



# Redefining entrepreneurship in the digital age: exploring the impact of technology and collaboration on ventures

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## Abstract

This study investigates the influence of recent technological advancements and collaborative networks on the burgeoning landscape of digital entrepreneurship, particularly within the Middle East and North Africa (MENA) region. For this purpose, the research design employs a mixed-method approach, which combines qualitative and quantitative data collection methods. Semi-structured interviews with MENA-based entrepreneurs have provided in-depth insights into the dynamics of the digital entrepreneurial ecosystem, and the perceived impact of technology on their ventures. Subsequently, a quantitative survey has been administered to eighty respondents, and the data is analyzed using Structural Equation Modeling (SEM), with Partial Least Squares (PLS) path modeling. The findings from both methodologies are expected to illuminate the positive influence of technological advancements and collaborative networks on digital entrepreneurship within the MENA region. Gaining an understanding of these factors can guide policymakers in fostering innovation in ecosystems and stockholder investments that support collaborative digital ventures in the MENA region.

**Keywords** Internet of things (IoT) · Technology · Digital Entrepreneurship · Innovation · Entrepreneurship ecosystem · MENA Region

## Introduction

Over the span of the last decade, technological advancements have revolutionized collaboration, supply and demand dynamics, product design, resource management, and business standards. Examples of these advancements include the Internet of Things (IoT), social media, mobile services, cloud computing, big data systems, and the growth of robotics. Traditional business strategies have increasingly been

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replaced by digital startups which have integrated up-to-date technologies into their operations. Innovative technological solutions have enabled the development of various forms of entrepreneurship, ranging from digital platforms to novel products and services (von Briel et al., 2018). Digital technologies have also led to dynamic interactions between actors, nurturing entrepreneurship through collective intelligence and collaboration.

The intersection between digital technology and entrepreneurship has paved way for a new entrepreneurial mindset that heavily relies on the mentioned tools. However, notwithstanding this topic's critical importance in today's world, research on how digital entrepreneurship and collaboration tend to influence and reshape the entrepreneurial ecosystem and regulations remains scarce (Farah & Ramadan, 2020). Theoretical frameworks typically integrate digital technologies into entrepreneurial research, thus exploring the entrepreneurial dimensions and testing how digital technologies affect the interactions between the actors that seek any resources from the companies. But the challenge of reaching a unified definition of entrepreneurship in the digital era still remains. As the world is evolving and accepting the digitization of operations, digital transformation and open innovation have impacted various industries, mainly digital ones (Sussan & Acs, 2017). Now, nations' competitiveness centers on their industrial enterprising spirit and their ability to evolve, update, and innovate from time to time. The growth of creative economies features the importance of the role of imaginative individuals creating novel products/services to drive international competitiveness (Nambisan, 2017). Academic work based on technological advancements and entrepreneurship highlights the substantial role of digital entrepreneurship in fueling successful economies. Research shows that digital innovations allow fluid entrepreneurial efforts, and they participate in the digital economy by always giving way to creativity in the work processes. Extant literature suggests that digital entrepreneurship is characterized by openness, affordability, and generativity (Nambisan & Zahra, 2016). Digital entrepreneurial activities are those that are conducted mainly through digital means, with minimal reliance on physical components.

It is also noteworthy that digital entrepreneurship also influences technology to moderate and control factors that are related to risks and uncertainties, thus paving the way for the establishment of successful new ventures. In the recent times, the inclusion of emerging digital technologies into various facets of entrepreneurship has profoundly amended the innate uncertainty within entrepreneurial processes and outcomes, ultimately promoting the overall economic growth. This digitization has disrupted two key assumptions underlying our understanding of entrepreneurial processes and outcomes. On one hand, digital technologies have made entrepreneurial means and consequences less constrained, shifting from the delineated and rigid boundaries, to gradually permeable and adaptable boundaries. Whereas on the other hand, digitization has reduced the predetermined nature of entrepreneurial agency, involving a broader, more diverse, and continuously evolving group of participants, transitioning from a static, focal agent to a more dynamic and collective one with diverse goals, motivations, and capacities. While entrepreneurship research has recognized the growing importance of technology, there is still a need for a more comprehensive understanding of how digital activities directly impact businesses in the

MENA region. Previous research on realm of technology and entrepreneurship has tended to focus on a more general context of advanced technologies, ignoring the specific dynamics of the MENA region (Felicetti et al., 2024).

This study aims to fill the knowledge gap that exists when it comes to digital entrepreneurship in the Middle East and North Africa (MENA) region. Existing research focuses on the relationship between technology and entrepreneurship, but a meagre amount of research specifically investigates the MENA region's unique dynamics. Therefore, for this purpose, this study uses the qualitative and quantitative methods to investigate the impact of technological development and collaborative networks on digital initiatives in the MENA region. The findings from both methodologies are expected to help illuminate the positive influence of technological advancements and collaborative networks on digital entrepreneurship, specifically within the MENA region. Understanding these factors can guide policymakers in fostering innovation specific ecosystems and stockholder investments that support collaborative digital ventures in the MENA region.

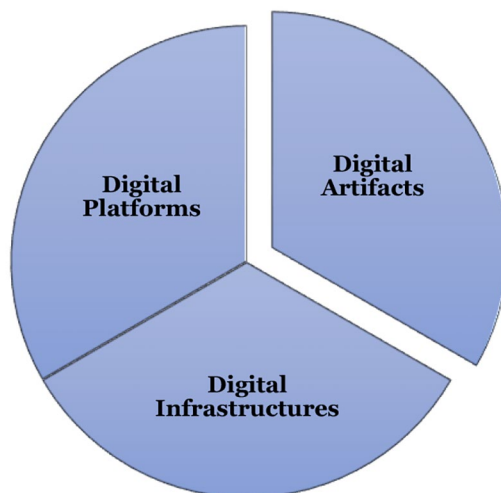
## Literature review

### Digitalization and the entrepreneurial ecosystem

Digital technologies are at the forefront of what is commonly known as the fourth industrial revolution and are driving digital transformation on a global level (European Commission, 2015). These technologies typically facilitate the convergence of computing, communication, content, and human networking. The concept of digital technologies encompasses three interconnected elements that have been presented in Fig. 1.

A digital artifact constitutes of components, applications, or media content that is integrated into new products or services, thus providing specific functionality or

**Fig. 1** Digital Technological Elements  
Reference: Nambisan, 2016



value to the end-users. Notable examples of this include devices such as the Amazon Dash Button and the Nike+ Sensor. Digital artifacts greatly help to extend the capabilities of physical products or services, thus fostering innovation. The collection of digital tools and systems that enable computing, collaboration, and communication is referred to as the digital infrastructure of a venture. Digitalization is, therefore, utilizing such digital infrastructure. Examples include cloud computing services such as Amazon Web Services, to digital prototyping tools like the MIT Fab Central, online communities, crowdsourcing platforms, and crowdfunding systems, such as Amazon Mechanical Turk and Kickstarter (Liu et al., 2024).

