Exploring AI Adoption in the Service Sector in Tunisia: An empirical investigation

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Abstract: **This article analyzes the adoption of artificial intelligence (AI) in the service sector in Tunisia through a mixed-methods approach. The study is based on a quantitative survey conducted with 58 companies, supplemented by qualitative data from several in-depth case studies. The findings highlight AI's potential to automate processes, reduce operational costs, and enhance service productivity. However, its adoption is hindered by several significant barriers, including the sometimes questionable reliability of AI-generated information, organizational and psychological resistance from employees, concerns over data privacy, and budgetary constraints that limit access to advanced technologies. These findings emphasize the need to implement targeted and tailored strategies to support the gradual and effective adoption of AI in Tunisian service companies.**

Keywords: **Artificial Intelligence, Service Sector, Mixed-Methods, Tunisia.**

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I. INTRODUCTION

In a world of rapid technological change, companies are increasingly adopting new technologies to enhance their performance and gain a competitive advantage [42]. Among these technologies, artificial intelligence (AI) has emerged as a strategic priority [30], attracting growing interest in both academia and the business world. It is emerging as one of the key drivers of organizational transformation. This technology is redefining standards of performance, innovation, and competitiveness, particularly in the service sector, a central pillar of modern economies. This technology offers significant potential for the service sector by enhancing efficiency, reducing costs, and providing improved decision-making capabilities [62].

The term "artificial intelligence" was introduced in 1956 by John McCarthy, who defined it as "the science and engineering of making intelligent machines" [26]. Since then, the evolution of AI has been marked by alternating periods of enthusiasm and stagnation. From the outset, researchers were encouraged by promising results and expressed strong optimism about the likelihood of rapid progress in the field [49]. However, advancements have been slower than initially expected, leading to repeated shifts in research focus—sometimes through the emergence of new approaches, and at other times through the refinement of existing methods [49].

Over the past decade, the explosion in data volume and velocity has driven the development of advanced technologies, including computing power and AI techniques [13], [23].

Faced with intensifying competition, exponential data growth, resource scarcity, and the demand for rapid decision-making, many organizations are moving toward the adoption of artificial intelligence in their services. This dynamic is largely influenced by the disruptive potential of AI, already demonstrated by large digital companies [44], [7], [53], [58]. As AI continues to evolve across various sectors, its implications extend far beyond mere technical improvements. It fosters innovative ways of conducting business, catalyzes the development of new service propositions, and drives organizational transformation [51]. However, these promising opportunities are accompanied by a series of complex challenges that require careful management, such as issues related to the black box and questions of accountability [1]. In the service sector, the strategic importance of harnessing AI opportunities while mitigating the associated challenges cannot be overstated.

The literature has extensively explored the adoption of AI across various domains, including the public sector [19], manufacturing industries [48], SMEs [6], AgriTech companies [21] and service businesses [29]. However, studies on the integration of AI in the service sector in emerging economies like Tunisia, remain limited, highlighting the importance of developing original contributions to bridge this gap.

In Tunisia, as in many emerging economies, the adoption of AI in the service sector is still in its early stages, despite its clear potential to enhance business efficiency and drive economic growth. Understanding the specific challenges and opportunities in this context is crucial to enabling Tunisian companies to leverage this technology. This study aims to fill this gap by shedding light on how Tunisian service companies are using AI and the factors that hinder its adoption. By identifying these obstacles and highlighting optimization levers, this research seeks to provide practical recommendations that will help decision-makers better integrate AI into their strategies.

By using a mixed-methods approach, combining a quantitative study through questionnaires with business executives and a qualitative study based on in-depth case studies, this research aims to provide valuable insights for managers and decision-makers. The goal is to help them better understand the challenges associated with AI adoption and support them in implementing technological solutions tailored to their specific needs.

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The article is structured as follows: the first section presents the literature review, followed by a second section detailing the mixed-methods approach of the study. The third section presents the survey results, and the article concludes with a fourth section dedicated to discussions and conclusions.

