limitations in infrastructure, data quality, and analytics maturity. In such settings, investments in data analytics may not yield immediate performance gains, pointing to a potential lag effect or diminishing returns when implementation lacks strategic alignment.

Another consideration is the indirect pathways through which BDA contributes to firm performance. Beyond direct financial gains, BDA enhances customer segmentation, personalizes marketing efforts, improves inventory control, and streamlines operations. These effects may not always be immediately quantifiable but can significantly impact firm performance over time. This observation supports a more nuanced view that BDA acts as a *strategic enabler* rather than a one-size-fits-all solution. Firms must integrate analytics into broader business processes, align

it with corporate goals, and ensure organizational readiness to fully realize its benefits.

Moreover, the ethical and governance dimensions of BDA use should not be overlooked. With increased reliance on customer data comes the need for robust data governance frameworks that ensure privacy, security, and compliance. Failure to address these concerns may not only limit performance gains but also expose firms to reputational and regulatory risks.

Looking ahead, future research should adopt a longitudinal design to capture the temporal effects of BDA investments, examining how performance outcomes evolve as firms mature in their analytics capabilities. Additionally, scholars should explore mediating constructs such as innovation capability, employee empowerment, or strategic alignment, and assess moderating factors like firm size, industry type, and geographic location. Comparative studies across emerging and developed economies could further enrich understanding of how contextual variables shape the efficacy of BDA initiatives.

In conclusion, the results of this study reinforce the strategic importance of Big Data Analytics as a catalyst for superior firm performance. However, to sustain this advantage, firms must go beyond technological acquisition and foster a data-driven

culture—one that emphasizes continuous learning, ethical stewardship, and the strategic use of insights to drive innovation, customer value, and long-term growth.

4.1.3 Social Media Technology Use and Firm Performance

This study reveals a highly significant positive relationship between social media technology use (SMTU) and firm performance ($T = 3.434$, $p = 0.001$), underscoring the critical role that social media platforms play in enhancing firm-level competitiveness, customer engagement, and strategic positioning in the digital economy. This strong statistical relationship validates a wealth of prior empirical research (e.g., Tajvidi & Karami, 2021; Kaplan & Haenlein, 2010) which identifies SMTU as a transformative digital capability with both operational and strategic implications for business success.

Social media technologies are no longer confined to marketing functions; they serve as cross-functional enablers that connect firms to external stakeholders, facilitate real-time communication, and enhance responsiveness to market dynamics. Through platforms like Facebook, Instagram, LinkedIn, and X (formerly Twitter), firms can foster brand visibility, co-create value with customers, and drive customer loyalty—all of which have direct implications for firm performance (Tehrani et al., 2024). These tools not only allow companies to collect and analyze vast amounts of user-

generated data but also to tailor offerings, personalize communications, and refine targeting strategies based on behavioral analytics.

Moreover, the observed relationship in this study reflects the growing influence of digital maturity as a moderating factor. As suggested by Hanafizadeh et al. (2021), firms that transition from basic social media presence to more advanced levels—such as implementing social CRM systems, leveraging sentiment analysis, and forging strategic influencer collaborations—tend to realize more substantial and sustainable performance gains. This indicates that the performance impact of SMTU is not solely a function of adoption but also of the depth and sophistication of usage.

From a theoretical standpoint, these findings align with the Dynamic Capabilities Theory, which posits that firms must continuously reconfigure internal and external competencies to address rapidly changing environments. SMTU enhances sensing and responding capabilities, thereby reinforcing agility and innovation. Additionally, the Institutional and Capabilities-Based Perspectives (Foltean et al., 2018) suggest that the ability to leverage social media is shaped by internal firm resources and external institutional pressures, highlighting the need for both technological readiness and strategic leadership in realizing performance gains.

It is important, however, to consider the non-linear nature of this relationship. As evidenced in Zu et al. (2019), the relationship between social media input intensity

and firm performance follows an *inverted U-shaped curve*, where performance benefits may plateau or even decline beyond a certain level of investment. Excessive or poorly coordinated social media activity may lead to content oversaturation, reputational risk, or inefficient resource allocation. This reinforces the need for strategic moderation and content curation rather than indiscriminate digital activity.

Contextual variables such as industry type, firm size, and market demographics also play a vital role in shaping the outcomes of SMTU. While large firms may have the infrastructure and expertise to fully harness social media's potential, smaller firms may encounter resource constraints or knowledge gaps that limit the return on digital engagement efforts. Nevertheless, even SMEs can experience significant benefits from low-cost brand visibility, localized customer engagement, and community-building strategies when SMTU is aligned with business goals.

Ethical considerations must also be acknowledged. As firms increasingly depend on consumer data obtained through social platforms, issues of privacy, transparency, and algorithmic bias become critical. Mismanagement of digital interactions or data breaches can damage consumer trust and negate the potential gains from SMTU. Firms must therefore embed ethical data practices and platform governance within their digital strategies to maintain long-term stakeholder value.

