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The role of artificial intelligence in organizational resilience

Mohamed Bouikiker[#1], HafsaOuahi'[*2], Majda El Agy[#3]

[#1]*Management Department, Cadi Ayyad UniversityUniversity Marrakech, Morocco*

[#2]*Management Department, Cadi Ayyad UniversityUniversity Marrakech, Morocco*

[#3]*Management Department, Cadi Ayyad UniversityUniversity Marrakech, Morocco*

[1]m.bouikiker.ced@uca.ac.ma

[2]h.ouahi.ced@uca.ac.ma

[3]m.elagy@uca.ac.ma

Abstract—**The objective of this research is to explore the role of artificial intelligence (AI) in strengthening the organizational resilience of businesses. To achieve this, we conducted a literature review, drawing on both the results of previous work and the model proposed by [37], to analyze the links between artificial intelligence and organizational resilience. Next, an exploratory qualitative study was conducted with ten entrepreneurs operating in the information and communication technology (ICT) sector. The results show that artificial intelligence is a tool that enables ICT companies to optimize decision-making, identify and exploit market opportunities, and anticipate both stakeholder needs and various crises. In addition, this research makes two major contributions. On a theoretical level, this research links artificial intelligence and the organizational resilience of businesses. From an empirical point of view, highlighting how artificial intelligence strengthens the resilience of organizations operating in the ICT sector is an essential point on which Moroccan entrepreneurial actors can rely to establish new entrepreneurial promotion strategies, particularly in times of adversity.**

Keywords—**Artificial Intelligence; Organizational Resilience; Adversity; Information and Communication Technology Sector ; Innovation**

I. INTRODUCTION

In a constantly changing environment, where risks are increasingly unpredictable, artificial intelligence (AI) is positioning itself as a powerful strategic asset in the hands of companies, particularly in times of uncertainty [1]. In this sense, [2] have asserted that the most resilient companies are those that have put AI at the heart of their system, as it is a catalyst for strengthening competitiveness and a relevant vector for decision-making.

Despite this importance, the role of artificial intelligence in strengthening corporate organizational resilience remains an unexplored topic. The previous work available to us focuses on the role of organizational learning [3], social capital [4] and digital transformation [5], ignoring the role of artificial intelligence.

In the same vein, [4] have argued that the various models that have been mobilized to study organizational resilience, such as the herringbone model, have several limitations. The marginalization of artificial intelligence is one of these shortcomings. As a result, the main objective of the present research is to highlight the benefits of artificial intelligence for companies operating in the technology sector, while demonstrating the role of this tool in strengthening the organizational resilience of these companies.

This need, both theoretical and empirical, leads us to seek answers to the following central problem: **What is the role of artificial intelligence in strengthening the organizational resilience of Moroccan technology companies?**

The first part of this research will be devoted to the conceptual and theoretical framework. The aim is to present the theoretical underpinnings of organizational resilience and artificial intelligence. We will then describe the methodological path followed. Finally, we will present the main results of the research, accompanied by an in-depth discussion, before concluding by highlighting the contributions and limitations of the research.

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II. LITERATUREREVIEW

A. Organizational Resilience

In entrepreneurship, the organizational resilience of companies has been the subject of several scientific studies in recent years [6]-[9]. Nonetheless, this concept remains at the center of attention, as a relevant construct in the field of entrepreneurship.

Through a review of the entrepreneurial literature [9]-[15], we can argue that organizational resilience is a rich and multidimensional construct. Researchers have used terms such as corporate, organizational and firm resilience interchangeably to describe it [16]. In this sense, [11] highlighted the absence of a commonly accepted definition of the concept.

In line with the capability-centered approach [17], organizational resilience is defined as the ability of an organization to absorb shock effectively, develop responses to the situation and engage in transformative activities that exploit disruptive surprises, which could threaten its survival. In this sense, [18] argue that organizations must not only react and adapt to crises, but also proactively initiate, renew and rethink their organizational structures and relationships, so that they can thrive even in times of adversity.

In the light of these advances, we can conclude that researchers adopting this capability-centric approach agree that organizational resilience rests on three strongly interwoven dimensions. First, an absorptive capacity, enabling the organization not to collapse in the face of the unexpected or disruption. Then, a capacity for renewal, enabling the company to invent itself and envisage new prospects for the future. Finally, a capacity for appropriation, enabling the company to draw lessons and become stronger from its experiences.

In contrast to the first perspective, [19] have argued that organizational resilience is "*a process of managing threats and exploiting opportunities arising from disruptive business model innovations*". Indeed, through this definition, these authors underline the crucial importance of the "time" variable, presenting resilience as an evolutionary process.

In addition, following a review of the literature on organizational resilience, we noted that some authors address it after moments of crisis [20], while others deal with it in the face of entrepreneurial adversity [21]. Like the latter, we will focus our analysis on the organizational resilience of companies in the face of entrepreneurial adversity, which is defined as "*an unfortunate event or circumstance, or a state of severe and persistent difficulty*" [22], that adversely affects entrepreneurial activity [21]. These authors argue that the concept of entrepreneurial adversity encompasses the various stressful situations generating psychological, financial and social costs for entrepreneurs, as well as for companies, such as loss of markets and financial difficulties.

In keeping with the capability-centric perspective of our research, we define organizational resilience as "*the ability of technology companies to adapt, invent and learn from different adversities affecting these companies*".

B. Artificial Intelligence

According to [23], the fourth industrial revolution is characterized by the growing adoption of emerging technologies, particularly AI. These new technologies have become a pervasive force in modern organizations [24], and are profoundly transforming the way they operate, both nationally and internationally [25].

In the entrepreneurial world, AI has attracted considerable research interest in recent years [23], [26]-[28]. Indeed, consultation of these works reveals that there is no universal and fairly valid definition of AI. Some authors define it as a set of technologies and algorithms capable of performing tasks requiring human cognition [29], [30], while others consider it to be the ability of a system to correctly interpret external data, learn from it and adapt accordingly [27], [32]. This leads us to conclude that authors approach this notion according to the object of the research and the data available.