Lastly, it must be known that digital platforms are standardized collections of services and architectural frameworks that facilitate hosting complementary offerings, including digital artifacts. Notable examples include Apple's iOS and Mozilla's Firefox browser. Digital platforms also enable real-time matching of diverse demands with personalized offerings, and have played a crucial role in industry transformations, as seen with services like Uber and Airbnb (Sussan & Acs, 2017).

### **Digital entrepreneurship**

Information and digital technology are known to have a diverse impact on entrepreneurship and innovation through intermediaries, business model landscapes, and certain enablers (Zendel et al., 2018). This dynamic has led to the introduction of the digital entrepreneurship concept by applying novel and innovative technologies which mainly include cyber-entrepreneurship. This involves exploiting the technological platforms, and the internet, to smoothly manage managerial operations with customers, partners, or even intermediaries that are dealing through electronic networks. The digital economy achieves advancements through the expansion of digital entrepreneurship, especially via numerous opportunities that are rooted in technologies and digital media operating within a lively business model framework that compromises on transactions, marketing, and operations. Adopting a knowledge-based approach simplifies acquiring, exchanging, and transferring knowledge, ultimately promoting innovation in the approach that businesses decide to implement (Möhlmann & Geissinger, 2018). In addition to this, digital entrepreneurship summarizes how startups employ digital technologies and the involvement of workforce in their entrepreneurial processes (Le Dinh et al., 2018).

### **Digital entrepreneurship ecosystem**

The entrepreneurial ecosystem, including its digital ecosystem, is a dynamic and complex process that includes a group of factors that come into play on different scales in both the digital and physical contexts. This versatile landscape embraces the different stakeholders that engage in activities such as networking. Effective entrepreneurship ecosystems facilitate productive connections among key private entities, including large corporations, innovation led high-growth firms, and micro-enterprises. These ecosystems foster an entrepreneurial culture, and also cultivate new relationships among entrepreneurial individuals, resource providers, and connectors (Hasni et al., 2021). The actors elaborated in the entrepreneurial ecosystem

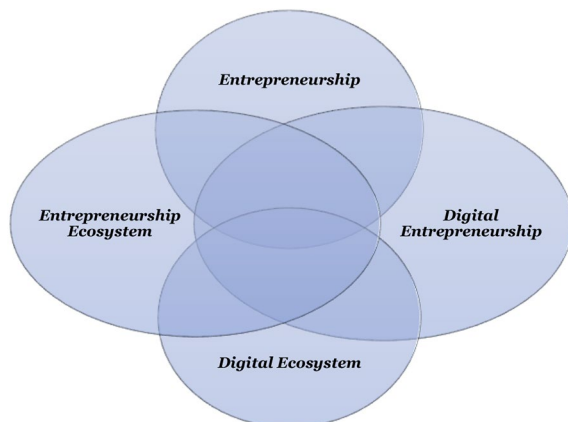
incorporate potential stakeholders, including suppliers, customers, entrepreneurs, social and cultural organizations, policymakers, experts, research centers, schools, universities, large organizations, and talented professionals, and finally, individuals. Entrepreneurial ecosystems arise from the vibrant, institutional interactions that are led by the individuals' entrepreneurial aspirations, abilities, and attitudes. These interactions feed the allocation of resources, in order to create and operate new startups, ideas, and ventures. The architectural design of these ecosystems encompasses a range of factors, such as financial support, market accessibility, human capital availability, market accessibility, professional support services, regulatory framework, an entrepreneurship pervasive culture, and commitment to education, innovation, and research. Also, the contributions above underscore the significance of exploring the position of digital technologies in stimulating and sponsoring the entrepreneurial procedure within ecosystems. This role involves spotting and accessing resources and potential partners, increasing interactions, advancing competencies, and then revealing information (Ramadan et al., 2023).

### The digital entrepreneurship ecosystem blend

Identifying business opportunities and modifying current or untapped resources to create, develop, and implement innovative services and products, is referred to as entrepreneurship. It is a vibrant process driven by change, visionary thoughts, creativity, and passionately implementing innovative ideas to different ventures by visionary individuals (Ramadan et al., 2023). The entrepreneurial ecosystem (presented in Fig. 2) is a collaborative network between the stakeholders encompassing all actors mentioned before, from external potential customers, suppliers, and experts to the investors and the governmental bodies who issue the policies. Also, the entrepreneurship ecosystem is self-organizing, interactive, and flexible in nature. It is characterized by the entrepreneurs' ambitions, ideas, skills, and mindsets in implementing their visionary ideas (Shi et al., 2024).

Digital entrepreneurship is a subgroup of entrepreneurship involving the transformation of physical products or elements into digital platforms or formats, employing

**Fig. 2** Digital Entrepreneurship Ecosystem Blend  
Reference: The Authors



technology and social media tools. It includes the establishment of new digital projects and reviving existing businesses by applying digitalized technology and innovative solutions. Digital ecosystems are flexible, self-organized systems embracing various digital, interconnected technologies. The main aim of such ecosystems is to increase collaboration, innovation, and thus the effectiveness encompassing interactions, technologies, and individuals to shape the ecosystem's behavior (Li et al., 2017). The Digital Entrepreneurship concept is somehow new, making it not clearly defined independently, as of yet. Ideas from the digital and entrepreneurial ecosystem domains are often integrated, forming an interrelated framework. A framework comprises of four key digital concepts: infrastructure governance, user citizenship, entrepreneurship, and the marketplace (Sussan & Acs, 2017).

The 'Digital Entrepreneurial Ecosystem', is defined as the elements that advocate innovative startups, ideas, or opportunities related to digital technologies (Du et al., 2018b). This definition differentiates it from the other entrepreneurial ecosystems on digital platforms, including crowdfunding and e-commerce. The Digital Entrepreneurship Ecosystem was first introduced as a collaborative effort between "digital species", so as to defeat any resource limitation an individual firm may face and accelerate the digital startups' creation. To reach a proper comprehensive Digital Entrepreneurship Ecosystem definition, it is vital to consider individual components, including entrepreneurship ecosystem, digital entrepreneurship, and entrepreneurship, and then incorporate all the definitions in order to understand this multifaceted notion in a logical manner (Felicetti et al., 2024).