II. LITERATURE REVIEW

A. USE OF AI IN SERVICES

Artificial intelligence is applied across a wide range of fields, including marketing, production management, business administration, and customer service [46], [12]. Based on their function, AI applications can be categorized into two main types: automation and augmentation. Automation involves AI systems that are intended to substitute human labor, whereas augmentation supports and enhances human intelligence by delivering valuable insights to aid in decision-making.

1) TASK AUTOMATION : Automation, as a concept, is not new—it traditionally refers to machines replacing human labor, such as robots operating on assembly lines. However, recent developments in artificial intelligence have enabled machines to learn, adapt, and improve over time, thereby significantly enhancing their capabilities [8]. Consequently, AI can now automate more sophisticated tasks that require cognitive functions like learning and problem-solving [25]. This evolution is commonly referred to as intelligent automation [37]. Intelligent automation makes it possible to automate tasks once deemed too complex, including those involving knowledge-based and service-oriented work [8]. In the service industry, AI can deliver digital and robotic solutions that shape customer experiences [10]. A notable example is chatbots, which emulate human communication [35]. Other examples include conversational intelligent agents such as Apple's Siri and Amazon's Alexa, which can perform tasks like writing messages, placing phone calls, or playing music through voice commands [11], [10].

2) HUMAN AUGMENTATION : In recent years, artificial intelligence has demonstrated the ability to outperform humans in executing certain complex tasks [33]. Its capacity to process vast volumes of data at high speed exceeds human cognitive limits [33], allowing AI to address human cognitive constraints. Augmentation refers to the collaboration between AI and human expertise to enhance decision-making and optimize actions [45]. This perspective emphasizes AI's role as a supportive tool that complements rather than replaces human input. Organizations often produce or have access to large and complex datasets. While this data holds valuable insights, its complexity can make it difficult for humans to analyze. AI helps managers extract relevant information, enabling more informed and effective decisions [4]. Predictive analytics, in particular, allows systems to learn from data, make precise forecasts, and support transactional-level decision-making [14]. AI can also interpret emerging management control signals and recommend corrective measures in cases such as declining sales or increased competitive pressure [2]. Additionally, it can be applied to sentiment analysis, offering insights into consumer opinions, attitudes, and emotions toward a specific product or service [12].

B. THE BENEFITS OF USING AI IN SERVICES

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1) PROCESS EFFICIENCY : The integration of artificial intelligence enhances service business process performance by improving efficiency metrics through task automation, which shifts routine work away from employees toward higher-value activities, thereby increasing productivity [8], [34], [14], [47], [56], [2], [18]. Additionally, AI-driven machines perform tasks faster and with greater accuracy than humans, further boosting productivity and reducing process completion times, error rates, and processing durations [47], [8], [50], [18].

2) INFORMATION GENERATION : Artificial intelligence excels at uncovering hidden patterns and insights within large datasets, aiding decision-makers in making more informed and timely decisions [41], [12]. By providing detailed and relevant information, AI enhances both the quality and speed of decision-making processes [9], [22]. Organizations leveraging AI's informational capabilities are better positioned to quickly detect market changes and respond effectively, thus improving their organizational agility in dynamic environments [50], [22].

3) OPERTAIONAL INNOVATION : Artificial intelligence, as a disruptive and innovative technology, enables service businesses to innovate and transform operations by redesigning workflows and altering task execution [50], [5]. Its adoption fosters new skills developed jointly by managers, employees, and AI systems, potentially redefining existing roles and creating new ones [14]. Additionally, AI facilitates more effective resource allocation, which can ultimately transform organizational structures [52].

4) SERVICE INNOVATION : Artificial intelligence (AI) is a transformative technology that facilitates the development of innovative products and complementary services, improving customer experience through tools like recommendation systems and chatbots [50]. Additionally, AI-generated recommendations assist designers in creating new products [41]. AI also enhances the quality of existing products and services by enabling personalized customer experiences, a key adoption goal for many executives [53].

