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Venturing on a double trend

Digital startups for climate action in Mexico

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ABSTRACT

Entrepreneurial ventures that combine sustainability and digital innovation are seen as potential solutions to change the status quo and modern way of doing business while addressing urgent environmental and societal problems, such as the climate crisis. However, there is still a lot to learn about these kinds of enterprises and how they deal with their complexities. This study explores the characteristics of sustainable digital entrepreneurs and reveals seven key challenges for this new kind of entrepreneur in Mexico. The findings further the understanding of sustainable digital entrepreneurship, especially within the context of the global south. Additionally, it provides implications for entrepreneurs, their ecosystems, and policy makers.

KEYWORDS

Sustainable digital entrepreneurship, Digital transformation, Sustainability, Startups, Mexico, Global south

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CONTENTS

1 INTRODUCTION

There are two macro-level, large-scale trends to which every organisation and institution has to adapt, these are digitalisation and sustainability (George et al., 2021). While digitalisation comes with new tools and solutions that are transforming the status quo, from how people make decisions to manufacturing and organising complete sectors, sustainability urges for the incorporation of environmental and social considerations in the preface of a climate crisis and other environmental disasters (Rockström et al., 2009; Steffen et al., 2018). The relationship between these two trends has brought about polarised opinions, some giving the heroic role to digitalisation against the climate crisis (e.g. Birkel & Müller, 2021; Tim et al., 2021), and some urging us not to forget the negative environmental and social impacts of the fast and unreflected adoption of these new technologies (D4S, 2022). For better and for worse, these two trends are leading us to a different world from the one we live in today, and thus it is important to understand how entrepreneurs engage with or even foster them.

Entrepreneurs have been identified as one of the main agents of change for the economy and society (Thiel & Masters, 2014). It is because they participate in different areas of our lives that entrepreneurial literature has seen a rise of different typologies, exemplified by often-used terms such as digital and sustainable entrepreneurship. Each of these entrepreneurial types has particular characteristics and among them different barriers and determinants for success (Chae & Goh, 2020; Baranauskas & Raišienė, 2022). Supporting entrepreneurs in their quest to shape a better future is relevant in today's context as it has been argued that more drastic changes are needed for the achievement of long-term goals, for instance, in making progress towards the sustainable development goals (SDGs) founded by the United Nations. This leads us to question: how are sustainable and digital entrepreneurs different from other types of entrepreneurs, what particular obstacles do they face, and how can they be supported to succeed?

The current study took part in a larger project to assess the digital transformation of countries around the world and its relation to the climate crisis. In this context, differences were also recognized between the global north and south (e.g. Satalkina & Steiner, 2020). Taking the case of Mexico, a leading country in technology within its region, this study presents an explorative and inductive multi-case study, which includes interviews and archival data, as well as a multi-stakeholder dialogue (MSD) with entrepreneurs, investors, and other key representatives of the startup ecosystem. The study expands the knowledge of sustainable digital entrepreneurship as a term that merges both trends; identifies peculiar challenges for this new kind of business endeavours in each of the three core dimensions of its innovation system: the entrepreneur, the entrepreneurial process, and the ecosystem; and provides theoretical, practical and policy implications.