From a technological perspective, [33] argues that AI refers to "*a broad class of technologies that enable a computer to perform tasks that typically require human cognition, including adaptive decision making*". These tools can perform a number of tasks, such as learning, analysis and problem solving, by mimicking human cognitive functions [29].

In the same vein, [30] assert that AI is a set of tools, techniques and algorithms designed to think like human beings and mimic their actions. This was confirmed by [34]. These authors argued that AI is the most common

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way of processing available information and anticipating data, incorporating it into an algorithm, which then generates new test data.

On the other hand, adopting a functional perspective of AI, approach AI as [32] "*the ability of a system to correctly interpret external data, to learn from this data and to use this learning to achieve specific goals and tasks through flexible adaptation*".

From the same perspective, [35] define AI as the ability of a computer system to collect external data, interpret it and take action on it. Such a system acts intelligently, being capable of executing tasks and continuing to learn from this process, while demonstrating certain human behaviors, such as cognition.

Finally, through research into the contribution of AI to corporate sustainability performance, [36] discuss AI as "*a technological asset enabling the development of capabilities related to the extraction of information from data analysis*" (p. 3). These capabilities are the main source of competitive advantage for user companies [36].

For the purposes of this research, we define artificial intelligence as "*a field of computer science that aims to create systems capable of performing tasks normally requiring human intelligence*". This includes capabilities such as natural language understanding, image recognition, decision-making and learning from data.

C. Artificial Intelligence and Organizational Resilience: TheHerringbone Model (Gibson and Tarrant, 2010)

According to [23], the fourth industrial revolution is characterized by the growing adoption of emerging technologies, particularly AI. These new technologies have become a pervasive force in modern organizations [24], and are profoundly transforming the way they operate, both nationally and internationally [25].

A meta-analysis of the literature on organizational resilience led to the development of a theoretical model known as the Herringbone Model [4]. This model (Figure 1) highlights dynamic and interdependent capabilities and characteristics within organizations that play a crucial role in building and developing resilience [37]. By integrating these elements, the Herringbone Model provides a better understanding of how organizations can adapt and strengthen themselves in the face of challenges and uncertainties.

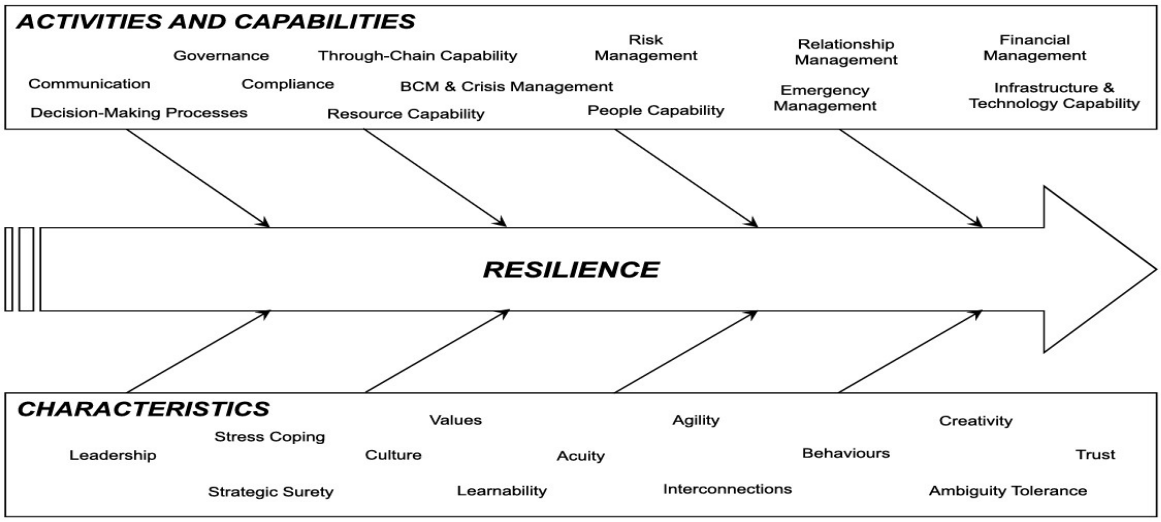

Fig. 1The Herringbone Model (Adapted from [37])

The model above illustrates activities and capabilities at the top, while characteristics are at the bottom, all contributing to building resilience, which is at the center. In fact, organizational activities and capabilities that foster resilience include effective relationship management, risk management, compliance, and resource management. Furthermore, organizational characteristics related to resilience include strong leadership, clear strategic direction, tolerance for ambiguity, and a high level of trust among organizational members. Furthermore, [37] argued that during times of crisis, qualities such as situational awareness, values, culture, creativity, agility, behavior, interconnectedness, stress management, and learning capacity prove particularly valuable in building and strengthening organizational resilience.

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According to [38], the Herringbone model encourages organizations to strive to maximize their skills in all the areas mentioned during normal times in order to better prepare for extraordinary events. The same authors argue that [37] designed this model as a unique solution, applicable to any organization, regardless of its size or sector, to help it identify and develop these key factors. However, it is at this level that the model presents its limitations, being criticized for its inability to take into account the specific challenges that an organization may face in achieving an optimal level of resilience, both planned and adaptive. In the same perspective, [4] stated that this caveat echoes a frequent criticism of organizational resilience models, namely their limited or untested generalization in sectors with unique characteristics, as well as for micro and small and medium-sized enterprises. In the same sense, the same authors argued that the Herringbone model is less relevant in the context of small and medium-sized enterprises, as it fails to capture the unique interaction of entrepreneurial characteristics and contextual factors that support their resilience. Moreover, although it emphasizes the role of the company's infrastructure and technological capabilities in strengthening organizational resilience, the Herringbone model tends to marginalize the specific contribution of AI, relegating it to a simple technological tool among others, without fully recognizing its transformative potential in decision-making processes, business models and the adaptation of the company, particularly in times of uncertainty.