5) MARKETING EFFECTIVENESS : Companies integrating artificial intelligence into their marketing strategies benefit from enhanced customer segmentation and deeper insights into customer preferences [5]. This enables more precise targeting and personalized marketing efforts, improving both efficiency and accuracy [43]. AI also allows real-time adaptation to changing customer behaviors [43] and helps firms proactively address negative experiences, boosting customer satisfaction through personalized solutions [36], [45]. However, these benefits may evolve as AI technologies advance.

TABLE I. *BENEFITS OF USING AI IN SERVICES*

Advantages	Description
Process Efficiency	The integration of artificial intelligence enhances process performance in service companies by automating routine tasks, which increases productivity, speeds up task execution, and reduces errors.
Information Generation	Artificial intelligence improves decision-making by uncovering hidden insights within data, enabling organizations to respond more quickly and effectively to market changes, thereby enhancing their organizational agility.

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Operations Innovation	Artificial intelligence, as a disruptive technology, enables service businesses to innovate and transform their operations by redesigning workflows, fostering new collaborative skills, and optimizing resource allocation, which can lead to a transformation of organizational structures.
Service Innovation	Artificial intelligence promotes innovation and the continuous improvement of products and services by enhancing the customer experience through personalized tools, while also supporting the development of new products and the quality of existing offerings.
Marketing Effectiveness	The integration of artificial intelligence into marketing strategies improves customer segmentation, enables more precise and personalized targeting, facilitates real-time adaptation to changing customer behaviors, and enhances customer satisfaction, although these benefits may evolve as AI technologies advance.

C. *RISKS ASSOCIATED WITH THE USE OF AI IN SERVICES*

1) BIAS AND ETHICAL CONCERNS : Companies face significant challenges in identifying and mitigating biases in AI algorithms, which can cause discrimination based on gender, race, or socio-economic status, as seen in recruitment and financial sectors [24], [38], [17]. The use of AI tools like ChatGPT also poses risks related to unethical applications and reliance on outdated or inaccurate data, potentially misrepresenting customer preferences and harming brand reputation [60], [3], [40], [20], [62].

2) TRANSPARENCY AND EXPLAINABILITY CONCERNS : The adverse impacts of artificial intelligence extend beyond biased results to include issues like opaque "black-box" algorithms, insufficient transparency and accountability, security vulnerabilities, and possible negative consequences for society and the environment [16]. These challenges have generated a widespread demand for increased transparency across the entire AI lifecycle, from data acquisition to output production [39]. When AI systems lack clear explanations and transparency, user trust diminishes, which may result in reduced adoption and usage [59].

3) CYBERSECURITY : The adoption of AI in service companies also brings cybersecurity risks. Service firms that utilize chatbots or virtual assistants are susceptible to cyberattacks [3], [62], [15]. Attackers may impersonate company representatives, deliver misleading information, and extract confidential data such as banking details. If a chatbot or virtual assistant is compromised, cybercriminals could access sensitive information stored on the company's servers, including customer data (e.g., names, addresses, phone numbers) and financial records. Table 2 summarizes the risks associated with the use of artificial intelligence in the service sector.

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Table II. RISKS ASSOCIATED WITH THE USE OF AI IN SERVICES

Risks	Description
Misuse of Technology	The use of AI by service companies can lead to biased outcomes in terms of sexual and racial discrimination.
Transparency and Explainability Concerns	The use of AI can lead to negative effects beyond biases, including a lack of transparency, black-box algorithms, security issues, and societal and environmental impacts.
Cybersecurity	Adopting AI in service companies introduces cybersecurity vulnerabilities, especially through chatbots and virtual assistants, which can be exploited by attackers to access sensitive customer and financial information.