### **Digital entrepreneurship ecosystem interpretative framework**

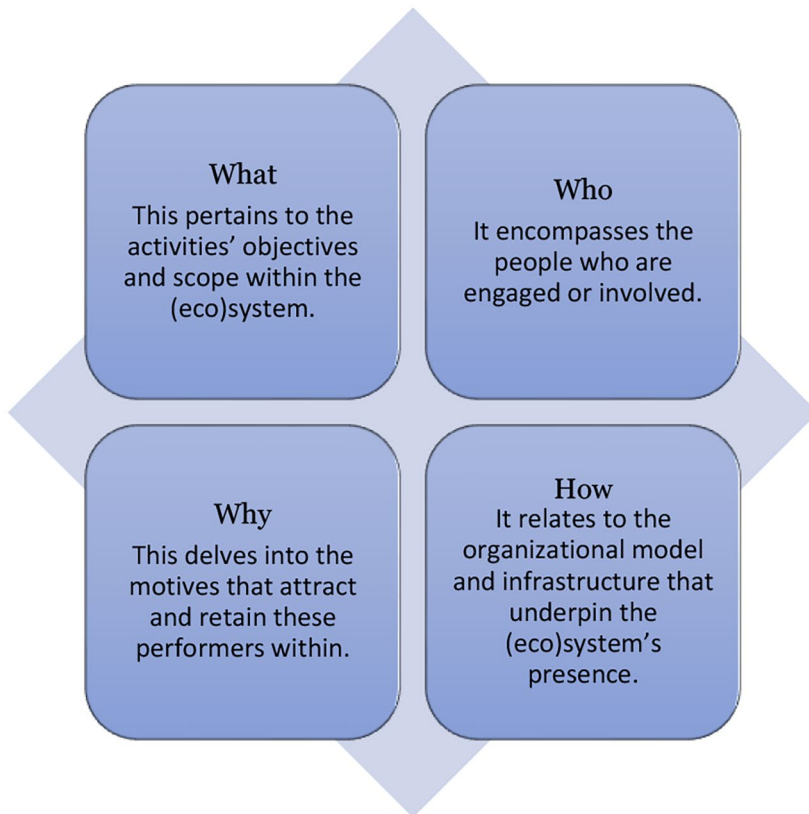
The digital entrepreneurship ecosystem functions in a self-organized manner, without a central controlling entity. Stakeholders act independently, where decisions are collectively reached without the presence of any formal authority. Nevertheless, when considering such a system as a meta-organization, specific design elements shall govern labor organizations and effectively incorporate efforts. The ecosystem resembles a collective intelligence system steered by diverse objectives and drivers of its actors, with massive interconnectedness between them (Du et al., 2018a). Modern technological advancements and universal internet access have led to new forms of collective intelligence that are accelerated by digital infrastructures, redesigning markets, and advocating innovation and entrepreneurship.

Moreover, collective intelligence investigates the way people and computers may demonstrate higher levels of intelligence, as compared to conducting an activity individually. It combines resources and knowledge through interactive processes to reach solutions for complex problems, or address any challenging issues that might arise, exceeding what any person could achieve (Naveed et al., 2021). Collective intelligence takes two forms: localized human-driven and global interactions, both empowered by information technology and digital services, including crowdfunding, user-generated content, ideation, problem-solving platforms, and due diligence tools (Elia et al., 2020).

This paper suggests that a digital entrepreneurship ecosystem can be viewed as a display of collective intelligence systems. It essentially involves self-organized,

interdependent entrepreneurial actors who adopt digital tools to detect technology-driven opportunities and rationalize all phases of the entrepreneurial journey. Two benefits result from these collaborative efforts, including enhancing the transition from idea to venture, and streamlining the production of innovative goods and services (Mrad et al., 2022), whilst incorporating networking and knowledge sharing. A collective intelligence system typically personifies four core “genes” or basic components (Malone et al., 2010). These building blocks (Fig. 3) encompass:

These four genes encapsulate the distinctive attributes and critical characteristics of systems where crowds play a pivotal role, particularly when they respond to open calls, often in web-based environments (Farah et al., 2020). However, this framework can also be applied to situations where crowds and online communities are not taken into account. Taking into consideration the significantly lowered barriers to entry on web-based platforms, as compared to previous years, the key advantages of relying on web-based crowds may be summarized as follows: increased chances to encompass a wide array of probable contributors, greater diversity in their backgrounds and



**Fig. 3** Intelligence system components  
Reference: The authors

geographic origins, heightened rate of recurrence and prosperity of their contributions, boosted simplicity in communication and relationship maintenance, and the swiftness in processing substantial volumes of digitized data. Subsequent sections will delve into the foundational elements of a digital entrepreneurship ecosystem, and explore the influence of “digital” and collective intelligence on digital output, the digital environment, and the hybrid entrepreneurship processes (Neff et al., 2024).

### **The what: digital activities**

The digital entrepreneurship ecosystem can be classified according to the innovation and entrepreneurial objectives it focuses on, encompassing “stand-up” (idea conceptualization), “startup” (venture creation), and “scale-up” (business growth) processes (Autio et al., 2018). Different typologies and elements in the ecosystem are duly recognized, highlighting the digital entrepreneurial opportunities and challenges that may be faced. As a digital-output body, the ecosystem is a hub of various stakeholders collaborating to transform their ideas into successful business models and increase the digital solutions market potential. Intellectual property and data privacy challenges may also be faced throughout the process (Sussan & Acs, 2017). Digital-output ecosystems combine physical modules with digital extensions to construct tailored digital interfaces, services, and products.

As a digital entity, the whole ecosystem benefits from digital technologies through stakeholders’ connections, knowledge sharing, streamlining processes, and effective task coordination (Elia et al., 2020). Virtual collaboration tools help to improve ideas management, while digital databases further patent research, crowdfunding platforms reinforce resource acquisition, and numerous technologies improve the effectiveness of day-to-day procedures.

Digital technologies are effective tools. They reduce coordination costs, increase coordination effectiveness, boost innovation, and tend to stimulate creativity. They foster collective intelligence and authorize collaboration exceeding hierarchies and traditional market-based approaches (Rippa & Secundo, 2018). These ecosystems incorporate various activities and processes, pushing digital technologies to boost creativity, innovation, and collaboration.

### **The who: digital actors**

The entrepreneurial ecosystem has an array of stakeholders and actors who play various roles in attaining the ecosystem’s objectives. According to the extant literature and research, these contributors might be incubators, accelerators, universities, information providers, and professional organizations. In the realm of digital entrepreneurship, actors include banks, business partners, incubators, intellectual property offices, governmental associations, engineers, universities, and industrialists. Roles within the innovation ecosystems can be grouped into leadership, support, direct value creation, and entrepreneurial ecosystem roles (Dedehayir et al., 2018).