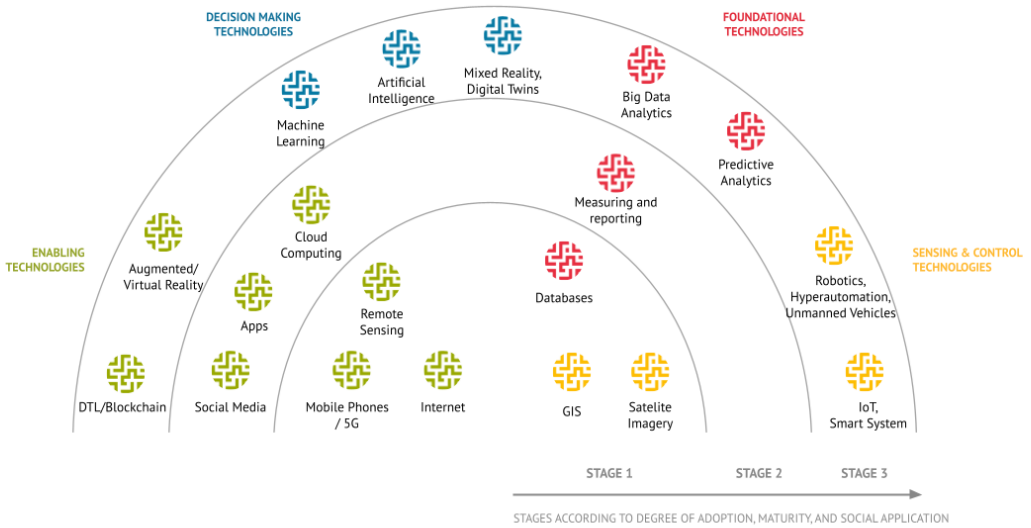
2 THEORETICAL BACKGROUND

In this study I connect literature on digitalisation, sustainability, and entrepreneurship to help explain the challenges that entrepreneurs face as they venture to use digital technologies for climate action. To do so I first look into what digital technologies are and how they can be used to tackle climate change. Second, I describe the role of entrepreneurs in accelerating the adoption of new technologies and the different typologies that arose from their interaction with digitalisation and sustainability. Finally, I look at the innovation system to help us understand the macro- and microenvironment and the conditions that are determinants for sustainable digital entrepreneurship.

2.1 Digital Technologies for Climate Action

Digitalisation involves the application of a wide range of technologies; from widely adopted technologies like the internet, social media, and apps, to frontier technologies that include artificial intelligence (AI), internet of things and robotics (Asian Development Bank, 2021). Graph 1 illustrates a variety of digital technologies through their different stages of adoption as well as in their use. These technologies have made their way into almost every aspect of our daily lives as companies from all industries and sectors have been exploring and exploiting this new kind of innovation (Matt et al., 2015, as cited in Kraus et al., 2019). The collective impact of the application of these technologies has suggested a new industrial revolution (Liao et al., 2017), transforming and disrupting regions, clusters, and global value chains (Hervas-Oliver et al., 2021). In the business context, digital transformation has brought improvements in productivity, sales, and interaction with clients, as well as in innovation and value creation through new business models and products (Matt et al., 2015; (Bouncken et al., 2020, as cited in Kraus et al., 2019). Given their potential, digital technologies have also been explored as potential solutions in the light of the climate and other environmental crises that are threatening human life on the planet (IPCC, 2022).

Graph 1. Types of digital technologies categorised according to stages of adoption and use clusters



Source: Own graph based on Asian Development Bank, 2021, and WEF, 2022a

Digital technologies are playing a key role in addressing the climate crises and promoting sustainable development (George et al., 2021). Their potential should not be underestimated. The World Economic Forum (WEF) has indeed described them as fundamental to facing the world's biggest challenges and the "best shot at saving the planet" (2022b). For example, a previous study of WEF and Accenture showed that scaling digital technologies across industries could reduce up to 20% of CO2 emissions coming from some of the most polluting and challenging sectors in the world (WEF, 2022a). Moreover, they can also support climate action further than in mitigation, and the areas of adaptation, disaster risk management, and environmental sustainability (Asian Development Bank, 2021). For instance, big data and predictive analytics can be used to better assess the demand for food in a world with a growing population; satellite imagery can be used to evaluate the degree of destruction and scope of the required auxiliary services after a disaster; and unmanned vehicles can be used for plastic and waste collection in rivers and oceans. It is because of this range of opportunities that countries around the world have set their agendas for the development and implementation of digital technologies as part of their climate response.

As promising as it may sound, the need for a thoughtful development and implementation of digital technologies should not be understated as their rapid adoption comes with different problems (George et al., 2021; Merrill et al., 2019, as cited in Dwivedi et al., 2022). These problems can be seen throughout the life cycle of digital technologies. First, their production requires continuing mining for raw materials which has negative social and environmental impacts (Asian Development Bank, 2021). Moreover, the use of digital technologies often consumes large amounts of energy. For instance, it is estimated that data centres worldwide were responsible for around 1% of the world's total electricity consumption in 2018 (Masanet et al., 2020). In the same lane, it was reported that bitcoin mining energy consumption was equal to that of countries such as Ireland (O'Dwyer & Malone, 2014, as cited in Dwivedi et al., 2022). Finally, their disposal is also problematic, as e-waste is the fastest-growing waste stream in the world with only 20% of it being

recycled (LeBlanc, 2019). This shows that digital technologies are not only energy consuming but in fact quite material. At the same time and aside from their life cycle, it has been argued that improvements in energy efficiency and eco-innovation, which are benefits often related to digitalisation, cannot deliver the holistic changes necessary to overcome the climate crisis and other grand challenges (Bocken et al., 2014). Therefore, more disruption in the form of social innovation and change in behaviour is still needed.