III. METHODOLOGY

In this study, we adopted a mixed-methods approach, combining both qualitative and quantitative methods to address the research objectives. The quantitative component is based on a questionnaire administered to 58 Tunisian service companies (IT, health, Finance, tourism…) that have adopted artificial intelligence (AI) or expressed interest in this technology. The questionnaire measures key variables such as current AI usage, intention to adopt AI, perceived applications, as well as perceived benefits and risks. The data were analyzed using SPSS 23 with a descriptive approach. The qualitative component is based on the analysis of four case studies of companies operating in the service sector in Tunisia. These cases were selected based on their use of AI or their clear interest in the technology. We analyzed the practices and perceptions of leaders through in-depth case studies, using a deductive thematic analysis guided by our literature review. Table 3 provides a summary of the two research methods used.

Table III. SUMMARY OF RESEARCH METHODS USED

Research Methods	Studied Companies		Data Collection Techniques
Survey Questionnaire	58 companies using or expressing interest in the use of AI.		- A purposive sample of 58 companies operating in the service sector based in Tunisia. - A self-administered questionnaire. - The respondents are members of the executive management (executives, sales managers, administrative and financial managers, IT managers).
Case Studies	Company (A)	Owner-Manager	- A 90-minute semi-structured, face-to-face interview. - Consultation of the company's website. - Consultation of the company's Facebook page.
	Company (B)	-Owner-Manager -Account manager	- A 70-minute semi-structured, face-to-face interview. - Consultation of the company's website. - Consultation of the company's Facebook page.
	Company (C)	Owner-	- A 72-minute telephone interview.

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		Manager	- Consultation of the company's website. - Consultation of the company's Facebook page..
	Entreprise (D)	Owner-Manager	- A 35-minute telephone interview. - Consultation of the company's website. - Consultation of the company's Facebook page.
General Themes of the Semi-Structured Interview Guide: - The Use of AI in Services - Benefits of Using AI in Services - Risks Associated with the Use of AI in Services - AI Usage Strategies in Services - Future Vision of AI in the Service Sector			

IV. RESULTS OF THE QUANTITATIVE STUDY

A. THE USE AND INTEREST IN AI

The results reveal that out of the 58 respondents, half incorporate artificial intelligence into their activities, while a large majority (91%) show strong interest in these technologies as part of their development strategy. A cross-analysis between AI usage and company size shows that among those not using AI, small businesses are the most represented (57%), which could be explained by their more limited innovation capabilities.

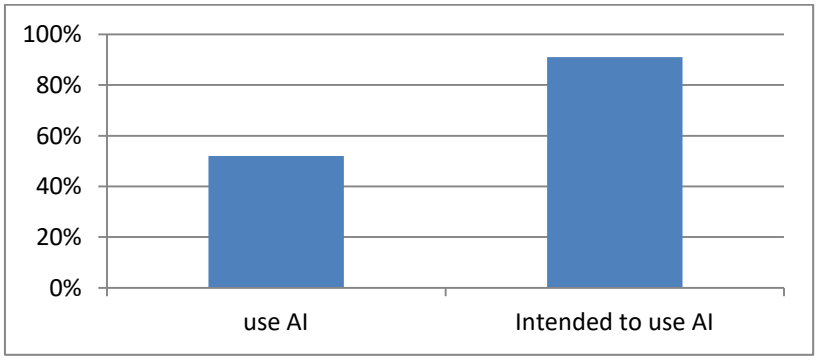

Figure 2. AI Usage and Interest

The application varies from one company to another, as shown in Figure 3. The results of our study indicate that business leaders show the greatest interest in adopting artificial intelligence (AI) in four key areas: customer and supplier relationship management, accounting and financial management, product or service management, and internal information systems. Notably, 34.48% of respondents intend to implement AI within their internal information systems. Additionally, nearly 28% express interest in leveraging AI to enhance interactions with customers and suppliers.