The stakeholders’ responsibility to shape and operate ecosystem systems is essential when it comes to the success of digital entrepreneurship. Stakeholder consultation and involvement helps to recognize how the system operates, recognize policy



cases, realign stakeholders, and advance commitment that is grounded on influence and motivation. Digital entrepreneurship frameworks may involve digital user citizenship, social customs, and a digital marketplace figuring digital infrastructure and entrepreneurial agents. Moreover, digital entrepreneurship ecosystems include traditional actors, but introduce a unique “digital entities” category, such as software systems, web applications, and algorithms. These entities are the ones that develop the actual data, accelerate matchmaking between all actors, offer recommendations, and cooperate with individuals to prop up the entrepreneurial processes. They count on the collective intelligence principle to analyze personnel contributions and behavior in a mutual context. In digital-output entrepreneurship ecosystems, the weight is on digital technologies to create new ventures. Yet these ecosystems may also demonstrate digital-environment attributes which integrate various digital bodies (Lungu et al., 2024).

### **The why: digital motivations**

The actors’ motivation in the digital entrepreneurship ecosystem plays an essential role in recognizing their contributions and participation. This aspect explores the reason behind the individuals’ and groups’ engagement in the ecosystem, specifies the required incentives, and details their roles accordingly. Motivational factors, including business opportunities, emotional aspiration, social impact, visibility, fame, and financial benefits, also drive participation in entrepreneurial communities. Stakeholder commitment in the ecosystem is bolstered by understanding these motivations and their potential influence. In the digital entrepreneurship ecosystems, the motivations differ between the output and environment ecosystems. In digital-output ecosystems, organizational motivations tend to focus on developing and marketing new digital solutions (Singh et al., 2024). In contrast, digital-environment ecosystems accommodate a wider range of scenarios and motivations. They may involve socially significant initiatives where intangible motivations, such as influencing social networks, gaining popularity, pursuing emotional aspirations, and achieving fame, become more apparent. These motivations can also be present in business-oriented projects, thus highlighting the complex interplay of motivations in the digital entrepreneurship context (Olan et al., 2024).

### **The how: digital organization**

The final digital entrepreneurship ecosystem dimension involves the norms for organizing players and activities within a structured template that supports the planned activities and evolving self-organized dynamic forces. There are various objectives that are taken into account to guide the organization of a digital entrepreneurship ecosystem. These essentially include task partition and distribution, reward circulation, and the information stream. Key activities encompass category design, specialty, captain allocation, self-selection, value and culture co-creation, physical association, and concentrated conferences. Digital infrastructure governance is also introduced as a concept encompassing coordination, governance, and authority (Li et al., 2017).

A stage-based model of entrepreneurial ecosystem actions, and a simulation of technology entrepreneurship movements tend to provide a vibrant perspective on how the ecosystem runs and operates. From a digital-output perspective, it resembles a traditional one, with individual actors optimizing the transition from idea to venture, and therefore maximizing the digital solution market potential. The fast-paced nature of digital technology requires an efficient establishment of technology development and project establishment processes, often involving outsourcing non-core activities to external contributors. Digital-environment entrepreneurship ecosystems leverage collective intelligence throughout the entrepreneurial procedure, which also includes underlying activities. Digital technology enables the collection of opinions, scenario assessments, and analyzing large participant groups' knowledge and expertise. In this context, the ecosystem functions as a collective intelligence system, ultimately utilizing the collective wisdom of its contributors to assist entrepreneurial decisions and conducts (Tekic et al., 2024).

## The MENA region entrepreneurial ecosystem: challenges and economic growth

The MENA region is progressing into a vibrant center for entrepreneurship and innovation, one that is undergoing continuous growth since the last few decades. The region's size, youthful population, technological accessibility, and the enhancement of its digital economy are the main elements contributing to this phenomenon (Alkasmí et al., 2018). It is noteworthy that the MENA region's environment encourages market scenarios for sustainable development, leading to the establishment of new initiatives and businesses. In the third quarter of 2022, the International Monetary Fund anticipated a 4.95% increase in the MENA region's Gross Domestic Product during the year 2022. This points towards an advancement from the 4.49% achieved in 2021, thus representing a persistent upward development in economic activity, and post-coronavirus recovery. Regardless of this improvement, the MENA region still faces an uneven recovery. It is affected by global economic factors and varying levels of monetary stimulus presented to oil-importing and exporting nations. The region's fundamental emphasis on development and entrepreneurial initiatives revolves around evolving environmental and social sustainability (Ismail et al., 2018). Adding to this, the dominant religion in the area, Islam, employs significant influence over the citizens' societal norms and behaviors (Bastian & Tucci, 2017).

Similar political structures are shared within the MENA region countries, essentially shaped by traditional monarchies, theocracy, and tribalism. Furthermore, crucial social and cultural aspects such as family clans, communism, and confessional groups play central roles in shaping the overall culture of the region (Aljuwaiber, 2021). Back in 2010, the Arab MENA region experienced major economic and political alterations, stimulated by numerous factors such as the Tunisian Revolution. This change extended to the Arab world, remarkably influencing countries like Yemen, Egypt, and Sudan. While most revolutionary movements were peaceful protests, some also escalated to civil wars and armed conflicts. For instance, the events that

took place in Syria and Libya in the past (Bastian & Tucci, 2017) and, lately, in Palestine in the year 2023.

The Arab MENA region exhibits diversity in the economic aspect, with countries like Libya, Algeria, and the Gulf states deemed to be rich in natural resources, while others like Yemen and Tunisia face resource scarcity. According to a World Bank Report, the region's economic circumstances are significantly influenced by oil prices. Nevertheless, a modest improvement in regional economic growth is anticipated, with an average evolution rate of 2.6% projected for the years 2019 and 2020 (Arezki et al., 2018). The economic classification of the MENA region involved categorizing it into three distinct groups; nations with significant oil production, countries deeply interconnected with the global economy and mainly dependent on tourism for both economic growth and employment, and nations grappling with significant challenges due to insufficient economic and social frameworks. Due to the diverse circumstances impacting entrepreneurial initiatives in the region, MENA nations have acknowledged the positive effect of entrepreneurship in reducing their dependency on oil and expanding the dimensions of their sources of income and social structures. Scholars claim that the entrepreneurial activities in the region differ across countries, influenced by their level of economic development and GDP. Applying the Endogenous Growth Theory, it has been recognized that active entrepreneurship plays a vibrant role in fostering economic progression. Other researchers insist that entrepreneurship is essential in this context. A broader perspective sheds light on the existence of a correlation between entrepreneurship, economic growth, innovation, and economic consequences (Neff et al., 2024).

Contrasting with the endogenous growth theory, supporters of the exogenous growth theory hypothesize that any nation's economic development is directly shaped by external factors involving regional activities that contribute to local growth. During the economic challenges confronted in the MENA region, addressing employment and job creation is viewed as a significant concern, mainly in the context of the level of youth specific unemployment. Over the past five years, the Arab youth demographics were described as "the largest, the most well-educated, and the most highly urbanized in the history of the Arab region" (McKee et al., 2017, p.9). A recent UNICEF report published in 2019 emphasized that citizens aged 10 to 24 are nearly one-third of the region's population. Although youth unemployment is a universal issue, it is a phenomenon that remarkably affects the MENA region.