2.2 Entrepreneurship: Digital and Sustainable

Several studies have shown the importance of entrepreneurs in value creation and in accelerating and facilitating the adoption of innovation (Hull et al., 2007, Pérez-Luño et al., 2011, Chae & Goh, 2020). It is because of their defining characteristic to bring about innovation and change in radical ways, marked by the famous schumpeterian term of "creative destruction" (Schumpeter, 1942), that entrepreneurs are often portrayed as heroes (Dacin et al., 2011; Meyer & Bromley, 2013), who challenge the status quo in their pursuit of their creative vision facing overwhelming resistance (Zhao et al., 2010) and with social implications that go beyond their organisational institutions (Markman et al, 2016; Seelos & Mair, 2005; Thiel & Masters, 2014). This is why attention has been turned to them in a time of multiple transformations and with the urgency for climate action and other societal challenges. Following the digitalisation trend, the term digital entrepreneurship has caught on. As with other terms, there are many definitions in the literature (Kraus et al., 2018). These include the "reconciliation of traditional entrepreneurship with the new way of creating and doing business in the new digital era" (Le Dinh et al., 2018), while also considering the user dimension, including activities that need digital engagement but may not in themselves be digital (Sussan & Acs, 2017). This type of entrepreneurial innovation takes into account digital artefacts, platforms, and infrastructure (Nambisan, 2017).

In the same way, the sustainability trend has brought its own typology of entrepreneurship, which includes social, institutional, sustainable, and green entrepreneurship (George et al., 2021; Ye et al., 2020). These terms have in common the intention and purpose to create positive environmental and societal impacts through their businesses, but differ in the range of issues that they address. This study focuses specifically on entrepreneurs that use digital technologies for climate action. Since climate action is intertwined with other sustainable development goals (Fuso Nerini et al., 2019), I will use the term sustainable entrepreneur throughout the paper. The societal impact of sustainable companies has also grown from "doing less harm" towards a more transformative intention to correct market failures across the economic, social and environmental realms (George et al., 2021). However, starting sustainable companies represents a big challenge as they suffer from market and institutional constraints (Hoogendoorn et al., 2019), and – especially if combined with digital technologies – commonly requires large capital investments (Bjornali & Ellingsen, 2014; Leendertse et al., 2021; Marra et al., 2015). This makes investing in them a high-risk endeavour (de Lange, 2017; Leendertse et al., 2021). Thus, in the top 17 global startup regions, only an average of 8.4% of startups that receive investment contribute to the SDGs (Tiba et al., 2021, as cited in van Rijnsoever, 2022).

It is only recently that studies have looked more at the interaction of sustainability, digitalisation and entrepreneurship. For example, Baranauskas & Raišienė (2022) use the definition of sustainable digital entrepreneurship as "embedding social, environmental, and financial goals and impact into a holistic and

coherent meaning of a sustainable value creation within digital artefacts, platforms, or the ecosystem." This development in literature is interesting as the many types of entrepreneurship often show particular characteristics and pose different challenges (Shahid, 2023). For example, digital entrepreneurs are often less diverse than traditional entrepreneurs, consisting of 89% males compared to 77% respectively (Chae & Goh, 2020). Moreover, Baranauskas & Raišienė (2022) identified key obstacles for digital entrepreneurs such as social dumping and discrimination, a new type of competition, and the incorporation of the sustainability domain. Finally, recent studies have explored the challenges of digital startups in the green tech sectors of specific countries; for instance, Vietnam (Akaki et al., 2023). This suggests that sustainable digital entrepreneurs will also face specific challenges and have their own characteristics.

2.3 Innovation System

In order to understand the role of entrepreneurship in the integration of sustainability and digitalisation so that it becomes transformative, it is necessary to consider the context in which it takes place. One way is to look at its innovation system. Satalkina and Steiner (2020) describe the innovation system as "a metasystem that provides the conditions for entrepreneurial activities and further innovation performance." It takes into account opportunities and limitations of the network of institutions from the macro level, as well as the internal organisation of the company and its relationship system at the micro level. In trying to understand the various effects of digitalisation with respect to different stakeholders and dimensions of the system, the mentioned researchers identified three core dimensions of the innovation system for digital entrepreneurship. The first dimension is the entrepreneur, which is characterised by personal attitudes, competences, decision-making processes, and knowledge, as well as personal outcomes and the consequences of entrepreneurial activity. The second dimension is the entrepreneurial process, which refers to activities related to strategy, operations, and to the organisational management process, as well as resources. Finally, the third dimension relates to the ecosystem and the influence that external infrastructure and institutions have on the development of this kind of entrepreneurship. Combined, these three dimensions have been used to identify the determinants of digital entrepreneurship and its key obstacles (Baranauskas & Raišienė, 2022). In the same way, they can help us understand the context and challenges for sustainable digital entrepreneurs.