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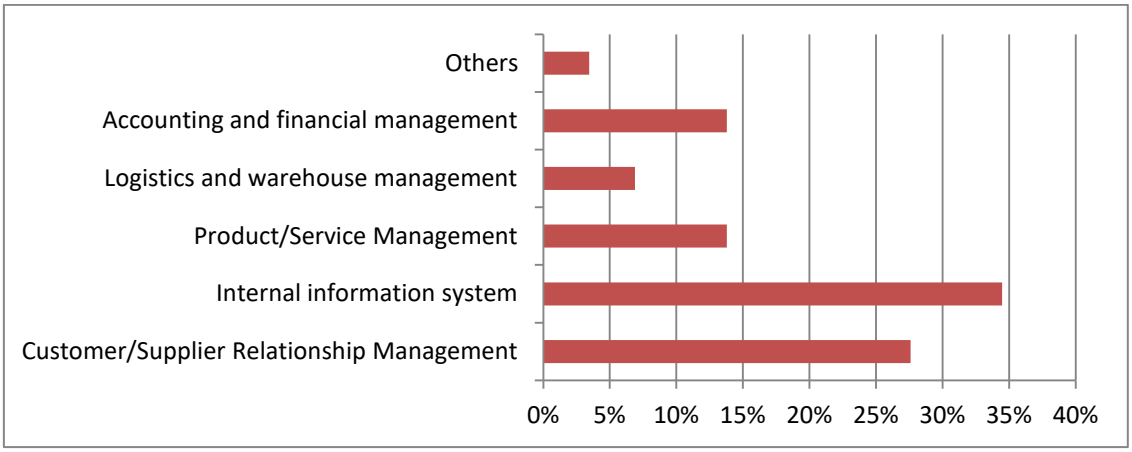

Figure 3. Different Uses of AI

B. THE PERCEIVED BENEFITS OF AI USAGE

As illustrated in the table below, business leaders identify several key benefits associated with the adoption of artificial intelligence. According to our study, the most frequently cited advantages include task automation (32.8%), improved operational efficiency (27.6%), and enhanced customer experience (24.1%).

Table IV. PERCEIVED BENEFITS OF AI

Perceived Benefits of AI Usage	Frequency (N=58)	Percentage
Improvement in Operational Efficiency	16	27,6%
Cost Reduction	2	3,5%
Improved Decision-Making	6	10,3%
Automation of Repetitive Tasks	19	32,8%
Better Customer Experience	14	24,1%
Others (Performance)	1	1,7%

Although interest in artificial intelligence (AI) within Tunisia's service sector is growing, its actual adoption remains in the early stages due to several challenges, as illustrated in Figure 4. The primary concern identified by respondents is data security and privacy, cited by 37.9% of participants, underscoring the critical importance of safeguarding sensitive information in the decision-making process. Additionally, nearly one-third of respondents consider employee resistance a major obstacle to AI adoption—likely driven by fear of change or uncertainty regarding the impact of AI on employment and established workflows. The high cost of AI technologies is also a significant barrier, with 25.9% of respondents highlighting financial constraints as a key impediment to implementation.

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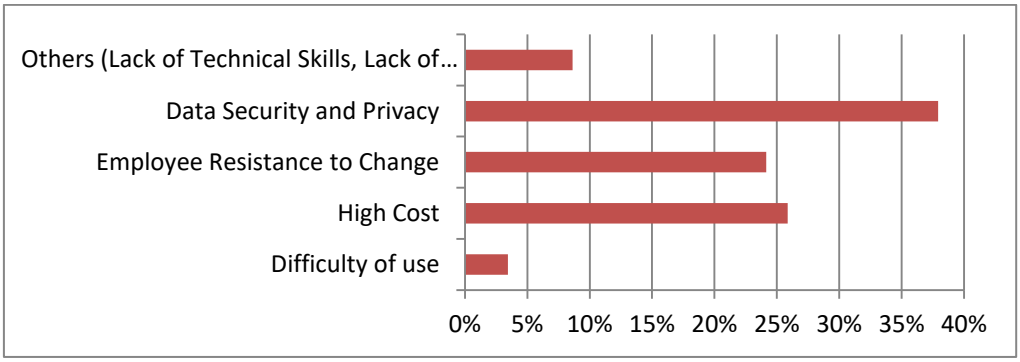