As per the GEM Report for the MENA in 2017, the unemployment rate of female youth (15 to 24 years) in the region is deemed to be around 39%, and 22% for male youth, which is inadequately high for both the genders. Egypt reports a female unemployment rate of 65%, while Yemen and Jordan are hoisted at 55%. This describes a scenario where the region will have one hundred million unemployed youth in the next decade, emphasizing the government's vital need for collective efforts to advance the entrepreneurship sector. Directing the education system and executive training is believed to be the main concern for the region. There is a concentrated effort towards encouraging the incorporation of entrepreneurship education into the educational curriculum at all levels, seeking to invest in the youth by enhancing the necessary skills to initiate their ventures (GEM-MENA, 2017).

The region's perspective on enhancing entrepreneurial activities remains positive despite the challenges of unemployment rates, economic hardships, and political unrest. The entrepreneurial setting in the Arab region shows a focus extends beyond the direct impact on individual states and regional economies. Prominently, within the indications of a fourth industrial revolution, the Gulf Cooperation Council (GCC) has commenced measures to align with this evolving landscape. Saudi Arabia's Vision 2030 demonstrates this initiative, intending to switch outdated economic practices to modern entrepreneurial cultures. Although these efforts are predicted to develop economic practices and advance corporate stability internally, scholars insist that the impact may be restricted to the implemented region, rather than widening to broader geographical areas. The entrepreneurial culture essentially stresses upon the desire to develop entrepreneurial skills for innovative pursuits (Fernandez-Serrano et al., 2018). This mindset offers increased regional economic development contribution, and operational efficiency improvement. The interconnection between economic competitiveness, cultural shifts, and cultural heritage preservation highlights the value of entrepreneurial culture in accelerating markets and influencing competition locally (Fritsch & Wyrwich, 2018).

The argument posits that the influence of entrepreneurial culture starts at a local level and expands to encompass the surrounding regions and countries, essentially combining traditional culture with entrepreneurial concepts for economic upliftment through specific thought processes and behavioral patterns. Entrepreneurs perceive competition and formulate customer interactions. In this regard, there are many unique factors that impact Arab entrepreneurs, distinguishing them from their global counterparts (Tlaiss, 2015). Unlike European entrepreneurial culture, Arab entrepreneurs encounter fewer challenges related to infrastructure and venture capitalists, relying primarily on family and community networks for support. However, challenging specific cultural or social norms presents a significant hurdle, as the Arab region tends to react negatively to innovative approaches stemming from younger entrepreneurs (Badawi et al., 2019). This exceptional entrepreneurial culture sets a dual risk, threatening social and business aspects, mainly in communities conveying concerns about perceived family solidity deficits. Promoting a diverse entrepreneurial agenda also has limited reach, with a lack of complete statistical data on entrepreneurial achievements due to Arab entrepreneurs' unwillingness to share innovations with wider communities (Lungu et al., 2024).

The challenge arises from the fear of being misunderstood by the local and wider communities. The non-existence of genuine data that is available on the dynamics of Arab entrepreneurs poses obstacles for those striving to advance a novel startup agenda opposing the regular community values. This forces many Arab entrepreneurs to reconfigure their cultural approach to tailor to customers' demands worldwide. Limited knowledge of the economic and social dynamics leaves the MENA region residents exposed to a stereotype favoring traditional solutions to permanent issues as the most effective way forward. Young entrepreneurs in the region engage in detailed research and rely on available scientific data rather than making assumptions that could jeopardize their businesses, which fosters positive transformation with time (Tipu et al., 2016). The MENA region's entrepreneurial culture is shaped by a lack of knowledge about how social means impact businesses. Given the mul-

titude of variations across several parts of the region, it can be assumed that local entrepreneurs face encounters due to inadequate resources and knowledge for promoting an entrepreneurial culture echoing every customer's need. Socio-economic challenges further complicate the situation, forcing entrepreneurs in the region to choose between risking their business by catering to a less progressive customer base, or limiting their creativity to align with outdated cultural norms (Baranik et al., 2018). Presenting "foreign" values may lead to disagreements and challenge business sustainability. The MENA region is viewed as an ideal landscape for startup notions and entrepreneurial developments due to the present agendas that can be redesigned as per innovative and novel trends. To succeed, young entrepreneurs must vigorously foster adjustable entrepreneurial cultures based on industry and consumer demographics. Although criticism may not directly influence entrepreneurial success, business leaders in the region should concentrate on boosting individual and societal morale and building businesses capable of surviving various scenarios and circumstances. Regardless of the absence of a common agreement on the ideal entrepreneurial culture, it is realistic to conclude that it should be associated with the dynamics of the modern world (Chabani, 2021).

## Methods

For the purpose of this research, we employed mixed methods, starting with interviews, and adopting a qualitative approach within the interpretive framework, in order to deeply explore entrepreneurs' viewpoints in the MENA region. We aimed to explore the Digital Entrepreneurship Ecosystem interpretations related to startups or businesses. It is grounded in the premise that our reality access, whether socially constructed or given, is mediated by social constructs such as linguistics, perception, and shared meanings (Ravishankar et al., 2013). This part pursues to comprehend the phenomenon by reflecting on it through the lens of the individuals who lived through the experience. It strongly highlights the subjective capabilities and principles of the involved individuals (Walsham, 2006).

The adopted semi-structured interviews were guided by a formal interview protocol and open-ended questions format. This provided flexibility while ensuring consistency across all interviews (Spieth et al., 2019). The study's interview protocol encompassed three main sections:

- a. Demographics.
- b. Focused on technology usage in the businesses, detailing what, who, how, and why, e.g., How did they include digital trends in their businesses, what technological changes influenced their business decisions, why they did this shift, and who was behind the shifting thoughts.
- c. Enabled respondents' open expression, posing complementary investigation to improve comprehension or gain additional understanding of significant details.

Prior to the interviews, the researchers investigated the participants' business tracks by examining their personal LinkedIn profiles and company websites. This allowed

the interviewers to create questions tailored to the interviewed business environments. Additionally, online investigations were conducted to recognize news studies associated with, or written by the interviewees, enriching the understanding of the interview subjects. On an average, each interview took approximately 60 min to complete. Interviews were recorded after obtaining the respondents' consent, with successive verbatim transcription.

The interview data underwent thematic analysis using the NVivo 11 software. The software accelerated efficient data organization, allowing the authors to investigate the code structure scientifically (Atherton & Elsmore, 2007). The analysis adhered to the guidelines provided for developing thematic codes, and followed the thematic analysis procedures (Braun & Clarke, 2006). After immersing ourselves in the data by thoroughly reviewing all the interview transcripts, we generated codes encompassing the entire dataset (detailed in the findings section).

