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**The interactions of entrepreneurial attitudes, abilities and aspirations in the (twin) environmental and digital transitions? A dynamic panel data approach**

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# **The interactions of entrepreneurial attitudes, abilities and aspirations in the (twin) environmental and digital transitions? A dynamic panel data approach**

## **Abstract**

Given the challenges faced by companies and society in general in terms of mitigating the effects of climate change and digitalisation, fostering and supporting digital and sustainable entrepreneurship represents a fundamental goal. Our research seeks to study the impact of national entrepreneurship systems (NESs) on what is known as the twin transition. Through recourse to dynamic panel econometric techniques applied to various databases (Eurostat, FAO, GEM, UN, and World Bank), we were able to evaluate the effect of the entrepreneurial attitudes, abilities and aspirations, and components of NESs, on the twin transition (digital and environmental). Globally, our results stand out for the positive interactions established by the entrepreneurial attitudes, abilities and aspirations, as pillars of NESs, with the digital and environmental transitions. Furthermore, the level of national economic development returns a positive moderating effect on the relationship between the NES components and the twin transitions.

**Keywords:** Twin transitions; National systems of entrepreneurship; Sustainability; Digital; Attitudes, abilities; aspirations.

## **1. Introduction**

The benefits of entrepreneurship for society and the economy have been consensually studied. Entrepreneurs are "agents of creative destruction" (Schumpeter, 1934, 1942) who play a crucial role in economic development, and entrepreneurship is generally responsible for job creation (Fernandes and Ferreira, 2014), innovation (Ferreira et al., 2016; Peres-Ortiz et al., 2018), productivity (van Praag, 2007) as well as facilitating technology and knowledge transfer from research to industry (Acs et al., 2009; Plummer and Acs, 2012; Urbano et al., 2019).

Nowadays, another challenge of entrepreneurship is its contribution to achieving two important transitions: environmental and digital transitions (twin transitions) (Youssef et al., 2018; Fernandes et al., 2021). In the last 20 years, the literature on the

relationship between environmental transition and entrepreneurship has highlighted some prominence (Wheeler et al., 2005; Seng et al., 2007; Hall et al., 2010). The study of this relationship is so important that several authors argue that entrepreneurship should be a solution rather than a cause of environmental degradation (Hall et al., 2010; York & Venkataraman, 2010; Dhahri & Omri, 2018). This path is not only advocated by academics but is also applauded by the European Union's Strategy 2030.

The relationship between entrepreneurship and the digital transition is no less observable at the level of the various investigations. The most diverse industries and markets have been transforming their traditional business models into new models adapted to the digital challenges (Zaheer et al. 2019). This transformation, which simultaneously constitutes a challenge, is essentially due to the entrepreneurial action that enables the use of digital technologies and that allows us to state that we are thus facing a new revolution, a digital revolution (Kraus et al., 2019; Caputo et al., 2021).

Being a research field on the rise, and relatively recent, the relationship between entrepreneurship and twin transitions faces "growing pains", which are characteristics that translate into a dynamic of terminologies and emerging vocabulary (internet entrepreneurship; cyber entrepreneurship; digital entrepreneurship; sustainable business systems, sustainable entrepreneurial ecosystems, among others) that several times hinder academic research (Matlay & Westhead, 2005; Zaheer, et al. 2019).

Regarding digital transformation, several authors argue that there is little clarity or consensus on the purpose, nature and boundaries of digital entrepreneurship (Matlay & Westhead, 2005; Davidsson & Gordon, 2009; Zaheer et al. 2019). Also, Dimov (2016) argues that research does not always go in sync with practice; thus, entrepreneurship and twin transitions should be considered together to ensure the future development of the whole society. When we observe the research in this area, we verify that in the last decade, there has been a trigger in the interest for alternative economic systems that allow a balance of environmental concerns while aiming at the increase of financial and social results (Daly and Farley, 2011; Neumeyer & Santos, 2018). However, various researchers have been faced with difficulty measuring entrepreneurship at the national level (Reynolds et al., 2005; Audretsch, 2007; Acs et al. 2014). Acs et al. (2014) made a key contribution to addressing this difficulty by creating the National Systems of Entrepreneurship (NSE), which allows entrepreneurship to be observed at the national level and in a systemic way.

Given the practical lack of studies that relate entrepreneurship (measured at the national level) with environmental and digital transition (twin transitions), it seems relevant to contribute to filling this gap in the literature. Thus, this research examines the relationship between NSE and twin transitions. To this end, to various databases (Eurostat, FAO, GEM, UN, and World Bank), and using dynamic panel econometric techniques, it was possible to assess the effect of NSE entrepreneurial attitudes, skills and aspirations on digital and environmental (twin) transitions.