The role of AI, particularly in small structures, is articulated with many components of the Herringbonemodel such as infrastructure and technological capabilities, interconnections, employee capacity, the decision-making process and culture. Indeed, it is only recently that authors have confirmed the positive impact of AI on organizational resilience [2], [5], [9], [39]. Therefore, it is interesting to study in depth the contribution of this technological factor to the organizational resilience of small Moroccan companies operating in the information and communication technology sector. Our goal is to enrich this model by highlighting the role of AI in strengthening absorptive capacity, renewal and organizational appropriation.

D. Artificial Intelligence: A Valuable Opportunity in the Hands of Businesses

According to [40], AI is transforming the entrepreneurial landscape, profoundly altering the ways businesses are created, developed, and managed. This innovative tool not only contributes to the growth of established businesses, but also facilitates and supports the creation of new ventures, as it can influence individuals' entrepreneurial intentions, opportunity recognition, and the way new business ideas are identified and exploited.

According to [27], AI represents an undeniable opportunity for businesses. This new technology is a strategic decision-making tool for these entities [41]. This observation is consistent with theoretical arguments [42]. These authors emphasize that one of the most significant applications of AI is the streamlining of decision-making processes. Businesses are leveraging Big Data to assess strategic opportunities, enabling AI to formulate recommendations and make decisions based on a comprehensive analysis of available data. This allows managers, according to [41], to make objective decisions, without necessarily mastering the underlying mechanisms of data collection and processing.

In this same perspective, [43] indicate that AI-based decision-making processes can be integrated into organizational structures in different ways. Continuing this logic, [44] identify several configurations that enable efficient and successful decision-making. These range from full human-AI delegation, often used for automated fraud detection or advertising recommendations, to hybrid AI-human or human-AI sequential decision-making approaches, and finally to aggregated human-AI decision-making, where AI serves as an independent counterbalance to the decisions of other board members. This approach shifts the cost of solving decision-making problems to the evaluation and selection of solutions [44].

Furthermore, through research on deep learning techniques applied in the healthcare field, [45] highlighted that the integration of AI-powered bots in account and operations management allows companies to streamline the costs associated with launching new businesses. This automation generates significant efficiency gains, particularly beneficial for young companies and start-ups.

Similarly, based on an exploratory study on entrepreneurial education in the era of AI, [46] stipulate that the application of AI in the management of university students' employment and entrepreneurship is of great value, as it helps to understand the overall situation, update data in real time, provide personalized advice, reduce pressure, and improve employment efficiency. These conclusions were supported through qualitative

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research by [47]. These authors confirmed that AI facilitates the process of recruiting new candidates through optimal sorting of job applications based on criteria set by the company.

Furthermore, it should be emphasized that new technologies, such as AI, constitute both a source of innovation [48] and a vector of internationalization for companies [49], by helping to shape ecosystems [50], optimize the commercial function [51] and create new business models and differentiated strategic positions [52].

Finally, [27], advanced solutions such as Chatbots (Alexa and Siri) allow entrepreneurs to better interact with their customers, not only by responding to requests for information, but also by taking into account their emotions and affective needs. These advanced solutions also offer the possibility of creating more personalized and empathetic experiences, thus strengthening customer relationships. In addition, [53] have argued that AI is effective in performing many mechanical tasks that are generally repetitive and require reliable performance. However, although AI offers many opportunities for businesses, some authors believe that it poses a threat to the economy in general and to entrepreneurs in particular [54]–[56]. According to [56], the use of AI can lead to a "dystopian" world where humans lose control over their lives. This loss of control could also affect entrepreneurs, who risk becoming overly dependent on automated systems, thus reducing their ability to make decisions and adapt flexibly to market changes. This observation was confirmed by [27]. These researchers argued that AI can reinforce increased monitoring and control, both at the management and employee levels, which can lead to a reduction in entrepreneurs' autonomy in their own decision-making. Furthermore, the same authors pointed out that the use of AI could also lead to excessive standardization of entrepreneurial practices, thus limiting creativity and innovation, crucial elements for success in a competitive economic environment. Thus, although AI offers opportunities for efficiency and profitability, it also carries risks that, if poorly managed, could limit entrepreneurial freedom and the ability to evolve in the face of unforeseen challenges [57], [58].

E. Technological Capabilities and Organizational Resilience: Is AI an Underestimated Factor?

Previous work in entrepreneurship has largely focused on exploring the determinants and factors contributing to the organizational resilience of firms [59]. In this sense, [4] emphasize the role of social capital and the individual resilience of the entrepreneur. [60], for their part, address the role of public support while highlighting the importance of financial aid granted by the German government in the survival of businesses during the Covid-19 period. On the technological side, several authors have focused on the contribution of digital technologies [9], technological innovation [2], and the digitalization of workplaces, thus ignoring the importance of AI.

In the entrepreneurial context, AI has been the subject of several scientific studies in recent years [27], [61]– [63]. Indeed, this innovative tool constitutes, according to these authors, a factor that can strengthen the organizational resilience of companies in the face of various adversities.

According to [2], the most resilient companies are those that have placed AI at the heart of their system. This technological asset constitutes a relevant vector for decision-making in the event of a crisis. In this sense, the same authors argued that AI plays a very important role in strengthening organizational resilience, as it allows for the automation of complex processes, more efficient use of resources, ensuring the speed of information flows, and improving human and accounting resource management through the use of algorithmic applications executed in the IT environment. This observation was confirmed by [43]. These authors stated that AI also plays a crucial role in analyzing existing data to understand customer behavior in response to new features or price changes. This allows companies to adapt their strategies according to consumer needs and preferences.

In the same vein, it is worth mentioning that the automation of sales operations using AI is a promising area for the development of resilient businesses [51]. In this context, the latter seek to optimize their sales operations by automating processes, which can free up time for more meaningful interactions with customers. In this sense, [51] argue that some companies are using AI to help marketers identify and target appropriate advertising to potential customers. This is of major importance in enabling the company to attract new customers while effectively anticipating their needs.