Figure 4. Challenges in using AI

V. CASE STUDY RESULTS

A. OPPORTUNITIES OF AI IN THE SERVICE SECTOR

The interviews conducted with company executives highlight several opportunities offered by generative AI tools, particularly in enhancing efficiency and fostering creativity. All the leaders interviewed underscored that AI significantly contributes to time-saving and streamlining operational tasks. This efficiency gain allows employees to reallocate their efforts toward higher-value activities. Beyond operational advantages, several executives emphasized the creative potential of AI. For instance, the manager of Company B noted: "Staff become more creative, especially during the idea generation phase. Sometimes, employees come up with multiple ideas at once and struggle to identify or organize a well-structured idea. This technology can address that issue by organizing the staff's ideas to help find a creative and original concept." This suggests that AI acts not only as a facilitator but also as a catalyst in the ideation process, helping employees clarify and structure their thoughts. Similarly, another manager pointed out: "By using AI to handle certain repetitive tasks, our team is able to dedicate more time to strategic and creative activities." This highlights AI's role in freeing up cognitive and temporal resources, thereby enabling teams to focus on innovation and long-term planning. However, a more nuanced view was expressed by the manager of Company A, who warned: "Excessive use of AI can, in the long run, negatively affect employee creativity. Humans must still engage their intellectual effort. They need to know how to use AI as a source of creativity." This statement underscores the importance of a balanced and intentional use of AI tools. While AI can support creative processes, overreliance on it may dull employees' initiative and critical thinking skills.

Overall, the analysis highlights that automating specific tasks through AI enables companies to enhance productivity and performance, ultimately contributing to increased profitability. Executives noted that AI plays a crucial role in optimizing workflows by taking over repetitive and time-consuming activities, allowing employees to focus on tasks with higher strategic value. One manager explained: "AI is a catalyst in executing work. By automating repetitive tasks, AI helps save time and frees up employees for strategic activities, which can increase productivity and performance." This statement underlines AI's function not merely as a support tool, but as a driver of organizational efficiency and a means to reallocate human effort toward more impactful tasks. Another executive emphasized the economic benefits of AI's reliability: "AI can reduce human errors, which in turn saves us time and money." This reinforces the view that AI contributes to both operational precision and cost savings, by minimizing mistakes and optimizing resource allocation.

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These insights suggest that when strategically implemented, AI not only improves day-to-day efficiency but also serves as a lever for long-term performance and financial gains.

B. CHALLENGES OF AI IN THE SERVICE SECTOR

Our findings indicate that service sector companies face several challenges in adopting and using AI technologies. One of the primary concerns raised by the four companies studied relates to the reliability of AI tools such as ChatGPT. The executives expressed skepticism about the current maturity and dependability of these technologies. As one manager pointed out: "AI has not yet reached a certain level of reliability. It can make mistakes and requires human intervention." Another reinforced this view, stating: "In reality, AI is not always intelligent. It is not reliable." These remarks suggest that AI-generated content may be based on outdated or questionable data sources, potentially resulting in outputs that misalign with customer expectations and preferences.

Ethical concerns and risks of inappropriate application were also highlighted. Respondents were particularly cautious about how AI might handle sensitive data. Most of the companies mentioned the possibility that AI systems could request confidential information, raising serious concerns about data protection. Nevertheless, all the managers emphasized their commitment to safeguarding client data. As one commonly echoed response stated: "We consider the security and confidentiality of our clients' data."

Cost was another significant barrier identified. Two of the executives specifically mentioned the financial constraints associated with adopting advanced AI solutions. One manager explained: "There are paid tools that don't even have a free trial version. Sometimes, it's expensive." This suggests that for many service firms—particularly smaller ones—the cost of accessing robust, high-quality AI tools can be prohibitive, limiting broader adoption.

In sum, issues of reliability, data security, ethics, and cost emerge as key challenges for service companies seeking to integrate AI into their operations. These findings underscore the importance of cautious and strategic implementation of AI technologies in this sector.