Our study leads to several contributions. First, we contribute to understanding the link between NSEs and twin transitions. We achieve this by identifying and studying an important but underdeveloped simultaneous interaction between digital and environmental transitions and national entrepreneurship. Our theory suggests that entrepreneurial attitudes, skills and aspirations positively impact twin transitions. We add important knowledge to the sparse literature concerning the intersection between NSE and twin transitions. Second, we add to the emerging stock of knowledge on twin transitions to investigate NSEs.

To our knowledge, this is the first study to examine the impact of NSE on twin transitions in a dynamic panel data approach. Our theory-based arguments suggest that associating a model that measures national-level entrepreneurship and environmental and digital transitions positively affects the achievement of the two (twin transitions).

Recently, scholars have called for research on the impact of entrepreneurship on types of transitions, particularly digital and environmental transitions (Matlay & Westhead, 2005; Zaheer et al., 2019; Tiba et al., 2020; Raposo et al., 2021). Our study represents an important effort in this direction. Thirdly we stress that managers, entrepreneurs and politicians should understand that entrepreneurship is a systemic phenomenon and that it is in this system that its impact and greatest contribution to achieving both the digital and environmental transition should be seen.

## **2. Theoretical background and hypotheses**

Despite Schumpeter (1934) having defended the role of entrepreneurship as a function of introducing new dimensions to the economy, the most diverse researchers have only concentrated their research at the level of the individual and new companies, broadly

ignoring any consideration of the restrictions and results at the system level (Shane and Venkataraman, 2000; McMullen and Shepherd, 2006; Autio et al., 2014).

Given the duality of analysis on entrepreneurship, and how researchers have demonstrated a certain inability to jointly consider the various facets of this phenomenon, Acs et al (2014) proposed a means of resolving this “institutions x individual” dilemma by approaching the role of the entrepreneur not only as regulators of opportunities and personal considerations as regards the viability and appropriateness for entrepreneurial actions but also as regulators of the results of entrepreneurial actions.

From the systemic perspective, Acs et al (2014) emphasise the aspect of mobilising resources for entrepreneurial actions through NESs thereby stressing the interactions between individuals and their institutional contexts in the production, the regulation and the results of entrepreneurial actions. These authors state that any NES definition needs to incorporate how entrepreneurship represents individual behaviours that mobilise resources for seeking out opportunities through launching new companies. Such behaviours arise from complex interactions at the population level involving entrepreneurial attitudes, aspirations and capacities while also not overlooking how they take place within a multifaceted economic, social and institutional context. Through the allocation of resources for efficient purposes, this context leads to the respective level of economic performance.

## **2.1. Entrepreneurial attitudes and the twin transitions**

It is now common knowledge that to be able to manage the disruption and compete effectively in the third decade of the 21st century, well-established and longstanding companies need to be open to the concept of digital transformation (Anderson, 2014; Caputo et al., 2021). However, recognising the need for change and understanding the purposes and goals are two different facets and long-existing companies generally encounter problems from the outset (Nowiński and Haddoud, 2019).

A common equivocation over the digital transformation stems from the conviction that injecting technology across every level of a company will resolve its issues. This does not at all encapsulate the processes required. Technology represents a facilitator of new ways of doing business while digital transformation involves innovating the business model (Caputo et al., 2021) and consequently rethinking the operations ongoing in companies (Fichter and Tiemann, 2018). One of the critical factors for success is the

mentality of those working in organisations. When the team can conceive of the company as a digital business, then they shall be able to rebuild the strategy based on this digital transformation (Palmié et al., 2020) and guide them towards obtaining a pro-growth mentality so that they become open to and capable of change (Hornuf et al., 2020). Another factor of particular importance is precisely the country's level of economic development (Hossan et al., 2022). A high level of development enhances entrepreneurial attitudes through various support policies that promote the digital transition (Adom et al., 2021; Zaman and Sarker, 2021).

Digital technologies provide new opportunities to entrepreneurs and the ways they may establish their businesses and sell their products and services all around the world (Elia et al., 2016). Digital technologies thus perform a transformative role in the world economy and particularly in entrepreneurship processes (Anderson, 2014; Brynjolfsson and McAfee, 2014). The virtualisation of businesses is able to strip out excessive costs and barriers to the entrance of new companies while simultaneously eliciting new opportunities for a new generation of entrepreneurs (Youssef et al., 2022). Furthermore, the widespread diffusion and application of digital technologies also create new needs, requiring new companies and a new type of entrepreneur (Elia et al., 2016).