According to [32], AI is a set of digital technologies capable of efficiently processing information to assist humans in performing various tasks. These technologies have contributed, according to [64], to transforming business models, which were previously linear, discrete, predictable, and stable, into more flexible, agile, and

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resilient models, thus enabling them to better cope with the unpredictability associated with the crisis and operate in a less linear manner. This view is supported by the contributions of [65]. These authors stipulate those digital technologies such as AI play a key role in identifying, evaluating, and exploiting opportunities. This tool also allows companies to strengthen their competitiveness and innovation processes, particularly in times of uncertainty, such as during natural disasters or pandemics [47].

Through research on the impact of digitalization on organizational resilience and employee resilience, [5] highlighted that the adoption of AI-based technologies improves information sharing and service quality, particularly in times of adversity. This is consistent with [66]. According to these authors, the rise of AI applications contributes to the optimization of work processes and the facilitation of agile procurement strategies, thus enabling companies to achieve significant savings in time, effort, and resources. This observation was confirmed by [67]. These authors argue that the use of AI in the workplace significantly contributes to improving employee productivity as well as business growth. This dynamic is notably driven by an acceleration of time-to-market, a determining factor in competitive and unstable environments.

Finally, according to [47], AI has emerged as one of the main vectors of adaptation and transformation of companies, particularly in the face of the uncertainty that characterizes the current context. Indeed, although the adoption of these intelligent tools requires prior preparation and considerable resources, the use of AI contributes significantly to strengthening organizational resilience through several levers. First of all, AI allows companies to adjust their strategies by offering them adequate solutions according to the market situation. Furthermore, it also optimizes the recruitment process by facilitating the identification of the most suitable profiles. In this regard, [68] stipulates that automated recruitment systems are capable of assessing desirable personality traits in candidates, in particular by analyzing their body language and vocabulary during interviews.

III. Research Methodology

A. Research Context

In this research, we focused on very small and small enterprises. These structures are characterized by a turnover of less than 3 million dirhams and a workforce of less than 10 employees (SME Charter, 2002, cited by [69]). This choice is explained, firstly, by the importance of these units in the Moroccan economy. Indeed, the country's productive fabric is largely dominated by these structures. In 2021, Morocco had 370,000 formal enterprises, of which 78.8% were very small enterprises and 9.2% were small enterprises (World Bank & MOVSSME[1], 2024). Secondly, and given their resource constraints, very small enterprises appear to be the main entities affected by this issue of artificial intelligence.

As a sector of activity, we chose the information and communication technology (ICT) sector. According to the Moroccan Office of Industrial and Commercial Property[2], the number of technology companies created in 2024 reached 2,733. This number represents 4.01%[3] of the companies created during that year. Indeed, given the importance of this sector for the country's economic development, this low rate reflects its multiple challenges: namely, rapid technology obsolescence, market fluctuations, and frequently changing customer needs. This prevalence of challenges makes this sector a fertile ground for studying the organizational resilience of companies.

B. Data Collection and Analysis

This research aims to analyze the role of artificial intelligence in strengthening organizational resilience within Moroccan technology companies. In fact, to achieve our ultimate objective, we will focus on the company as the unit of analysis and the entrepreneur as the data source. From a methodological point of view, we opted for an exploratory qualitative approach that allows us to analyze in depth the role of AI in the organizational resilience of companies. Indeed, this approach is part of an interpretivist epistemological paradigm that aims to understand a social phenomenon from the point of view of the people interviewed and to interpret their perceptions, giving meaning to their behaviors [70]. Regarding the mode of reasoning, our research follows an abductive reasoning that consists of going back and forth between theory and the field.

[1]MOVSSME: Moroccan Observatory of Very Small, Small, and Medium Enterprises
[2]http://barometre.directinfo.ma/index.html, consulté le 22/01/2025.
[3]http://barometre.directinfo.ma/index.html, consulté le 22/01/2025.

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Following this logic, we mobilized semi-directive interviews with 10 entrepreneurs operating in the ICT sector (Table 1). These interviews, lasting between 30 minutes and 1 hour 15 minutes, were carried out over a period of three months, face to face and remotely, using the ZOOM and Google Meet platforms. We continued our search until we reached data saturation, that is, until no new information was available that could enrich our analysis or reveal additional results [71].

TABLE I
CHARACTERISTICS OF THE SAMPLE

Entrepreneurs interviewed	**Gender and age**		**Main activity**	**Creation date**	**Legal form**	**Duration of interview**	**Date of the interview**
ENTR 1	M*	34 YO	Application développementand conception	2019	SMLLC***	49 minutes	29/01/2025
ENTR 2	M	32 YO	Digital marketing	2021	SMLLC	32 minutes	11/03/2025
ENTR 3	M	36 YO	Software and platform development and marketing	2015	SMLLC	38 minutes	7/03/2025
ENTR 4	M	55 YO	The creation of IT solutions and products.	2018	SMLLC	30 minutes	14/03/2025
ENTR 5	M	26 YO	Digital marketing and web development.	2023	SMLLC	40 minutes	25/01/2025
ENTR 6	M	28 YO	Development of money transfer and payment applications	2022	SMLLC	44 minutes	23/01/2025
ENTR 7	F**	28 YO	Creating IT products and solutions	2023	SMLLC	35 minutes	14/03/2025
ENTR 8	M	25 YO	Creating IT products and solutions	2020	SMLLC	1h14 minutes	24/02/2025
ENTR 9	M	33 YO	Developing IT solutions	2016	SMLLC	35 minutes	13/02/2025
ENTR 10	M	30 YO	Creating IT products and solutions	2018	SMLLC	40 minutes	15/03/2025

M* Male; F**: Female; SMLLC***: Single-Member Limited Liability Company

After completing the interviews with the entrepreneurs, we proceeded to transcribe the voice recordings, which totaled 7 hours. This step consists of faithfully reproducing what was said by the interviewee, resulting in 85 pages. To correct spelling and stylistic errors, we made a transcription. This phase gave us an initial idea of the possible results.

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In addition, given the large volume of data collected, a content analysis of the statements made by the entrepreneurs interviewed was conducted using MAXQDA 24 software, followed by a manual analysis in accordance with the protocol established by [72].

IV. Research Results

The MAXQDA 24 software allowed us to retain the word cloud, the code matrix, and the code cloud, which we have presented below.