The open-ended interviews encouraged the respondents to express their thoughts and ideas freely and spontaneously. They communicated their experiences regarding the new digitalization era and how they moved forward or started their businesses' insight into the new digitalization trends. The businesses' founders and co-founders who were interviewed had a profound knowledge of the company's lifespan and ways of operation. The authors confirmed that all respondents were decision-makers in their respective organizations and were mainly in the adoption or upgrading operations. The qualitative section is followed by a quantitative approach, which includes a survey of eighty responses, to validate the results and evaluate the impact of technology and collaboration on entrepreneurship.

## Findings and analysis

### Semi-structured interviews

In this research, we have conducted a combination of hybrid and in-person in-depth semi-structured interviews with 13 entrepreneurs in the MENA region, as outlined by (Armstrong et al., 2018). The focus on entrepreneurs in this specified region has helped the authors to better understand the entrepreneurs' experiences within the digital entrepreneurship era. Theoretical sampling was adopted to recognize interviewees from the entrepreneurs' networks in the area. These individuals were chosen based on a specific criterion:

1. must either be founders or co-founders of businesses.
2. must utilize digital technologies in their operations.
3. must have sustained the business success with a positive return on investment (ROI) for over three consecutive years.

The researchers focused on differentiating the sample to reduce potential biases in the data collection and ensure a nuanced comprehension of the phenomenon that is being investigated, thus enhancing the findings' validity (Bouncken et al., 2018; Eisenhardt & Graebner, 2007). The sample mainly involved entrepreneurs engaged in several

**Table 1** Interviews' gender results

Gender	Frequency	Percent
Male	8	61.5
Female	5	38.5
Total	13	100.0

Reference: The authors

**Table 2** Interviews' age groups

Age	Frequency	Percent
25–35	5	38.5
36–46	7	53.8
47–57	1	7.7
Total	13	100.0

technology startups, spanning diverse segments, including virtual reality (VR), aviation services, healthcare, solar system innovations, construction and engineering, environmentally friendly industrial solutions, education and training, organic beauty products, NFT coffee shops, fashion, waste management solutions, and cybersecurity. A snowball sampling technique was employed, where prior interviewees referred to another the six respondents.

### Interviews' descriptive analysis

In the context of our analysis, thirteen respondents were included. We examined the gender distribution within this sample; the results are presented in Table 1. Of these thirteen respondents, eight identified as male, representing 61.5% of the total sample. On the other hand, five of the thirteen respondents identified as female, accounting for 38.5% of the total sample.

The analysis of the data reveals the age distribution within the sample population. Among the respondents, five individuals (38.5% of the total sample) fall within the age range of 25–35 years, representing 38.5% of the valid responses. Most participants, specifically seven respondents, are between 36 and 46 years old, constituting 53.8% of the total sample. In terms of valid percentage, this age group accounts for 53.8% of the respondents. Additionally, one respondent falls within the age bracket of 47–57 years, comprising of 7.7% of the total sample, with the corresponding valid percentage also being 7.7% (Table 2).

The data analysis illustrates the distribution of market experience among a sample population comprising of thirteen respondents. The majority, consisting of twelve respondents (92.3% of the total sample), possess 1 to 10 years of market experience, representing 92.3% of the respondents in terms of valid percentage. In contrast, one respondent (7.7% of the total sample) reports 11 to 20 years of market experience, with a corresponding valid percentage of 7.7% for this experience range (Table 3).

### Linkage between findings and entrepreneurship intelligence system components

When linking our findings with Entrepreneurship Intelligence system components, the main outcomes are as follows:

**Table 3** Years in the market

Years in market	Frequency	Percent
1–10	12	92.3
11–20	1	7.7
Total	13	100.0

### The what: digital activities

Respondents agreed that digital transformation is a necessary revolution that needs to take place inside their businesses, especially those that are over five years old. They knew they could not increase their market share if they failed to align themselves with the new and innovative technologies. The healthcare lady respondent who started her business 17 years ago realized that she had to upgrade the business in order to maintain its place in the market; she said:

*“Even though our company was making a profit, we had to invest in digitalizing all the processes in 2021. We upgraded the software and are working on upgrading the processes that may be developed accordingly.”*

Other respondents almost started as digitalized ones, and were aware that they would achieve success if they prioritized this digitalization matter; for instance, the virtual reality company co-founder said,

*“We are a virtual reality institution, a digitalized one, yet we always invest in researching and keeping all the processes and the software up to date. We can’t ignore that our R&D department is in non-stop action to make sure we are always safe.”*

Moreover, the two respondents who consulted external experts to learn more about the course of action that they must adopt, despite the digitalization trends, were the “Organic Beauty Products” and the “Environmentally Friendly Industrial Solutions,” where they realized the need to start the paradigm shift in their respective organizations. The lady who was representing the Organic Beauty Products stated,

*“We had to replace some of the machines in our factory and upgrade our systems to more secure and accurate ones. We were unaware that such upgrading would increase our ROI that fast.”*

Even though Environmentally Friendly Industrial Solutions was a fully digitalized organization with up-to-date industrial machinery, yet, after they realized that AI solutions were invading the business market rapidly, they had to externally consult experts to enhance their new outputs before hiring an internal AI expert. In this regard, the founder stated,

*“Due to the fast and sharp growth of the new digitalized ideas and tools, we have to hire someone who stays 24/7 alert of all the new ideas and upgrades.”*



*We have to stay on an ongoing increase in our profits; otherwise, we won't compete a year from now".*

### **The who: digital actors**

As per the participants, the whole ecosystem is shifting to a digitalized one, stretching across the external stakeholders to the internal employees as well. They believed that they could not split or exclude any entity in the system that was not making a shift in this direction; otherwise, such entities would not be able to save their place in the whole revolutionary circle. The training company founder expressed that,

*"We couldn't survive the pandemic if we were not open to full digitalization. Our customers who were fully digitalized from the beginning didn't face the same issues as those we had to treat in that aspect. The non-fully digitalized lost at least half a year to recover and recompile again in the market."*

The NFT coffee shop co-founder was surprised as we asked the questions. She believed that their entire business model is based on the concept of digitalization, as their whole ecosystem from the very beginning has been digitalized. In this context she stated:

*"We wouldn't face anyone who does not have the full digitalized concept as a primary one. Usually, people interested in or dealing with the NFTs know the facts behind the metaverse and the full digitalized process. We are a digitalized ecosystem as a whole."*

When talking to the respondents from the education sector, there was a confession that after the Covid-19 pandemic that faced the world, they had to make a shift towards increased digitalization of processes, yet they are still struggling to make the full move. But it is safe to claim that they are in the process of being fully digitalized. In this regard, she said;