We thus arrive at our first research hypotheses:

*H1a: Entrepreneurial attitudes bring about a positive impact on the digital transition.*

*H1b: The positive relationship between the focus on entrepreneurial attitudes and the digital transition becomes stronger when the national level of development is higher.*

The attitudes of individuals leading to the adoption of specific behaviours result from their behavioural beliefs that describe the perceived probability of positive or negative results from these same behaviours (Ajzen, 1991). When we refer to entrepreneurial attitudes that drive the environmental transition, we refer to perceptions of both economic and non-economic gains that may reduce or raise the intentions of some individuals to embark on sustainable business models (Vuorio et al., 2018; Muñoz, 2018; Ramadani et al., 2022). Thus, the country's higher level of development will also lead to a positive impact on entrepreneurial attitudes toward the environmental transition (Golušin et al., 2013). This level of development can be seen through the quality of its institutions and its policies to support entrepreneurial attitudes that consider the environmental transition, thus enhancing the positive effect of entrepreneurial attitudes on the environmental transition (Lee and Mason, 2006).

Krueger et al. (2000) defend that entrepreneurship constitutes an intentionally planned behaviour. Correspondingly, entrepreneurs do not only react to external stimuli or catalysing events but rather adopt intentionally planned processes on deciding to advance with launching their companies. Different studies defend that the factors shaping these entrepreneurial intentions are susceptible to the application of the assumptions of the theory of planned behaviour (TPB), given their capacity to model and validate entrepreneurial intentions (Krueger et al., 2000; Liñan and Chen, 2009; Moriano et al., 2012; Thelken and Jong, 2020) and specifically entrepreneurship with a focus on the environmental transition (Vuorio et al., 2018).

Entrepreneurs adopting business models in keeping with the environmental transformation display the intention of achieving a balance between social, environmental and economic goals (Cohen and Winn, 2007; Shepherd and Patzelt, 2011). Verification of the impacts of entrepreneurial attitudes towards the environmental transition emerges from the focus of entrepreneurs on nature preservation, supporting quality of life and the community in seeking out the perceived opportunities and converting them into new products, processes and services (Hall et al., 2010; Shepherd and Patzelt, 2011).

Hence, the values and attitudes of entrepreneurs serve as a compass guiding their business models for the environmental transition (Muñoz, 2018; Vuorio et al., 2018; Ramadani et al., 2022). Entrepreneurs with a focus on environmental transformation are also key actors and drivers of innovation in the transition to a (more) circular economy (Veleva and Bodkin, 2018; Eikelenboom and de Jong, 2019; Singh et al., 2020). We may thus present the following research hypotheses:

*H1c: Entrepreneurial attitudes return positive impacts on the environmental transition.*

*H1d: The positive relationship between the focus on entrepreneurial attitudes and the environmental transition is stronger when the national level of development is higher.*

## **2..2. Entrepreneurial abilities and the twin transitions**

Entrepreneurial activities take place through the interactions of various institutions, clients and individuals in a holistic context (West and Wood, 2013). The digital transition reflects a phenomenon emerging as a result of technical assets, such as the Internet and information and communication technologies (ICTs). The definition of the entrepreneurial abilities that foster the digital transition reflects the same contents as those

for any entrepreneurial action that converts an asset, service or key component of a digital company (Hull et al., 2007).

As entrepreneurial abilities thus represent a key factor in recognising entrepreneurial opportunities (Baron, 2006) and with studies adopting them as a crucial characteristic of any business (Valliere, 2013), as powerful social influences and with economic impacts (Storr and John, 2015). Thus, the country's level of development also has an important positive impact, not only in the promotion of entrepreneurial skills (through the promotion of various actions to train entrepreneurs) but also in policies that promote the digital transition (Amer Ahmed et al., 2016; Ren et al., 2021).

The digital transition and diverse business partnerships support a diversified set of actors and their efforts to extract value and facilitate the growth of companies and countries (Sebastian et al., 2020; Chavoushi et al., 2021). Similarly, entrepreneurial abilities enable the identification of opportunities that favour the digital transitions of companies (Sarasvathy et al., 2003; Short et al., 2010; Tang et al., 2012), helping them to grasp the complex environments in which they operate (Fellnhöfer, 2021).

We may thus conceive of entrepreneurial abilities as the backbone of the digital transition of companies. The digital transition of any territory only becomes possible when the local companies deploy the abilities necessary to acquire and apply the necessary digital technologies (Fellnhöfer, 2021). Therefore, it is fundamental for companies to recruit and retain the right talents with the set of abilities appropriate to undertaking the digital transition (Sebastian et al., 2020).