VI. DISCUSSION OF RESULTS

Although interest in artificial intelligence (AI) within the service sector in Tunisia is clearly growing, its actual adoption remains limited. A cross-analysis of data from quantitative surveys and qualitative case studies reveals that decision-makers primarily identify four key benefits of AI integration: the automation of repetitive tasks, improved operational efficiency, increased productivity, and enhanced customer experience. Among these, automation stands out as the most frequently mentioned advantage, cited by 32.8% of respondents. These findings align with those of [55], who argue that automation is one of the core pillars of AI use in modern businesses. This emphasis reflects a clear intent to streamline internal processes, minimize human error, and reallocate human resources toward more strategic, high value-added activities. Such a focus on efficiency highlights the pragmatic approach adopted by Tunisian companies, which are primarily seeking to enhance their competitiveness in an increasingly digital environment. These findings are also consistent with the work of [14], who emphasize that task automation allows organizations to relieve employees from repetitive and routine activities, enabling them to focus on more knowledge-intensive tasks that add greater value to the

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organization—ultimately enhancing productivity [47], [56], [2], [18]. In the same vein, case study results indicate that managers highlighted the productivity gains enabled by AI. These findings also align with the research of [62], who reported that the growing adoption of generative AI is essential for improving business productivity, particularly through the automation of decisions, services, and processes.

Despite the benefits offered by artificial intelligence, its late adoption by some companies is explained by various difficulties. Case studies highlight in particular a lack of reliability of the content produced by AI. This observation is consistent with that of [62], who point out that this content can be affected by biases or inconsistencies from training data, thus compromising its quality and reliability.

In the literature, [32] emphasize the importance of allocating a dedicated budget for the implementation of artificial intelligence. However, findings from the questionnaire survey and case studies indicate that some AI tools remain out of reach for many organizations due to their high cost. This issue is especially pronounced in the Tunisian context, where financial resources for technological innovation are often limited. Such budgetary constraints may partly explain the slow adoption of AI and highlight the urgent need for affordable, locally adapted AI solutions. The case studies and the questionnaire survey highlighted concerns related to customer data protection, illustrating a global issue in the adoption of artificial intelligence. This issue is consistent with the findings of Deslée (2021), for whom data privacy issues are a major risk influencing the intention to adopt new technologies. Furthermore, the survey revealed that a third of respondents also consider employee resistance as a significant obstacle, thus highlighting the need for effective change management and appropriate training to promote the acceptance of AI within organizations.

VII. CONCLUSION

This article explores the current state of artificial intelligence (AI) adoption in Tunisia's service sector, identifying the most common areas of application. It highlights the key opportunities offered by AI, including process optimization, cost reduction, and productivity improvement. At the same time, it examines the main challenges associated with AI integration, such as limited reliability, employee resistance, data privacy concerns, and budgetary constraints. The study aims to provide an analytical framework for assessing the impact of AI on organizational structures and service delivery processes, there by contributing to the broader literature on digital transformation in developing countries. The findings will offer practical recommendations for Tunisian service-sector businesses on how to effectively integrate AI, address implementation barriers, and fully leverage its potential. This study may also inform public policy in Tunisia by underscoring the importance of workforce training, financial support for small and medium-sized enterprises (SMEs), and the development of digital infrastructure to foster widespread AI adoption. While the research focuses on Tunisia's service sector, its findings cannot be readily generalized to other low- or middle-income countries without accounting for local specificities. Each country faces distinct economic, cultural, and technological challenges that shape the trajectory of AI adoption in different ways. A comparative analysis between Tunisia and other similar economies could yield valuable insights into country-specific factors that influence the integration of AI in the service sector. Furthermore, future research could benefit from a more granular approach by investigating the impact of AI in specific service subsectors such as healthcare, education, or tourism. These fields may present unique challenges and opportunities, and targeted studies could offer tailored recommendations to maximize the benefits of AI in each domain.

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