3 METHODS

As the term sustainable digital entrepreneurship grows in theoretical and practical importance, this study presents an explorative and inductive multiple-case study (Eisenhardt et al. 2016) to expand the literature in this infant area of research and to support its real-life development by identifying the key challenges that this particular group of entrepreneurs face. The study is based on 11 semi-structured in-depth interviews, a multi-stakeholder dialogue (MSD) with key participants of the startup ecosystem in Mexico, and secondary data, such as online databases, reports, and company documents.

3.1 Research Setting: Mexico and the Global South

The current study was part of a larger project which aimed to address issues relating to digitalisation, particularly in the global south, and with a particular focus on the topics of entrepreneurship, the future of work, and issues of AI in connection with sustainability and climate protection. As much of the research on digitalisation and sustainability came from global north countries (e.g. Satalkina & Steiner, 2020) and context influence the way that people and organisations make sense of grand challenges, such as climate change (Gümüsay et al., 2020), a focus on understanding the current state of sustainable digital entrepreneurship in the global south became crucial to support sustainable digitalisation that is appropriate to local conditions.

Mexico has become an important hub for startups in Latin America. It is the second-largest startup market in the region after Brazil, and the key place for entering and expanding among Spanish-speaking countries (PwC, 2021). Moreover, its geographical proximity to the United States and Canada as well as favourable trade agreements makes for potential expansion to the north. With over 130 million people and the second-largest GDP in the Latin America and Caribbean region (IMF, 2022), it is also one of the largest markets in the world. Due to these factors, it has attracted many forms of private funding from local and international venture capital funds, family offices, and corporations.

In environmental terms, the country faces big challenges. Mexico is the second biggest emitter of greenhouse gases in Latin America and its economy is highly dependent on the oil industry. At the same time, it already suffers from worsened draughts, scarcity of clean water, air pollution in big cities, and rural deforestation and erosion (Muno et al., 2022). In the face of this situation, the national government has aligned with global efforts to address climate change and other environmental problems (INECC & SEMARNAT, 2022). With a growing startup ecosystem and a commitment to sustainable development, Mexico constitutes a good case for analysing the development of sustainable digital entrepreneurship in the global south.

3.2 Data Collection and Analysis

Data were collected in three ways. First, in-depth and semi-structured interviews with 11 entrepreneurs and key investors were conducted. To identify them, the researcher conducted a mapping for digital startups that address climate action through their products and services. This included digital solutions for climate change mitigation and adaptation, disaster risk management, and environmental sustainability, as described in section 2.1. Online databases, such as startupblink.com and crunchbase.com, and highlighted cases in the media and reports were used. The initial mapping showed a small presence of sustainable digital startups in Mexico. The interviews were complemented with archive material, such as company presentations, website information and social media posts. The mentioned documentary data forms part of the second data collection method. The interviews started with questions on the technologies used, the purpose of the company, and the background of the entrepreneurs. This was then followed by a historical recount of the trajectory of the company, in which it was attempted to identify the key challenges faced by the entrepreneurs throughout the conception and life of their startup. The investors were asked for an overview of the companies that are supported or have sought financing from them, their way of evaluating

and matching startups, as well as to comment on the state of the entire ecosystem. An overview of the interviewees is presented in table 1.

Table 1. Overview of interviewees

	Entrepreneurial venture description	Interviewee(s) position	Industry
1	AI for advanced nature analytics and risk management	Founder	Agriculture
2	Technology transfer across small agriculture producers	Founder	Agriculture
3	AI and big data for crop preventing and regenerative monitoring	Founder	Agriculture
4	AI and big data for real-time monitoring and decision making	Founder	Agriculture
5	Cloud base platform for monitoring carbon footprint	Founder	Energy
6	App for courier services using the sharing economy	Founder	Transportation
7	App for short and long-distance travel using the sharing economy	Founder	Transportation
8	Online platform using AI to recommend circular economy purchases	Founder	Waste
9	App for sorting and collecting waste in communities, schools, and businesses	Founders	Waste
10	Venture capital fund	Investor	Finance
11	Family office	Investor	Impact finance

Third, the study also draws on the insights of a MSD in Mexico City, in which 13 members of the digital sustainability ecosystem of the country came together and discussed the challenges of digital entrepreneurship for climate action. These stakeholders came from the government, academia, the private sector, and civil society. This additional method was chosen as it was wanted to create a connection between theory and practice (Helbig et al., 2021). In this way, the MSD helped to further describe the ecosystem and challenges as well as to confirm previous assumptions and assessments. The discussion followed a presentation of this study's preliminary results, and for a more organised debate, the stakeholders were divided into two groups. The first one addressed economic and institutional challenges and the second

one social and technological challenges. Notes of these discussions were taken and added to the data collection. An overview of the MSD participants is presented in table 2. Interviewees and MSD participants are mentioned as "participants" throughout the study.