The digital transition correspondingly serves to provide tasks of discovery exploring the objective exogenous situations in the respective company's surrounding environment susceptible to *ex-ante* observation and identification and, first and foremost, by individuals deploying entrepreneurial abilities (Aldrich and Kenworthy, 1999; Alvarez and Barney, 2007). Therefore, we reach the following research hypotheses:

*H2a: Entrepreneurial abilities have a positive impact on digital transition processes.*

*H2b: The positive relationship between the focus on entrepreneurial abilities and the digital transition becomes stronger when the national level of development is higher.*

Entrepreneurs perform a vital role in national economic development. They mobilise resources and aggregate value to the surrounding environments by providing the new goods and services necessary to society (Schaltegger & Burritt, 2018). On the other hand, the country's level of development is also an important driver of entrepreneurial skills that enhance the environmental transition (Amer Ahmed et al., 2016; Ren et al., 2021). And

so, diverse authors have proposed the importance of undertaking research focused on the entrepreneurial abilities capable of fostering the environmental transition (Cohen and Winn, 2007; Kuckertz and Wagner, 2010; Stål and Bonnedahl, 2016). Hence, entrepreneurial abilities contribute to creating value through identifying opportunities, possibilities and impacts not only for the organisation but also for other stakeholders and society, especially through the environmental transition (Cohen et al. 2008).

Given the current challenges, entrepreneurial abilities, in general, should interrelate with the environmental transition, essentially through its respective advancement. The abilities of individuals, therefore, reflect an essential factor for any company. Deepening business abilities, such as creativity, innovation, calculated risk-taking and the resolution of problems, capable of implementing the environmental transition, is, therefore, a fundamental goal (Schaltegger and Burrit, 2015).

Entrepreneurial abilities focused on the environmental transition correspondingly foster business success through generating positive effects for the environment and humanity and enabling the creation of value for a broad range of stakeholders (Hall & Wagner, 2012; Freudenreich et al. 2019). Entrepreneurial abilities may therefore actively contribute to the environmental transition (Schaltegger et al., 2015). Hence, we may present the following research hypotheses:

*H2c: Entrepreneurial abilities return a positive impact on the environmental transition.*

*H2d: The positive relationship between the focus on entrepreneurial abilities and the environmental transition becomes stronger when the national stage of development is higher.*

### **2.3. Entrepreneurial aspirations and the twin transitions**

The digital transition is essentially a socio-technical transformation in which the adoption and successful application of digital technologies depend on human and technical factors (Mirvis et al., 1991; Wu and Wu, 2005; Gilbert, 2006; Tilson et al., 2010).

Entrepreneurial aspirations with a digital transition focus need to consider how digitalisation is an inherently trans-functional process spanning organisational borders and extending beyond the internal scope of information technology (Bharadwaj et al., 2013). This thereby conveys how, in addition to the need to incorporate the digital transition into the strategic context and objectives set for every level of the organisation

(Le Dinh et al. 2018; Ghosh et al., 2020), it is fundamental for entrepreneurial aspirations to take into consideration the organisational culture that enables the processing of new factors (Ritala et al, 2021). This means that the entrepreneurial aspirations necessarily extend to integrating individuals, in keeping with their networking abilities, as a crucial facet of implementing digital strategies (Yoo et al., 2010). However, in these strategies, we cannot forget the importance of the country's level of development (Hossan et al, 2022). A country with a high level of development promotes actions that lead entrepreneurs to adopt the digital transition in their organisations (Amer Ahmed et al., 2016; Ren et al, 2021).

Darnihamedani and Hessels (2012) state that in terms of entrepreneurial aspirations there are essentially two types of entrepreneurs: those who base their activities on research and consequently commercialise technological innovations; and imitative entrepreneurs that develop already existing markets and to this end gather the organisational resources available. Therefore, entrepreneurs focused on the digital transition trust in digital communications and information technology tools in their search for new opportunities (Dutot and Van Horne, 2015; Autio et al., 2018; Wagner and Wäger, 2019). Thus, we arrive at our next research hypotheses:

*H3a: Entrepreneurial aspirations return a positive impact on digital transitions.*

*H3b: The positive relationship between the focus on entrepreneurial aspirations and the digital transition is stronger whenever the national level of development is higher.*

York and Venkataraman (2010) defend that entrepreneurial aspirations represent means of resolving environmental problems given they drive the mitigation of climate change and help institutions obtain their objectives without calling into question environmental sustainability (Shepherd and Batzel, 2011; Sarango-Lalangui et al., 2018). The country's level of development also plays a crucial role in the environmental transition of organisations (Amer Ahmed et al., 2016; Ren et al, 2021). Through the various political and economic institutions, as well as the enabling industrial and technological sectors (Pizzi, Corbo and Caputo, 2021), countries can encourage entrepreneurs to process the environmental transition necessary to mitigate climate change (Sarango-Lalangui et al., 2018).