Fig. 2Word cloud

This word cloud highlights the most common concepts associated with AI and organizational resilience. First, AI, resilience, company, tools, anticipation, and market represent the most frequently mentioned words by the entrepreneurs surveyed. We then note a strong presence of words related to uncertainty management, such as crisis, difficulty, challenge, adversity, and change, which reflects a particular focus on AI in times of adversity. The notion of time is also present, with the words during, before, after, and times, indicating that AI intervenes at different stages of adversity. Finally, we also found that the words anticipation, solution, and innovation demonstrate AI's forward-looking approach.

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Fig. 3Code cloud

After coding using MAXQDA24 software, we determined that AI's contribution to organizational resilience affects five main elements, including improving entrepreneurs' decision-making, identifying opportunities, anticipating needs and crises, and the staff recruitment process. Based on this, we conducted our analysis and presented it as follows:

Examination of the word matrix indicates that artificial intelligence makes a particular contribution to decision-making and staff recruitment, as indicated by the larger squares associated with these two sub-themes. Second, the results indicate that AI plays a central role in identifying market opportunities and anticipating crises and stakeholder needs. Finally, we were able to observe that AI contributes, for some entrepreneurs, to boosting organizational culture by fostering a mindset of continuous innovation.

Fig. 4Word Matrix

A. AI: A Strategic Lever for Moroccan Technology Companies

The analysis of the collected data provided valuable insights and concepts from entrepreneurs operating in the ICT sector regarding the integration of AI. Indeed, one of the notable findings of this research is the pronounced need for AI adoption to remain competitive and ensure the sustainability of the business. This finding is rooted in the words of the ninth respondent, who stated: "We are obliged to integrate it and follow the trend to remain competitive in the market" (Entrepreneur 9).

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Furthermore, it is worth noting that this integration is achieved through the use of several intelligent tools. In this regard, the results emphasize generative tools for text (ChatGPT, Jasper AI, Notion AI, Grock, Perplexity, Qwen2.5), images (DALL-E, META AI), and data and reasoning (Causal AI). These tools are very effective, according to the respondents, in several areas. In this context, the third respondent draws attention to their effectiveness in language conversion, as well as correcting coding errors: “AI tools allow us to convert language X to another, more comprehensive language… We also use these solutions to correct errors that exist in coding” (Entrepreneur 3). The ninth respondent, for his part, argues that these technologies are effective in content and image generation, as well as in strategic thinking: “AI is useful in everything related to content generation on LinkedIn, image generation and strategic thinking” (Entrepreneur 9). The latter defined AI as a set of intelligent assistants aimed at facilitating various tasks for users, including entrepreneurs: “As I already said, AI is a set of assistants. It has a thinking capacity that helps us formulate strategies” (Entrepreneur 9).

Along the same lines, the same results affirm that AI, as an innovative tool, represents a strategic lever for companies in the sector, insofar as it allows them, as the first respondent indicates, to increase their productivity, improve responsiveness, and stimulate their creativity: "AI is an advantage for me because it allows us to be more productive, faster, and more creative" (Entrepreneur 1). This observation is also highlighted by the sixth interviewee. He argues that AI plays a key role in bringing the company closer to its customers by enabling it to quickly identify and respond to different customer needs: "In the money transfer and payments sector, AI can improve the way we operate and interact with our customers" (Entrepreneur 6).

However, with rapidly evolving market trends and technological advances, some entrepreneurs state that AI poses a threat to entrepreneurial activity. In this regard, the sixth interviewee emphasizes that the integration of AI represents a costly investment for entrepreneurs. Indeed, they must also acquire a set of specific skills in order to manage the impact of AI on their entire business: “AI can also pose challenges, particularly in terms of integration costs, necessary skills and data protection” (Entrepreneur 6). The second respondent, for his part, argues that AI could lead to the disappearance of certain products, such as the “Landing-Page”, due to the ability of clients to automatically generate landing pages via AI: “Thanks to AI, the client no longer needs us to generate landing pages” (Entrepreneur 2).

B. Entrepreneurial Adversity in the technology sector: Meaning and Forms

Our question about what entrepreneurial adversity means for entrepreneurs operating in the ICT sector revealed that it constitutes a difficult period marked by obstacles, challenges, and unfavorable conditions. These situations can be the source of various factors, as the tenth entrepreneur emphasizes: "Entrepreneurial adversity represents times when unforeseen challenges, such as customer loss, market saturation, or financial crises, test our ability to adapt and overcome obstacles" (Entrepreneur 10). Indeed, in the information and communications technology sector, the results reveal that this adversity also manifests itself through technical difficulties related to coding, as well as financial constraints. Furthermore, it is interesting to note that being overwhelmed by technology constitutes a problem in itself. This is evident in the statements of the seventh respondent. According to him: "The biggest problem is being overwhelmed by technology" (Entrepreneur 7).

However, the first respondent states that adversity is an opportunity to strengthen the entrepreneur's resilience, learn from difficult situations, and increase the company's adaptability. "Entrepreneurial adversity is not an end in itself, but rather a stage that builds character, vision, and resilience. Every challenge is an opportunity to learn, grow, and make the company stronger and more adaptable" (Entrepreneur 1).

To cope with this adversity, the entrepreneurs interviewed emphasized the importance of resilience, agility, and risk-taking. The eighth entrepreneur states, "Personally, I think that above all, you have to be resilient and agile to venture out and take risks" (Entrepreneur 8). They also emphasized the importance of effective communication to manage customer expectations, as well as the technical expertise needed to offer tailored solutions. "Communication is very important because it allows us to understand customer needs and overcome difficult times" (Entrepreneur 5). Furthermore, a clear vision, significant patience, strong leadership, and informed decision-making are considered essential, as indicated by the fourth respondent: "In terms of qualities, I would first cite patience and stress management, as well as strong and solid leadership" (Entrepreneur 4).