Table 2. Overview of MSD participants

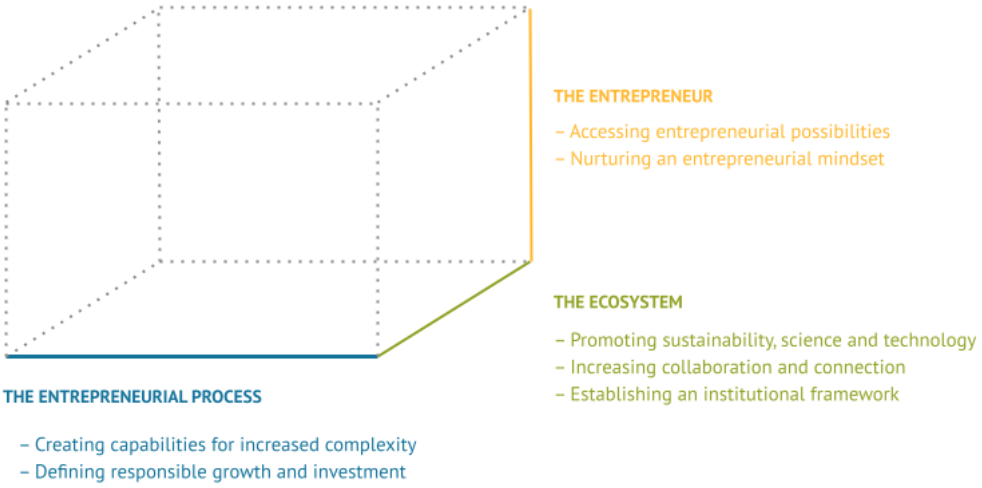
	Representing organisation description	Participant position	Type
1	Professor of environmental engineering and sustainability	Professor	Academia
2	Student of environmental engineering and sustainability	PhD candidate	Academia
3	Social enterprise using digital technologies to make families more economically resilient	Consultant	Non-profit organisation
4	Consulting firm for sustainable economy and finance	Consultant	Private sector
5	Consulting firm for sustainable economy and finance	Consultant	Private sector
6	Digitalisation services for public administration offices	Executive manager	Startup
7	Research institution for technology	Researcher	Support organisation
8	Research institution for technology	Researcher	Support organisation
9	Action tank promoting the responsible use of technology in Latin America	Coordinator	Support organisation
10	Action tank promoting the responsible use of technology in Latin America	Marketing and communications	Support organisation
11	Centre focusing on supporting the digital transformation of Mexico	Technical adviser	Support organisation
12	Centre focusing on supporting the digital transformation of Mexico	Coordinator	Support organisation
13	Regional centre focusing on clean technology and green entrepreneurship	Board member	Support organisation

The data analysis involved a formal coding of the data based on grounded theory to identify the main relevant topics (Strauss, 1987; Corbin & Strauss, 1990). Since the literature is still scarce on digital sustainability (Kraus et al., 2018), and the global south remains very underrepresented (Satalkina & Steiner, 2020), this study attempts to illustrate the key challenges that entrepreneurs in this sector and region face, and through that explore specific characteristics of this kind of entrepreneurship. To this end, the research was guided by recent studies on digital entrepreneurship by Satalkina and Steiner (2020) and Baranauskas and Raišienė (2022) and the three core dimensions of the innovation system as described by them. These dimensions correspond to the entrepreneur, the entrepreneurial process, and its relevant ecosystem as mentioned in section 2.3. The use of this schema provides structure to the data analysis and findings, and, at the same time, knowing where the challenges lie within the innovation system can help practitioners guide efforts to address them.

4. FINDINGS

The analysis revealed the following challenges for sustainable digital entrepreneurs in Mexico through the three core dimensions of their innovation system, as identified by Satalkina and Steiner (2020).