Entrepreneurs are increasingly aware of the potential market for “green” products and services, contributing to ensuring that the environmental transition represents an entrepreneurial aspiration ever more present among entrepreneurs (Youssef et al., 2018).

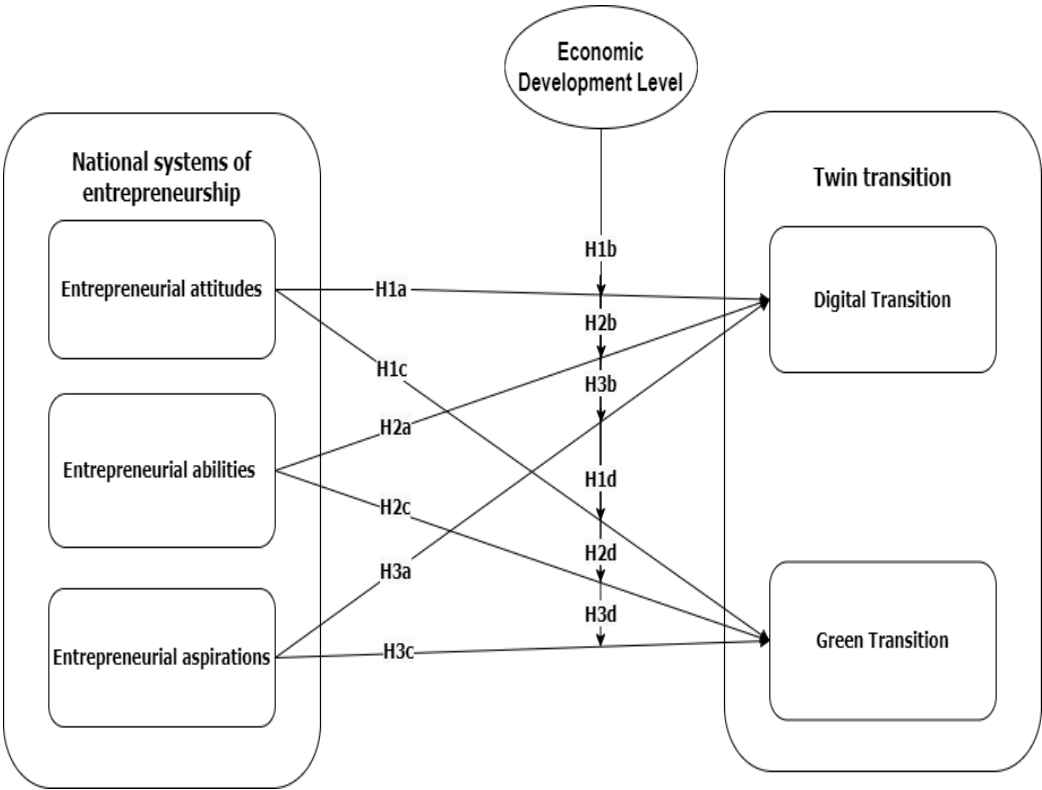
According to Jinjiang et al. (2020), entrepreneurial aspirations based on opportunities are positively associated with environmental quality and sustainable development.

Within their businesses, entrepreneurs need to focus more sharply on the business ideas that serve to balance their activities with the economic, environmental and social impacts of their activities and engage in sustainable practices within the framework of striving for competitiveness and effectiveness across the components making up sustainable development (Perrini et al., 2007; Dhahri et al., 2021). Hence, entrepreneurial aspirations, combined with sustainable processes in companies, shall certainly enable them to process and advance with the environmental transition (Harms et al., 2014; Rahdari et al., 2016; Youssef et al., 2018; Horne et al., 2020) and therefore providing our following research hypotheses:

*H3c: Entrepreneurial aspirations return a positive impact on the environmental transition.*

*H3d: The positive relationship between the focus on entrepreneurial aspirations and the environmental transition becomes stronger when the national level of development is higher.*

Figure 1 sets out the research model.



**Fig. 1 Research model**

### 3. Methods

#### 3.1. Data and sample

The data applied incorporates aggregate statistics at the national level gathered from different sources, in particular Eurostat, the Food and Agriculture Organization (FAO), Global Entrepreneurship Monitor (GEM), the United Nations (UN), the World Bank (WB) and the World Economic Forum (WEF). The study sample spans the 27 European Union member states for the years from 2015 to 2019 (5 years). For the variables and countries with missing data, we imputed the respective variable based on the average for the variable and the country.

#### 3.2. Measures

Table 1 displays all of the variables deployed for calculating the different indices and for the econometric estimates.