*"It was not easy even on us. We are not used to being digital learners as our curriculum has not been renewed for years. Initially, we faced some issues with the learners until the pandemic forced us to be digitalized. Now, we are mixing both the traditional and the fully digitalized way. We believe that in a maximum of 5 years, all our stakeholders will ask for digitalization. We won't be able to survive except in this way."*

### **The why: digital motivations**

All the respondents shared that the initial and basic reason for them to upgrade towards additional digitalization was the need to stay relevant in the market. In this regard, the construction and engineering co-founder said,

*“The first and most important reason was to ensure our market share. We could not play the observers’ role. We knew we would perish one day if we didn’t invest in the new trends.”*

The training company founder believed that they are currently in an incredibly competitive market. He inferred this due to the many requests from their customers to be trained on issues concerning the digitalization in organizational structures and operations, and this led them to address this concern in their efforts to upgrade as well. In this context, he said;

*“In no time, everyone was asking for training concerning new digitalized trends, so we had to learn as well as upgrade our delivery and the platforms we deal with our customers on.”*

The aviation service co-founder stated that, “we already started our company as high-tech, so we are very glad everyone is coming to our zone. The style of our business is the first “why”.

Other respondents’ answers were mostly put forth for more visibility and impact, as the fashion founder said,

*“People are buying fashion on the metaverse, so staying non-digitalized will make us lose all our attractiveness in the market. We started investing in the change to keep our customers’ passion rising.”*

In the Waste Management solution co-founder’s opinion, being always up-to-date increases the customers’ loyalty, so in addition to the monetary benefits they looked forward to in their startup, they also believed that they were more attractive when they reflected a digitally driven direction in their organization; she believed that;

*“People would always love to see us talking and working digitally; this makes us more attractive and increases our sales and thus profits on a longer term.”*

### **The how: digital organization**

The respondents were mainly digitally aware of how to shift or start digital businesses. Almost 5 of them were computer scientists or engineers, yet even as they said, they needed someone to keep them up to date with the new trends in the market, especially after AI has started invading the digital landscape. The Aviation services co-founder said,

*“I’m a computer engineer; yet I graduated 7 years ago where everything developed and changed. Due to the time constraints and the success of our business, we are searching for a prompt engineer to stay onboard.”*

The Environmentally Friendly Industrial Solutions asked their R&D team to save at least one or two days a week to focus on research and find out, in-depth, the best ways to stay afloat with the newest trends in technology, he said:

*“We couldn’t except spare some time for our R&D department’s team to ensure that the know-how and the processes are always clear to the whole team when things change. We cannot waste time on the how process. It shall be known before we even think of the process.”*

The interviews conducted in this study were complemented by a questionnaire analysis designed to validate the research findings. In specific terms, there were six measurement items that were employed to assess the impact of technology, drawing from an investigation that was undertaken previously (Reyna et al., 2018). Furthermore, the study also sought to assess the impact of collaboration on entrepreneurship, employing six measurement items (Olanmi, 2016). In addition to this, the investigation probed into the entrepreneurship variable, encompassing various aspects of entrepreneurial behavior and actions. Six specific measurement items were adopted from Feng and Chen’s study in 2020, to assess this variable. The number of measurement items and variables in this study are summarized in Table 4 for reference.

The study encompassed a total of eighty respondents. The data was analyzed using the Partial Least Squares (PLS) and the Structural Equation Modeling (SEM) approach which is a widely adopted statistical methodology in business research. This methodology examines the relationships between latent constructs and observed variables. Within the PLS study, construct reliability and validity assessment are conditional upon the measurement model, as depicted in Fig. 4, which is essential in assessing the constructs under examination.

Factor loadings in the current study signify the strength of the association between observed variables and latent constructs. They indicate the extent to which a corresponding latent construct can account for variance within the observed variables.  $\lambda$  (lambda) values represent factor loadings, and they are considered satisfactory when surpassing the threshold value of 0.50 (Lee & Peterson, 2000); in this regard, it must be noted that the factor loading values in this study exceed this threshold (Fig. 1). Reliability, a fundamental aspect of the measurement model, is measured by two widely employed metrics in Partial Least Squares (PLS) studies, Cronbach’s alpha, and composite reliability. When evaluating a latent construct, Cronbach’s alpha determines the internal consistency among items, with values normally exceeding 0.70, thus indicating high-reliability levels (Nunnally, 1978). Both Cronbach’s alpha ( $\alpha$ ) and composite reliability values for all constructs surpass the 0.70 thresholds (Table 5), confirming their reliability. Additionally, in order to measure convergent validity, the Average Variance Extracted (AVE) is employed, measuring the variance

**Table 4** Variables and measurement Items

Variables	No. of Items	Sources
Impact of technology	6	Reyna and Meier (2018)
Impact of collaboration	6	Olanmi (2016)
Entrepreneurship	6	Feng and Chen (2020)

Reference: the authors

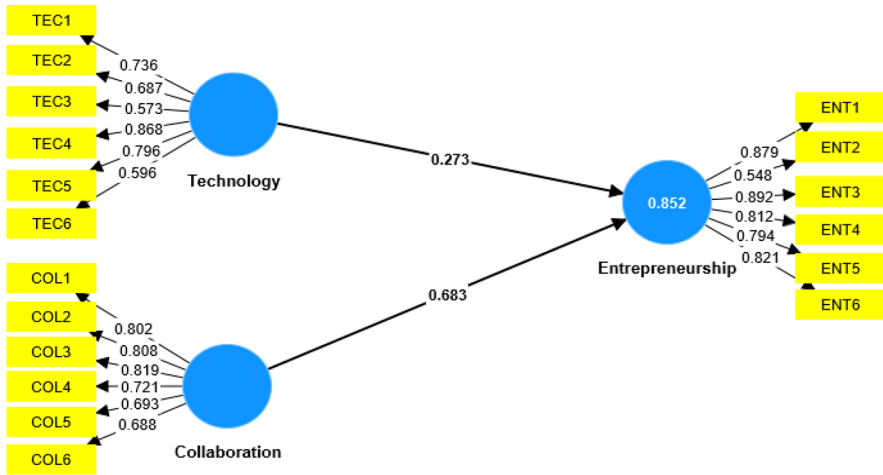


Fig. 4 Structural Equation Model (SEM)

Table 5 Fornell and Larcker's criteria of discriminant validity

Constructs	Collaboration	Entrepreneurship	Technology
Collaboration	0.911		
Entrepreneurship	0.834	0.843	
Technology	0.757	0.799	0.717

proportion captured by a construct's indicators relative to the total variance in the construct. The AVE values should ideally exceed 0.50 to prove convergent validity (Fornell & Larcker, 1981). This study's AVE values surpass the 0.50 benchmark (Table 6). These findings underscore the robustness and validity of the measurement model adopted in this research.