Graph 2. Key challenges for sustainable digital entrepreneurship in Mexico and their dimensions in the innovation system



Source: Own graph

4.1 The Entrepreneur

Accessing entrepreneurial possibilities

The study reveals a high concern with who can become an entrepreneur in Mexico in two categories:

access to capital and cultural as well as gender biases. First, participants mentioned that in Mexico it is important to come from a stable and high socio-economic background to start a company. Indeed, many of the founders of the startups analysed pivoted to sustainable digital ventures from a related existing company. Personal access to capital matters due to the high upfront costs and professional specialisation needed to create digital and sustainable solutions. Without the financial support of external organisations and institutions, it is very unlikely that people with different socioeconomic backgrounds will join this ecosystem. Second, the study finds that women and minorities are underrepresented in the startup scene. In this regard, it was mentioned that certain communities still hold patriarchal characteristics, where a woman who undertakes an entrepreneurial project will face social criticism and often hardship in balancing the tasks expected from her with her actual personal interests and endeavours. Both of these categories are actually related, as women and minorities have less access to financial resources and services (e.g. Rodríguez, 2021). Moreover, in a country with high inequality as Mexico (ranked 25 worldwide as it can be seen in World Bank Data, 2020) it is not uncommon for increasing economic opportunities to benefit those at the top end of the socioeconomic ladder.

Nurturing an entrepreneurial mindset

The discrepancy between who gets to start a business or not is also related to the clash of the prominent entrepreneurial culture with a precarious reality and mindset. One of the interviewed entrepreneurs, who mentors young people in rural areas, described that aspiring entrepreneurs tend to rather think small but safe than empower themselves to take a risk. It is part of the financial reality to be prudent and it is well respected to get a fixed job position at an established company or organisation. In certain places taking risks can even be considered as being arrogant and overbearing. Moreover, participants reflected that through their entrepreneurial journeys, it has been challenging to navigate career and salary expectations as well as family relations. Therefore, the study identifies the challenge to cope with these established cultural rules and continue to develop an entrepreneurial mindset that is ready for uncertainty and can accept failure for the financial, career, psychic, family and social risks associated with it (Kuratko et al., 2021). Just as the innovation system is tied together, an entrepreneurial mindset can only be built up around certain support from the ecosystem, as it will be discussed in further sections.

4.2 The Entrepreneurial Process

Creating capabilities for increased complexity

Starting and growing a business is in general associated with numerous challenges such as limited resources, affording and finding the right team, and other managerial and strategic issues. The technology component adds other challenges such as high entry costs in different sectors, the training and acceptance of digital technologies, and the need for digital facilities and infrastructure (Satalkina & Steiner, 2020). The climate action and the sustainability component present additional challenges to entrepreneurs. For instance, the study's data shows that new products and services are perceived to have to be first and foremost economically sensible for customers to have a chance in the market. It has been described by participants that the portion of people who are willing to pay more for ecological and social benefits is very small, and incorporating principles such as circularity does not guarantee revenues or savings. Nonetheless, entrepreneurs have innovated and changed their business models, for example, by targeting their products

and services to larger institutions with more at stake, either in terms of risk management or market development. In this intricate market with constantly changing demands and expectations, it can be easily assumed that the role of an entrepreneur is to find solutions amid such challenges; however, the degree of expertise required to manage both technological and ecological factors has increased the level of complexity and skills required and in turn has deterred entrepreneurs from these kinds of ventures.

Defining responsible growth and investment

Digital startups in particular have been linked to fast growth and geographical expansion. It is so with the case of unicorns, companies with high valuations driven by new technologies and business models on the premise that they will become highly profitable sometime in the future (Bock & Hackober, 2020). This growth, in turn, is something to be cautious of because it often means higher failure risks and added complexities for entrepreneurs as it lacks structure and solid standards (Giones & Brem, 2017). At the same time, digital technologies need to meet environmental and social requirements that are currently not present. For example, the inclusion of life cycle assessments and regional systems for e-waste management are important for the environment but not yet widely available in Mexico. Moreover, products that address environmental and social problems themselves face slower adoption patterns as it has been described by the participants that the market does not receive them easily yet. Participants also described how entrepreneurs are looking to satisfy the expectations of their investors throughout the life of their companies, and if there is not a good match from the start it can often lead to disagreements even on the strategy and purpose of the company. Combined with the associated challenges of finding and retaining investment (e.g. PwC, 2021[1]), this situation gives a lot of leverage to investors. Therefore, it is important for investors to integrate environmental and social bottom lines into their evaluation criteria and use this to create new success factors for their investments.