**Table 1. Description of the variables**

| Global Entrepreneurship Index |                        |                                                                                                                                                                                                                                                |                            |
|-------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Sub-index                     | Pillar                 | Variable                                                                                                                                                                                                                                       | Source                     |
| Attitudes Sub-Index (ATT)     | Cultural Support       | Average of the percentage of the 18-64 aged population saying that people consider starting business as good career choice and The percentage of the 18-64 aged population thinking that people attach high status to successful entrepreneurs | GEM                        |
|                               |                        | Corruption Perceptions Index, normalized on 0-100 (best)                                                                                                                                                                                       | International Transparency |
|                               | Networking             | The percentage of the 18-64 aged population knowing someone who started a business in the past 2 years                                                                                                                                         | GEM                        |
|                               |                        | The number of Internet users in a particular country per 100 inhabitants                                                                                                                                                                       | WB                         |
|                               | Risk Perception        | The percentage of the 18-64 aged population stating that the fear of failure would not prevent starting a business                                                                                                                             | GEM                        |
|                               |                        | Future orientation of government, normalized on 0-100 (best)                                                                                                                                                                                   | WEF                        |
|                               | Startup Skills         | The percentage of the 18-64 aged population has the knowledge/skills required to start a business                                                                                                                                              | GEM                        |
|                               |                        | Secondary education enrolment, gross %*                                                                                                                                                                                                        | WB                         |
|                               | Opportunity Perception | The percentage of the 18-64 aged population recognizing good conditions to start business in the next 6 months in the area he/she lives                                                                                                        | GEM                        |
|                               |                        | Business freedom, normalized on 0-100 (best)                                                                                                                                                                                                   | Heritage Foundation        |
| Abilities Sub-Index (ABI)     | Competition            | Percentage of the TEA businesses started in those markets where not many businesses offer the same product                                                                                                                                     | GEM                        |

|                                                                 |                                                                                                                |                                                                                                                                                                                                                                   |          |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Aspirations Sub-Index (ASP)                                     |                                                                                                                | Extent of market dominance: “Corporate activity in your country is (1 = dominated by a few business groups, 7 = spread among many firms)”                                                                                         | WEF      |
|                                                                 | Human Capital                                                                                                  | Percentage of the TEA business owners/managers having continued beyond secondary education                                                                                                                                        | GEM      |
|                                                                 |                                                                                                                | Labour market, normalized on 0-100 (best)                                                                                                                                                                                         | WEF      |
|                                                                 | Technology Absorption                                                                                          | Percentage of the TEA businesses that are active in technology sectors (high or medium)                                                                                                                                           | GEM      |
|                                                                 |                                                                                                                | Firm-level technology absorption capability: “Companies in your country are (1 = not able to absorb new technology, 7 = aggressive in absorbing new technology)”                                                                  | WEF      |
|                                                                 | Opportunity Startup                                                                                            | Percentage of the TEA businesses initiated because of opportunity start-up motive                                                                                                                                                 | GEM      |
|                                                                 |                                                                                                                | Effect of taxation on incentives to invest (1 = significantly reduce the incentive to invest; 7 = do not reduce the incentive to invest at all)                                                                                   | WEF      |
|                                                                 | Risk Capital                                                                                                   | The amount of informal investment calculated = The mean amount of 3 year informal investment x The percentage of the 18-64 aged population who provided funds for new business in past 3 years excluding stocks & funds (average) | GEM      |
|                                                                 |                                                                                                                | Domestic market size that is the sum of gross domestic product plus value of imports of goods and services, minus value of exports of goods and services, normalized on a 1–7 (best)                                              | WEF      |
|                                                                 | Internationalisation                                                                                           | Percentage of the TEA businesses where at least some customers are outside country (over 1%)                                                                                                                                      | GEM      |
| Domestic competition, normalized on 0-100 (higher competition)  |                                                                                                                | WEF                                                                                                                                                                                                                               |          |
| High Growth                                                     | Percentage of the TEA businesses having high job expectation average (10 or more employees and 50% in 5 years) | GEM                                                                                                                                                                                                                               |          |
|                                                                 | Venture capital availability, 1-7 (best)                                                                       | WEF                                                                                                                                                                                                                               |          |
| Process Innovation                                              | Percentage of the TEA businesses offering products that are new to at least some of the customers              | GEM                                                                                                                                                                                                                               |          |
|                                                                 | Gross domestic expenditure on R&D (GERD) as a percentage of GDP                                                | WB                                                                                                                                                                                                                                |          |
| Product Innovation                                              | Percentage of the TEA businesses using new technology that is on average less than 5 years old                 | GEM                                                                                                                                                                                                                               |          |
|                                                                 | Innovation capability, normalized on 0-100 (higher capability)                                                 | WEF                                                                                                                                                                                                                               |          |
| Twin Transition Measures                                        |                                                                                                                |                                                                                                                                                                                                                                   |          |
| Indicator                                                       | Variable                                                                                                       |                                                                                                                                                                                                                                   |          |
| Economic Development Level                                      | Environmental Transition Index (0 – 100)                                                                       |                                                                                                                                                                                                                                   | Eurostat |
| Digital transition                                              | Digital Economy and Society Index (0 – 100)                                                                    |                                                                                                                                                                                                                                   | Eurostat |
| Moderator variable                                              |                                                                                                                |                                                                                                                                                                                                                                   |          |
| Environmental transition                                        | Stage 3: Innovation-driven (0 – No; 1 – Yes))                                                                  |                                                                                                                                                                                                                                   | WEF      |
| Control variables                                               |                                                                                                                |                                                                                                                                                                                                                                   |          |
| Variable                                                        |                                                                                                                |                                                                                                                                                                                                                                   | Source   |
| GDP per capita, PPP (constant 2011 international US\$) (GDP_pc) |                                                                                                                |                                                                                                                                                                                                                                   | WB       |
| GDP growth (annual %) (GDP_growth)                              |                                                                                                                |                                                                                                                                                                                                                                   | WB       |
| Population, total (POP)                                         |                                                                                                                |                                                                                                                                                                                                                                   | WB       |
| Population growth (annual %) (POP_growth)                       |                                                                                                                |                                                                                                                                                                                                                                   | WB       |