Discriminant validity plays a key role by weighing the distinctiveness of different constructs or variables within a study, confirming that they capture distinctive dimensions. In this study, the authors used the Fornell and Larcker criteria to determine the discriminant validity. This principle compares the square roots of the Average Variance Extracted (AVE) values correlated with each construct against the inter-construct correlations. As per Fornell and Larcker's guidelines (1981), when the square root of a construct's AVE goes beyond the correlations, it satisfies the discriminant validity criteria (Table 5). The study's findings denote that the square roots of the AVE values for all constructs exceed the corresponding inter-construct correlations, thus affirming agreement with the Fornell and Larcker discriminant validity criteria.

## Regression analysis

The hypothesis findings in Table 7 within the PLS (Partial Least Squares) structural model elucidate the interrelations among various constructs. In accordance with the criteria used in this study, a beta ( $\beta$ ) value nearing +1 indicates a robust positive relationship, while a proximity to -1 shows a negative association. The significance of the

**Table 6** Reliability and validity of the variables

Constructs	Items code	Factor loadings	$\alpha$	C.R	AVE
Technology	TEC1	0.736	0.806	0.835	0.514
	TEC2	0.687			
	TEC3	0.573			
	TEC4	0.868			
	TEC5	0.796			
	TEC6	0.596			
Collaboration	COL1	0.802	0.850	0.856	0.573
	COL2	0.808			
	COL3	0.819			
	COL4	0.721			
	COL5	0.693			
	COL6	0.688			
Entrepreneurship	ENT1	0.802	0.882	0.902	0.639
	ENT2	0.808			
	ENT3	0.819			
	ENT4	0.721			
	ENT5	0.693			
	ENT6	0.688			

**Table 7** Hypotheses result

Constructs	$\beta$ -values	Standard deviation	t-values	p-values	Support
Collabo- ration $\diamond$ Entrepre- neurship	0.683	0.092	7.385	0.000	Yes
Technology $\diamond$ Entrepre- neurship	0.273	0.268	2.888	0.004	Yes

Reference: The authors

t-value is determined by comparison to a threshold of 1.96, while the p-value's significance is assessed through comparison to a threshold of 0.05. Notably, the analysis reveals that the relationship between collaboration and entrepreneurship, as denoted by a  $\beta$ -value of 0.683, reflects a notably strong and positive association. Furthermore, the statistical significance of this relationship is substantiated by a t-value of 7.385, and a p-value of 0.000, signifying a highly significant association. Similarly, the second hypothesis positing a positive and meaningful relationship between technology and entrepreneurship is upheld by the  $\beta$ -value of 0.273, accompanied by a t-value of 2.888 and a p-value of 0.004, all indicative of statistical significance, thus supporting the hypothesis.

## Conclusion and policy implications

Several key considerations can characterize a digital entrepreneurship ecosystem:

- It views entrepreneurship as a dynamic process that turns opportunities into innovative solutions and ventures.
- Digital technologies play a vital role, serving as a focal point and the environment where value propositions are created through product development and organizational change.
- Digitization connects entrepreneurial actors, and fosters an environment that is conducive to entrepreneurship, including the emergence of a digital entrepreneurial community.
- It encompasses a system with elements and stakeholders networking through various flows.

Digital technologies operate within a dual role in this ecosystem, portraying the output or objective of the whole entrepreneurial procedure and the context or environment where these processes happen. This leads to two different understandings of the digital entrepreneurship ecosystem, which pertain to the digital output and the digital-environment ecosystem. The digital-output ecosystem implies the collaboration of entrepreneurial actors, including entrepreneurs, investors, incubators, accelerators, and research institutes. These entities collaborate to form digital enterprises that employ digital technologies to construct innovative digital artifacts or services. Silicon Valley illustrates an ecosystem known for hosting technology giants and startups leveraging digital innovation. The digital environment ecosystem practices digital technologies as facilitating structures or adaptable tools to bring together a diverse network of stakeholders from various locations to support startup creation. Digital platforms, like Startup Compete and Google for Startups, empower entrepreneurs to connect, share ideas, access resources, and collaborate throughout their entrepreneurial journey.

Digital technologies influence both the domain of the entrepreneurial process (digital-output ecosystem) and the community or context in which it unfolds (digital-environment ecosystem). While these dimensions often tend to overlap, they can be distinguished in nature as well. Some ecosystems primarily focus on producing digital outputs (e.g., Apple), while others use digital technology to deliver non-digital services (e.g., Uber) while also producing digital outcomes (e.g., apps). In the intersection between these dimensions lies a hybrid space comprising of initiatives and ecosystems encompassing both digital-output and digital-environment aspects. The digital entrepreneurship ecosystem includes living components (actors and agents) and non-living components (digital infrastructure).

Generally, an ecosystem is akin to a “community” comprising living and non-living components interacting as a coherent system. Drawing an analogy between natural and creative ecosystems, this concept can be applied to digital entrepreneurship ecosystems as well, in order to address two key aspects. Firstly, the richness of such ecosystems, as measured by the multitude and diversity of existing “species” or entrepreneurial actors, fosters the aggregation of various perspectives and contributions. This, in turn, creates an open environment where individuals can collaborate and cultivate innovative concepts that may serve as the seeds for future groundbreaking innovations and successful enterprises. Secondly, the interactions and interdependence among these components are geared toward enhancing the probability of

success for ideas and solutions that are under development. Entrepreneurial actors engage with other participants to bolster the prospects of success throughout the entrepreneurial process, taking leverage from and optimizing factors such as market acceptance, social relevance, technological viability, and economic sustainability. These interactions can be explicated regarding various actions or “flows” within the ecosystem.

## Limitations of the study

In exploring the dynamic landscape of digital entrepreneurship in the MENA region, our study delves into the intricate interplay of technology, collaboration, and the evolving business environment. However, it is crucial to acknowledge certain limitations that may influence the interpretation and generalizability of our findings. The limited existing literature on tech startups in the MENA region, challenges in identifying such startups due to economic and political complexities, and the region-specific focus are key aspects shaping the context of our study. Additionally, the rapidly advancing technological landscape and the study’s exclusive concentration on specific factors pose potential constraints. The following points highlight these limitations, contributing to a comprehensive understanding of the boundaries within which our research operates.

- A limited number of studies tackling tech startups and entrepreneurial cases in the MENA region, restricting the available literature on this subject.
- Identifying tech startups in the targeted context proved challenging due to economic, political, and peace related issues. The study’s reliance on eighty respondents may impact the representativeness of the entrepreneurial population in the MENA region.
- The focus on the MENA region may restrict the generalizability of the study’s results to a broader global context. Different regions exhibit diverse economic, cultural, and regulatory landscapes that could affect the applicability of the findings.

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