4.3 The Ecosystem

Promoting sustainability, science and technology

While the focus on sustainability, science and technology makes its way around governmental policies, academia and higher levels of management, the same engagement hasn't caught up across the population. The interviewees and MSD participants showed big concerns for reaching the amount of highly skilled and experienced professionals in this hybrid sector (and even independently) that is required for the desired digital and sustainable transformation. For instance, even though fintech (financial technologies) represents one of the larger shares of startups in Mexico, participants have described higher expertise in "fin" compared to "tech". This scarcity of talent and the lack of knowledge crossover between the two fields could explain why there are very few startups using digital technologies for climate action and sustainability in Mexico. Developing countries in a large part have been challenged by the lack of professionals and shortage of university graduates, in particular around science, technology, engineering and mathematics as well as those with environmentally sustainable skills (Ye et al., 2020). Moreover, the general awareness of these

[1] The report shows that even though investment in Mexico has grown in recent years, most startups rely heavily on their family, friends, and own investment even after three years in operation.

sectors is also important from the market perspective, as it has also been described by entrepreneurs that they face challenges convincing and building trust with clients around their technologies and proving the importance of sustainability, for instance, in reducing their environmental footprint.

Increasing collaboration and connection

The startup ecosystem in Mexico has been described as growing as it becomes one of the main hubs in its region. This has not only brought different kinds of investment but also other intermediaries and entrepreneurial support organisations, such as accelerators, incubators and associations. However, the challenge remains in connecting these players and promoting their collaboration. For instance, participants described the importance of mentors and investors connecting entrepreneurs with potential clients, and how that can sometimes be more valuable than the investment itself. The importance of networking extends to other entities along the value chain that can help build better and more efficient solutions. This is particularly important for digital technologies, as they often require the participation of multiple players, as digital innovations go beyond company-level boundaries, requiring the formation of digital ecosystems (Satalkina & Steiner, 2020). Similarly, it was also mentioned that sustainable and digital startups would benefit from collaborations with universities and research institutions as they can be key to the development of these technologies as well as the databases that they often require.

Establishing an institutional framework

The formalisation of an active ecosystem is important to strengthen the work of each of its members. The analysis revealed that even though the digital and sustainable startup ecosystem has been growing, their parts often act separately. Among some of the gaps identified by participants are the need to include education and professional training for these new economies, endorsements and legal support to emerging sectors, and investments in the infrastructure required for digital technologies to be deployed as well as circular economy systems. The role of the government is important in this regard, because there is a need for a clear national plan that includes digital and sustainable transformations and bridges across them to support each other as well as the national goals. Moreover, while Mexico used to have a public institution dedicated to entrepreneurship (National Institute of the Entrepreneur, or INADEM for its Spanish acronym), it was reportedly closed in 2019 (PwC, 2021). Since then, the task to organise has been carried out informally by other organisations in the ecosystem. Surprisingly, the number of startups and investments are reported to have increased during the last few years (PwC, 2021). The role of corporations in providing technology and mentorship as well as the financial backup of the private sector is worth emphasising in reaching this outcome. Still, the articulation of a plan that integrates these important players and brings back the participation of the government is needed for the right digital and sustainable transformation of Mexico.

5. IMPLICATIONS

5.1 Implications for Theory

Digital sustainability merges two powerful trends: sustainability and digitalisation (Stuermer et al., 2017). Although scholars and practitioners have introduced the term digital sustainability, literature on this topic remains scarce (Kraus et al., 2018). In this context, this research has theoretical implications which help us understand the role of entrepreneurship in its innovation system and define further areas of research. First, it supports the need to study this particular type of entrepreneurship because it presents its own characteristics and challenges (Chae & Goh, 2020; Baranauskas & Raišienė, 2022). While some of the challenges might look similar to traditional ones, the increased complexity identified in the study as well as the paradoxical nature of digital sustainability often described in the literature (Hellemans et al., 2022) leads to more complex challenges and potentially different effects. Second, studying sustainable digital entrepreneurship in the context of the global south provides further differentiation. The socio-economic situation of entrepreneurs is highly important to take into consideration as well as the larger digital divide and vulnerability to climate change that is often associated with these areas. This shows the importance of understanding geographical clusters and poses the question if some of the current identified promises or perils of digital sustainability (e.g. Siebold et al., 2022) might be the same in different regions. This paper took the case of Mexico because of its importance in the Latin American region; however, while the region displays common characteristics, the data presented in this study also suggest that country-specific information might be relevant. Furthermore, in times when organisational resilience is of high academic interest (Hillmann & Guenther, 2021; Chen et al., 2021), this study shows that we could learn from (sustainable digital) entrepreneurs in this region, as they overcome challenges and accomplish goals amid big social, economic and institutional constraints. Finally, as more organisations are turning toward and addressing societal grand challenges (Gümüsay et al., 2022), this research gives insights into the challenges that might be faced by these organisations in implementing digital and sustainable solutions in the global south.