### **3.2.1. Independent Variables**

In order to evaluate the impact at the level of the environmental and digital transitions and the prevailing level of national entrepreneurship, we deployed an approach similar to that developed by Acs & Szerb (2016) and Raposo et al. (2020), which captures the multidimensional nature of NESs. This indicator measures the dynamic and institutional interactions incorporated into the entrepreneurial attitudes (ATT), the entrepreneurial abilities (ABI) and entrepreneurial aspirations (ASP) of individuals who drive the allocation of resources through the founding of new businesses. The methodology applied, including a bottleneck penalty (Ács et al., 2014; Lafuente et. al., 2016; Raposo et al., 2020), involved calculating three indices reflecting each of the three dimensions identified. Each of these scores may range from 0 to 100.

### **3.2.2. Moderator Variable**

The moderating variable applied to measure the national stage of development derived from the WEF classification (proxy for economic development). As EU member states belong to Stage 2: Efficiency-driven (Bulgaria), Transition from stage 2 to stage 3 (7 countries) and Stage 3: Innovation-driven (19 countries), in order to measure economic development, we applied the dummy variable (0 – No; 1 – Yes) depending on whether or not the country belonged to the higher Stage 3: Innovation-driven level of economic development.

### **3.2.3. Dependent Variables**

In order to gauge the national level of environmental transition, we applied the Environmental Transition Index (ETI) obtained from the Transitions Performance Index (TPI). The TPI is a Eurostat developed scoreboard that monitors and ranks countries based on four transitions (Economic, social, environmental and governance) to fair and prosperous sustainability. The ETI includes variables such as Gross greenhouse gas emissions (tonnes per capita); Energy productivity (2015 PPP\$ per koe); Key biodiversity areas (KBAs) protected (%), Area of cropland (ha) with pesticides (kg/ha); Resource productivity (PPP\$ per kg); and Material footprint (tonnes per capita)). The ETI returns a result that may vary between 0 and 100.

In order to measure the prevailing level of digital transition in a country, we adopted the Digital Economy and Society Index (DESI). DESI summarises indicators on Europe's digital performance and tracks the progress of EU countries related with Internet user skills, advanced skills and development, fixed and mobile broadband take-up and coverage, digital technologies for businesses, e-Commerce and e-Government. The DESI returns results ranging between 0 and 100.

#### 3.2.4. Control variables

As control variables, we applied macroeconomic factors associated with the national level of entrepreneurial activities. Thus, we correspondingly deployed the national GDP per capita, adjusted by purchasing power parity (in thousands of dollars and at constant 2015 values), and the respective annual growth rate, the population size (millions) (POP) and the annual population growth rate.

### 3.3. Data Analysis

Despite the potential for added value and not very commonly applied to entrepreneurial contexts (Raposo et al., 2020), the estimates here resulted from econometric methodologies based on dynamic panels with the objective of capturing differences over the course of time (Bond, 2002) in keeping with how the levels of entrepreneurship may shape the environmental and digital transitions in the subsequent years. We employed the two-step Generalized Method of Moments estimators using moment conditions (Arellano & Bond, 1991), with one lagged level of the dependent and two entrepreneurship variables.