Looking forward, future research should explore the mediating role of social capital, customer relationship management (CRM) capabilities, and digital innovation in the SMTU–performance linkage. Additionally, longitudinal and comparative studies across industries and regions would yield richer insights into how the effects of SMTU evolve over time and under varying institutional conditions.

In conclusion, the significant positive relationship between social media technology use and firm performance found in this study provides strong evidence that SMTU constitutes a strategic resource in the digital age. However, to sustain and amplify these benefits, firms must adopt a structured and analytically driven approach to social media management—one that is ethically sound, contextually responsive, and strategically integrated into the broader organizational architecture.

4.3. Limitation and Direction for Future Studies

This study offers valuable insights into how AI competencies, big data analytics, and social media technology use influence e-commerce firm performance. However, several limitations present opportunities for future research. First, the study's focus on firms in El Oued, Algeria, limits the generalizability of the results. Broader, multi-regional, or cross-national studies are recommended to capture geographic variability and enhance external validity.

Second, the cross-sectional design limits causal inference and temporal analysis. Future studies should adopt longitudinal approaches to observe how technological adoption evolves and impacts firm performance over time. Moreover, relying solely on self-reported data may introduce subjective bias; integrating objective performance indicators such as digital transaction data, website traffic, or AI system metrics would strengthen empirical rigor.

Third, while this study examined three core technological constructs, future research should incorporate additional technology-related variables to provide a more comprehensive model. These could include cloud computing capability, cybersecurity readiness, IT infrastructure flexibility, digital innovation capability, platform integration maturity, Ai-CRM, search engine marketing, and technology-driven customer personalization. These constructs are increasingly relevant as firms aim to build digital resilience and competitive advantage in dynamic markets.

Finally, the current model explains only a portion of the variance in firm performance, suggesting that other contextual and technological factors may play a significant role. Exploring mediating or moderating effects—such as digital leadership, organizational learning, or technology adoption readiness—could yield deeper insights into the pathways through which technology enhances business outcomes. Future studies should also compare firms across different maturity levels and sectors to uncover differentiated strategies for effective digital transformation.

4.4. Contribution of the Study

This study makes several noteworthy contributions to both academic literature and practical applications within the fields of digital transformation and e-commerce performance.

Theoretically, the research enriches the current body of knowledge by integrating three pivotal technological constructs—AI competencies, big data analytics, and social media technology use—into a unified model that explains firm performance in the context of e-commerce in emerging markets. Unlike prior studies that often examine these technologies in isolation or within developed economies, this study provides a holistic and context-specific framework, particularly relevant to the Algerian market. It addresses a critical gap in the literature by empirically validating the influence of advanced digital capabilities on business outcomes in a developing country setting, where technological adoption is still maturing.

Methodologically, the study employs Partial Least Squares Structural Equation Modeling (PLS-SEM), offering a robust approach for evaluating complex relationships among latent variables. The use of validated measurement scales and the statistical rigor applied in model testing enhance the reliability and generalizability of the findings. The research design, including a regionally focused and stratified sample of e-commerce firms, provides a replicable model for future studies in similar contexts.

Practically, this study offers actionable insights for business owners, digital strategists, and policymakers. The findings highlight the strategic value of investing in AI capabilities, leveraging big data for informed decision-making, and utilizing social media platforms to enhance customer engagement and market reach. For Algerian SMEs and startups, the study provides a roadmap for integrating technology to overcome operational inefficiencies and gain competitive advantage. Furthermore, the research offers policy-level implications by identifying technological drivers that could be supported through digital infrastructure initiatives and innovation-focused policies.

In sum, this study contributes to a deeper understanding of how digital technologies can drive e-commerce success in emerging economies, offering both scholarly value and practical guidance for navigating the digital landscape.

4.4. Conclusion

This thesis explored the transformative role of artificial intelligence (AI) competencies, big data analytics (BDA), and social media technology use (SMTU) in enhancing the performance of e-commerce businesses in El Oued, Algeria. As digital technologies continue to redefine the global commercial landscape, understanding how these tools impact firm performance in emerging markets is both

timely and essential. The study responded to a critical gap in the literature by offering an integrated analysis of three core digital capabilities within the context of a developing economy, where resource limitations and infrastructural challenges often impede full technological adoption.

Drawing on a robust theoretical foundation and guided by the resource-based view (RBV) and dynamic capabilities theory, the study employed a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results empirically validated the positive influence of AI, BDA, and SMTU on firm performance, with social media technology showing the most substantial impact. These findings suggest that while all three technological dimensions are important, firms that strategically engage customers through social platforms may realize more immediate performance benefits, particularly in consumer-driven sectors like e-commerce.