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C. The Role of AI in Strengthening the Organizational Resilience of Technology Companies

Our results show that AI contributes to strengthening the organizational resilience of companies operating in the ICT sector on several levels. First, this tool improves the company's ability to make good decisions in times of adversity thanks to a range of choices, allowing the organization to better select the optimal option. This result stems from the words of a third interviewee. According to him: "When there are blockages, AI helps us make good decisions" (Entrepreneur 3). In addition, the same respondent emphasized that, thanks to the advanced data analysis offered by AI, the company benefits from multiple perspectives, which allows it to make informed decisions. Thus, it manages to adapt more effectively to the situations encountered: "When we analyze data with AI in a more advanced way, it gives us several perspectives on the solution to unblock the situation" (Entrepreneur 3).

Along the same lines, it is worth mentioning that the importance of AI in strategic thinking is a crucial element that deserves to be highlighted. Indeed, AI's ability to take on multiple roles allows, firstly, to compensate for the limited knowledge of entrepreneurs and bring a diversity of solutions to the table. Secondly, the ninth interviewee states that this multiplicity of roles allows companies in the ICT sector to adapt their strategies and adjust their business models. This gives them the ability to cope with shocks and subsequently develop: "AI is a set of assistants. It has a capacity for reflection that helps us formulate and adjust our strategies after a shock" (Entrepreneur 9). Furthermore, the research results show that AI's inability to fully master the situation and all the market variables leads some companies to mobilize the knowledge of their employees through brainstorming techniques. This collaboration aims to formulate proposals, which are then tested using AI. This result is reflected in the statements of the fifth respondent, who states: "…Through brainstorming workshops, we obtain several proposals and several solutions to the situation. And to make a good decision, we ask the AI to choose the right proposal" (Entrepreneur 5).

In addition, beyond decision-making, our question on the role of AI in the organizational resilience of ICT companies revealed that it helps companies exploit and identify opportunities presented by the crisis. Indeed, as the last respondent explains, AI's ability to access information on existing technologies in other contexts or among competitors allows companies to leverage this knowledge to guide their strategic choices: "It allows us to identify opportunities, yes, because it informs us about existing technologies and solutions in other markets" (Entrepreneur 10). Adding to this, the second respondent states that companies can analyze the market situation, especially in times of uncertainty, by using intelligent AI-based tools. This analysis gives these entities the ability to adjust their offers in real time and target new customer segments: “Thanks to tools like Google Trends and AI-based analytical platforms, we can adjust our offers in real time and target new customer segments” (Entrepreneur 2). In the same vein, the third respondent argues that AI promotes the organizational resilience of technology companies through innovation. Indeed, launching discussions using AI tools such as ChatGPT allows companies to create new technological solutions and/or develop existing ones: “Starting a conversation with AI allows us to think of new solutions. It also allows us to unblock situations by proposing AI solutions that we can use” (Entrepreneur 3).

Furthermore, it is worth noting that the research results show that AI strengthens the organizational resilience of companies operating in the ICT sector, by improving both their ability to anticipate the needs of stakeholders such as customers, employees and partners, as well as their ability to anticipate crises. In fact, as indicated by the sixth respondent, the importance of AI in generating dashboards offers companies the possibility of accessing relevant information on payment deadlines, periods without charges as well as off-peak periods: “AI helps us generate dashboards that allow us to have an idea on payment deadlines, peak dates and off-peak periods” (Entrepreneur 6). This helps them to monitor stakeholder trends in demand, in particular by proposing offers that encompass their different requirements. In addition, thanks to these indicators, the company visualizes when activity slows down or intensifies. As a result, it can adjust workloads, better plan vacation schedules, and increase staffing levels during peak periods, thereby improving employee engagement and satisfaction.

Furthermore, regarding crisis anticipation, the same results reveal that AI is an asset for businesses, as it allows them to analyze market trends and identify weak signals that may indicate potential malfunctions or risks. This result is rooted in the words of the eighth respondent, who states: "AI makes it possible to detect weak signals in data and anticipate potential crises, whether related to the market or internal factors" (Entrepreneur 8). In fact, by benefiting from these practices, businesses are able to develop preventive

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strategies that allow them to overcome adversity, which strengthens the resilience of these entities. Finally, our question on the role of AI in staff recruitment in times of adversity revealed that the use of this new technology allows companies to streamline their recruitment processes, by identifying the most qualified candidates more quickly and reducing human bias. In this sense, the first respondent states that through filtering job applications (Curriculum Vitae) based on criteria predetermined by companies, AI allows them to save time and energy: "…Based on the criteria set, AI gives us the opportunity to choose the best profiles. This allows us to save time and costs" (Entrepreneur 1). This statement was supported by the tenth respondent. The latter states that AI is also beneficial in personalizing job offers, as it facilitates the creation of targeted offers, adapted to specific profiles, which optimizes not only the recruitment process, but also long-term talent retention: "Yes, AI makes recruitment easier. "We recently launched a specific internship offering based on AI" (Entrepreneur 10).

In conclusion, it is worth noting that AI strengthens the organizational resilience of companies in the ICT sector, particularly by facilitating adaptation to change and improving business flexibility. In this sense, the results show that when introduced in a well-managed manner, AI can boost organizational culture by fostering a mindset of continuous innovation. In this regard, the seventh interviewee stated that involving employees from the very beginning of the transformation process makes AI beneficial in terms of business resilience: "In our company, employees are open to the integration of AI" (Entrepreneur 7). This observation was confirmed by the eighth respondent, who emphasized the importance of recruiting young employees who are open to technology: "The team must be young... This new generation is open to the use of AI" (Entrepreneur 7).

V. Discussion of The Results

In recent years, organizational resilience in businesses has received significant attention [6]–[9]. Despite its importance, this research remains insufficient. Among the gaps in the literature regarding these antecedents, we highlight the role of information technology, particularly AI.

In this context, through this research, we seek to understand how AI promotes a resilient posture in businesses in the face of adversity. Using data from interviews with entrepreneurs operating in the information and communication technology sector, we reveal the role of AI in the development of organizational resilience in these businesses, based, of course, on the theoretical foundations advanced in previous work, as well as the Herringbonemodel [37]. Our results reveal three major themes; two themes relating to the benefits of AI adoption by these businesses and its role in strengthening their organizational resilience. Another is related to understanding entrepreneurial adversity in the ICT sector.