5.2 Implications for Entrepreneurs and Support Organizations

The current study has several practical implications for members of the digital sustainability ecosystem in Mexico. First, there must be an active focus to include more people with different backgrounds in the ecosystem. The individual entrepreneur stands at the centre of the entrepreneurial process as a key agent, where the interplay of biological, psychological, and context-related factors have an impact on the outcome of their ventures and the types of solutions they put forward (Obschonka & Stuetzer, 2017; Ozkazanc-Pan, 2022). Therefore, the identity of the entrepreneur matters for the diversity of ideas and solutions. The need to include people with diverse demographic and cultural backgrounds becomes an important challenge as different groups are affected differently by climate change and other grand challenges and sensible solutions to these problems might only come from within these groups. At the same time, it has been warned that digitalisation may become a source of new inequalities (Satalkina & Steiner, 2020), and the global south is already characterised by social, cultural and institutional gaps, resource restrictions and a present digital divide that makes this a compelling social concern to address. Second, the strengthening of the ecosystem and its strategic decisions are important. Entrepreneurial support organisations, such as incubators, accelerators, and venture builders can accelerate startups' success (e.g. van Rijnsoever, 2020). This is particularly important when startups suffer from market constraints, as it is in the case of sustainability, or are strongly technology-based (van Rijnsoever, 2022). The continuous improvement of these organisations

through new partnerships and resources as well as the collaboration among them will also reverberate to sustainable digital startups and their solutions. At the same time, support organisations face the challenge of directing resources and increasing the number of digital startups for climate action. Van Rijnsoever (2022) proposes admission regimes, that is including sustainable development as an additional selection criterion, as the most effective way to overcome the lack of sustainable digital startups. Finally, a new mindset that integrates people's attitude towards entrepreneurship, support throughout tough times, and new ideas and measures of success for all members of the ecosystem are needed – this might in turn shrink the paradoxes associated with digital sustainability.

5.3 Implications for Policymakers

Policymakers can promote the development of sustainable digital entrepreneurship in two ways. First, they should create conditions that benefit the disadvantaged sustainable digital startups against non-sustainable or "traditional" startups. In this regard, the data in this paper confirm challenges from other studies. For example, sustainable startups operate in imperfect or failing markets, in which environmental and social values are insufficiently accounted for in the prices of goods and services (Hoogendoorn et al., 2019; Pinkse & Groot, 2015; as cited in van Rijnsoever, 2022). Moreover, consumers in countries such as Mexico cannot afford the higher prices often associated with sustainable products (Li & Zhong, 2017; Tiba et al., 2021), and in many cases, there are higher costs and longer development times when working with complex digital technologies. Finally, there are often regulatory difficulties in digital sectors such as in the sharing economy, gig economy, and fintech (van Rijnsoever, 2022). It is because of these constraints that digital and sustainable startups often rely on policy support (Ye et al., 2020). Therefore, it is critical for Mexico and other countries in the region to deploy strategies that merge these trends and to incorporate entrepreneurship as an agent in these transformations. Creating these conditions can take place in different forms, for instance creating market conditions that would favour certain business models (van Rijnsoever, 2022). Even though the Mexican startup ecosystem grew after the closing down of INADEM, these insights suggest that the ecosystem could grow even further with certain policy interventions. Second, educational and training institutions outside of the startup ecosystem are also responsible for shaping the perceptions of sustainable entrepreneurship (Urban, 2013), this can also apply to other sciences and fields necessary to build a proper digital sustainability ecosystem. Therefore, educators play an important role in making digital sustainability an attractive career choice (Urban & Kujinga, 2017), and at the same time in creating the awareness needed to grow this market. Therefore, education policies combined with other financial and institutional policies that support entrepreneurs are needed.

6. CONCLUSION

The world agendas are set on digitalisation and sustainability, but how to rightfully merge both trends requires creativity and innovation. As the business context becomes more complex and grand challenges more pressing, a theoretical and practical look into sustainable digital entrepreneurship and its innovation

system might help find solutions. In this study, I present seven key challenges to this new kind of entrepreneur within the Mexican context: accessing entrepreneurial possibilities, nurturing an entrepreneurial mindset, creating capabilities for increased complexity, defining responsible growth and investment, promoting sustainability, science and technology, increasing collaboration and connection, and establishing an institutional framework. Entrepreneurs might take a lead role in this transformation. Their success, however, requires the active participation of the whole startup ecosystem as well as endorsements from governments and their influence in other parts of life.

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