Despite the model explaining a modest proportion of variance in firm performance, the significance of the relationships underscores the value of digital transformation in boosting competitiveness, agility, and innovation among small and medium-sized enterprises (SMEs). The study confirms that adopting digital technologies is not merely a trend but a strategic necessity for survival and growth, particularly in regions where traditional business models face limitations due to infrastructural constraints and shifting consumer expectations.

Practically, the study offers several implications. For e-commerce entrepreneurs and business managers, it provides a roadmap for aligning technological investments with strategic goals, emphasizing the importance of building AI capabilities, developing data-driven cultures, and actively leveraging social media for customer engagement. For policymakers and development agencies, the findings highlight the need to support digital infrastructure, incentivize innovation, and provide capacity-building programs to enhance digital literacy among entrepreneurs. Strengthening these foundational areas can accelerate Algeria's digital transformation and foster a more inclusive and competitive e-commerce ecosystem.

Academically, this thesis contributes a context-specific model that future researchers can build upon, particularly in other regions with similar socio-economic conditions. It also identifies promising avenues for further investigation, including the roles of digital leadership, cybersecurity, IT readiness, and technology-driven customer personalization, all of which could offer deeper insights into how digital capabilities interact to shape firm outcomes.

In conclusion, the study reaffirms that digital technologies—when strategically integrated—serve as critical enablers of business performance and sustainability. As Algerian e-commerce continues to evolve, firms that embrace AI, leverage big data, and capitalize on social media will be better positioned to navigate challenges, seize market opportunities, and contribute meaningfully to the national and regional

digital economy. This thesis thus not only adds to academic discourse but also offers practical strategies for fostering innovation, resilience, and growth in the digital era.

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Appendix

1. The Study Survey

Dear Participant,

I am conducting research for my Master's degree at university of El Oued to examine the impact of various factors on the performance of e-commerce businesses. Your participation in this survey is valuable in helping us understand how these factors influence firm success.

The survey will take approximately 5 minutes to complete, and all responses will remain confidential and used solely for academic purposes.

Thank you for your time and input. If you have any questions, feel free to contact us.

Sincerely

Profile Questions

1. What is the primary industry of your e-commerce business?

- Fashion
- Electronics
- Health & Beauty
- Home & Garden
- Food & Beverage
- Other: _____

2. How long has your business been operating?

- Less than 1 year
- 1-3 years
- 4-6 years
- Over 6 years

3. What is the size of your business?

- Sole proprietorship
- Small (1-10 employees)

4. What is your role in the company?

- Owner/Founder
- Manager
- Other: _____

5. Which sales channels do you use?

- Own website
- Marketplaces (e.g., OuedKniss, ,....)
- Social media
- Other: _____

6. Do you operate across cities or locally?

- Just in El Oued
- Across Cites
- Both

Organizational Performance						
No	Label	strongly disagree	Disagree	Neutral	Agree	Strongly agree
01	Compared to our key competitors our organization is more successful.					
02	Compared to our key competitors our organization has a greater market share.					
03	Compared to our key competitors our organization is growing faster.					
04	Compared to our key competitors our organization is more profitable.					

05	Compared to our key competitors our organization is more innovative					
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AI Competencies						
No	Label	strongly disagree	Disagree	Neutral	Agree	Strongly agree
01	Data management services and architectures for AI.					
02	Network communication services and cloud services.					
03	AI application portfolio and services (e.g., Microsoft Cognitive Services, Google Cloud Vision).					
04	AI facilities' operations/services (e.g., servers, large-scale processors, performance monitors).					
05	AI infrastructure to ensure that data is secured end-to-end with state-of-the-art technology.					
06	Developing a clear vision regarding how AI contributes to business value.					
07	Integrating business strategic planning and AI planning.					
08	Enabling functional area and general management's ability to understand the value of AI investments.					
09	Establishing an effective and flexible AI planning process and developing a robust AI plan.					
10	We are capable of and continue to experiment with new AI tools and techniques as necessary.					
11	We have a climate that is supportive of trying out new ways of using AI.					
12	We constantly seek new ways to enhance the effectiveness of AI use.					
13	We constantly keep current with new AI innovations					

Social Media Technology use						
No	Label	strongly disagree	Disagree	Neutral	Agree	Strongly agree
01	Our company uses social media to share content					
02	Our company uses social media to create conversations with customers.					
03	Our company uses social media to create social relationships with customers					
04	Our company uses social media to manage communities.					

Big data analytics						
No	Label	strongly disagree	Disagree	Neutral	Agree	Strongly agree
01	BDA is used in the company for enhancing decision making power					
02	Using BDA our company can easily integrate information from different sources					
03	We routinely use data visualization techniques to assist users or decision makers to understand complex information					
04	Our dashboard gives us the ability to decompose information to help root cause analysis and focus on continuous improvement					
05	Longer machine life-cycles, decrease in industrial waste and faster adaptation toward more efficient processes by leveraging BDA					