A. AI: A Strategic Lever for Moroccan Technology Companies

The results of this theme reveal the importance of adopting AI to remain competitive and ensure the survival of companies in the ICT sector. This confirms the theoretical postulates according to which new technologies such as AI strengthen the competitiveness of companies [62]. This observation also echoes the results of [2], where they stipulate that the integration of AI has now become a necessity to maintain the survival of companies.

In the same vein, the same results affirm that AI represents a strategic lever for companies in the ICT sector, in the sense that it allows them to increase their productivity, improve responsiveness, and stimulate their creativity. This result corroborates with that of [67], where they stipulate that the automation of processes by AI allows to optimize speed to market, something that guarantees the growth and productivity of companies, a crucial factor to ensure a competitive advantage in the market [23].

In addition, the integration of AI puts entrepreneurial activity in front of threats. Indeed, with the rapid evolution of technologies and the development of markets, the integration of AI remains expensive. In addition to the high investment costs, entrepreneurs are always in need of developing their skills in order to manage the impact of AI on the company and to be able to manage its trends. Among the undesirable effects of AI we found the disappearance of certain services or products that are obsolete today with technological advances. The threats of AI for companies and the economy have been demonstrated in the literature by some authors, such as [54]–[56]. These researchers mentioned its negative impact on the autonomy of

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entrepreneurs and the ability to make decisions. This is because AI risks controlling human lives, in the sense that entrepreneurs may become too dependent on automated systems [27], [56].

B. Entrepreneurial Adversity in the technology sector: Meaning and Forms

To understand organizational resilience, it is first important to understand how the companies studied perceive adversity. According to them, adversity is a difficult period characterized by challenges and obstacles related, for example, to technical difficulties in coding, financial constraints, or market saturation. This aligns with the definition proposed by [21] and [22], which defines it as a serious difficulty that negatively impacts the company. This situation has negative consequences for the company, its development, and its financial situation, testing its ability to adapt and resilience. However, some interviewees believe that adversity represents an opportunity for learning and development, both for themselves and for their companies. Indeed, the lessons learned from these situations strengthen the adaptive and renewal capacity of ICT sector companies. These results align with the theoretical arguments of [18], which argue that organizations must not only react and adapt to crises, but also proactively initiate, renew, and rethink their organizational structures and relationships in order to thrive even in times of adversity.

C. The Role of AI in Strengthening the Organizational Resilience of Technology Companies

To understand organizational resilience, it is first important to understand how the companies studied perceive adversity. According to them, adversity is a difficult period characterized by challenges and obstacles related, for example, to technical difficulties in coding, financial constraints, or market saturation. This aligns with the definition proposed by [21] and [22], which defines it as a serious difficulty that negatively impacts the company.

The analysis of the results of this theme, which represents the core of our research, reveals that AI is also one of the antecedents that strengthen the organizational resilience of ICT companies in the face of adversity. Indeed, AI represents several advantages for these companies, which we discussed in the first theme. Among these advantages, the results emphasize the role of AI in decision-making. This finding was supported by [61], who stipulate that mastering AI promotes decision-making and creative thinking, which consequently contributes to their resilience during times of adversity. These results are consistent with those identified by [42]. These authors emphasize that one of the most significant applications of AI is the streamlining of decision-making processes. This finding was confirmed by [41], who indicates that the use of AI gives companies the ability to make objective decisions, without necessarily mastering the underlying mechanisms of data collection and processing.

In addition, research findings indicate that AI, as a technological asset, allows companies to identify and exploit opportunities presented by times of adversity. In fact, AI's ability to access information on existing technologies in other contexts or among competitors allows companies to leverage this knowledge to guide their strategic choices. This result aligns with the theoretical arguments put forward by [65]. These authors stipulate those new technologies such as AI play a key role in identifying, evaluating, and exploiting opportunities.

Furthermore, it is worth noting that AI promotes the organizational resilience of ICT companies by strengthening their ability to anticipate stakeholder needs. This result complements that put forward by [27]. Indeed, beyond satisfying customer needs as put forward by these authors, the research results demonstrate that AI gives ICT companies the ability to anticipate customer needs using smart dashboards.

According to [73], the use of AI-based tools helps companies optimize internal processes and anticipate market trends. In fact, the results obtained confirm this assertion. In fact, although anticipating crises requires massive data, the entrepreneurs interviewed indicate that the importance of AI in analyzing market developments and identifying weak signals helps them anticipate crises. This result highlights the role of AI in the entrepreneurial adventure as a whole.

In the same vein, it is captivating to note that the research results also highlight the role of AI in recruitment processes. In this sense, the use of this new technology allows companies to streamline their recruitment processes, identifying the most qualified candidates more quickly and reducing human bias. This result aligns with the theoretical postulates put forward by [47]. These authors argue that AI allows companies to optimize the recruitment process by facilitating the identification of the most suitable profiles. This result also echoes the statements of [68]. According to this author, AI-based recruitment systems are

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capable of assessing desirable personality traits in candidates, particularly by analyzing their body language and vocabulary during interviews.

To conclude, our question on the contribution of AI to the organizational culture of ICT companies revealed that this innovative tool can boost organizational culture by fostering a mindset of continuous innovation.

To conclude, our question on the contribution of AI to the organizational culture of ICT companies revealed that this innovative tool can boost organizational culture by fostering a mindset of continuous innovation.

Finally, within the framework of this research, the Herringbone model developed by [37] provides a framework for understanding the resources and capabilities that foster organizational resilience in companies. Indeed, this research confirms the importance and effectiveness of this model in analyzing the resilience of organizations, particularly micro, small, and medium-sized enterprises.

Next, following [4], who has already confirmed the importance of individual resilience and social capital, we confirm, through this research, the importance of companies' technological capabilities, particularly new artificial intelligence tools.

Figure 5 below offers an updated version of the Herringbonemodel. More specifically, it highlights the role of technological capabilities such as AI in creating and developing organizational resilience in companies.

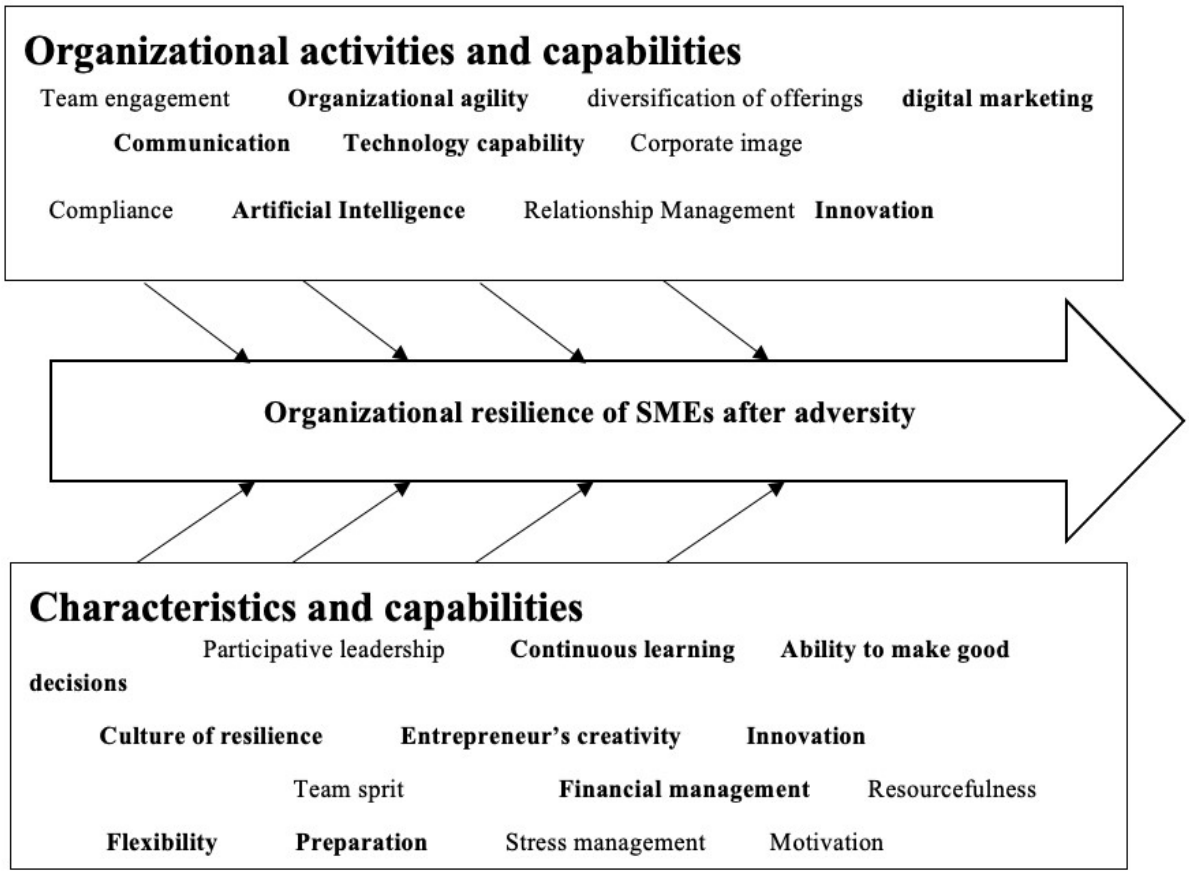

Fig. 5Revised Herringbone model

VI. CONCLUSION

This research builds on previous work exploring the link between AI and organizational resilience [2], [5], and [47]. More specifically, it aims to analyze the role of AI in strengthening the organizational resilience of ICT companies in the Marrakech-Safi region.

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To do this, we presented the theoretical foundations of the concept of organizational resilience, as well as artificial intelligence. We then used the Herringbone model [37], followed by a theoretical synthesis of the research linking these two concepts, to theoretically address our research question.

Furthermore, from a methodological perspective, we conducted an exploratory study based on semi-structured interviews with ten entrepreneurs operating in the ICT sector and located in the Marrakech-Safi region. The collected data were then analyzed using MAXQDA 24 software, followed by manual content analysis, in accordance with the recommendations of [72].

The results of this research confirm that AI represents an undeniable opportunity for companies in the ICT sector. Indeed, mastery of computer tools and possessing theoretical background specific to their field of activity allow them to fully and effectively exploit the advantages offered by AI. In this sense, it is interesting to note that the adoption of AI by companies in the ICT sector has now become a requirement to ensure their survival and maintain their competitiveness in both the national and international markets.

Similarly, the research results indicate that companies in the ICT sector perceive entrepreneurial adversity as a difficult situation marked by ups and downs in entrepreneurial activity. In this sense, the same results show that agility, risk-taking, communication, and resilience are essential to pursue entrepreneurial opportunities under the best possible conditions.

Furthermore, in relation to the role of AI in strengthening the organizational resilience of ICT companies, the research results reveal that AI is an innovative tool that allows these entities to optimize the decision-making process. The same results also affirm that AI also allows these companies to identify and exploit opportunities presented by various adversities. Furthermore, the same results indicate that AI gives ICT companies the ability to anticipate stakeholder needs, as well as future crises. Finally, it is interesting to note that AI streamlines the recruitment process for new candidates.

This research makes two important contributions. In fact, on a theoretical level, this study links artificial intelligence and the organizational resilience of ICT companies. In this sense, the focus on the company as the unit of analysis can also be considered a contribution of this research. Finally, highlighting how artificial intelligence strengthens the organizational resilience of ICT companies is an essential point on which Moroccan entrepreneurial stakeholders, consultants, researchers, banking institutions, and the government can draw to formulate and enrich new entrepreneurial promotion strategies, particularly in uncertain environments.

Despite its contributions, this research has a limitation. Although it is useful in terms of the reliability of its results, the main limitation of this research is its focus on a specific region, such as the Marrakech-Safi region.

However, to deepen our understanding of the relationship between artificial intelligence and organizational resilience, we recommend conducting a mixed-methods study, focusing on companies that have experienced significant crises to deepen our knowledge on the subject.

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