In order to analyse the impact of entrepreneurship on the environmental and digital transitions, we applied the linear models as follows:

$$a) Trans_{it} = \alpha + \beta_1 Trans_{it-1} + \beta_2 Control_{it} + \beta_3 Entre_{it} + \beta_4 Entre_{it-1} + \beta_5 Entre_{it} \times Stage\ 3$$

Given the adoption of a dynamic model, we are only able to complete the estimates for the years between 2016 and 2020 (5 years). In total, we estimated four models (2 for each transition). Models 1 and 2 deal with the environmental transition while Models 3 and 4 capture the digital transition. Models 1 and 3 apply the control variables as their predictive variables while Models 2 and 4 adopt, as their predictive control variables, the three entrepreneurship indices and the terms of interaction between the entrepreneurship indices and the level of development.

We processed the data through the STATA version 15.0 software (StataCorp LP, Texas, USA).

#### 4. Results

Table 2 presents the results for the descriptive variable for these years before Table 3 details the results for the levels of correlation ongoing among the different variables. We observe in table 2 how the mean scores for the environmental and digital transitions (0-100) range between 65 and 70 and thus reflecting similar results while the scores for the Attitudes (ATT), Abilities (ABI) and Aspirations (ASP) indices return higher means for Attitudes and lower for Aspirations. In terms of the correlations existing (Table 3), we may report that the scores for the entrepreneurial attitudes (ATT), entrepreneurial abilities (ABI) and entrepreneurial aspirations (ASP) of individuals significantly correlate with the environmental and digital transition scores.

**Table 2 – Descriptive statistics (mean)**

|                                         | 2015  | 2016  | 2017  | 2018  | 2019  |
|-----------------------------------------|-------|-------|-------|-------|-------|
| <b>Environmental Transition (0-100)</b> | 66.12 | 67.02 | 66.11 | 66.22 | 67.03 |
| <b>Digital Transition (0-100)</b>       | 65.04 | 65.22 | 67.06 | 68.01 | 69.18 |
| <b>GDP_pc (Thousands)</b>               | 30.58 | 28.01 | 28.37 | 28.74 | 29.11 |
| <b>GDP_growth (%)</b>                   | 2.13  | 2.14  | 2.08  | 2.11  | 2.09  |
| <b>Pop (Millions)</b>                   | 15.09 | 15.14 | 15.19 | 15.24 | 15.29 |
| <b>Pop_growth (%)</b>                   | 0.90  | 0.92  | 0.94  | 0.97  | 0.99  |
| <b>Stage 3: Innovation-driven</b>       | 0.62  | 0.62  | 0.62  | 0.62  | 0.62  |
| <b>ATT (0-100)</b>                      | 61.43 | 61.89 | 62.51 | 63.14 | 63.76 |
| <b>ABI (0-100)</b>                      | 46.51 | 45.33 | 45.88 | 46.42 | 46.96 |
| <b>ASP (0-100)</b>                      | 38.33 | 37.96 | 38.06 | 38.15 | 38.25 |

**Table 3 - Correlations**

|                                       | (1)      | (2)      | (3)     | (4)     | (5)     | (6)      | (7)     | (8)     | (9)     | (10) |
|---------------------------------------|----------|----------|---------|---------|---------|----------|---------|---------|---------|------|
| <b>(1) Environmental Transition</b>   | 1        |          |         |         |         |          |         |         |         |      |
| <b>(2) Digital Transition</b>         | 0.178**  | 1        |         |         |         |          |         |         |         |      |
| <b>(3) GDP_pc</b>                     | 0.302**  | -0.235** | 1       |         |         |          |         |         |         |      |
| <b>(4) GDP_growth</b>                 | -0.254** | 0.129*   | -0.131* | 1       |         |          |         |         |         |      |
| <b>(5) Pop</b>                        | -0.184** | -0.068   | -0.155* | 0.239*  | 1       |          |         |         |         |      |
| <b>(6) Pop_growth</b>                 | -0.417** | 0.112    | -0.019  | 0.221** | -0.008  | 1        |         |         |         |      |
| <b>(7) Stage 3: Innovation-driven</b> | 0.092    | 0.357**  | 0.381** | 0.151*  | 0.059   | -0.398** | 1       |         |         |      |
| <b>(8) ATT</b>                        | 0.274**  | 0.308**  | 0.447** | -0.154* | -0.164* | -0.054   | 0.354** | 1       |         |      |
| <b>(9) ABI</b>                        | 0.234**  | 0.192*   | 0.530** | 0.152*  | 0.026   | 0.159*   | 0.128   | 0.385** | 1       |      |
| <b>(10) ASP</b>                       | 0.280**  | 0.066    | 0.593** | 0.028   | -0.015  | -0.059   | 0.327** | 0.428** | 0.366** | 1    |

**Note:** \*  $p < 0.05$ ; \*\*  $p < 0.01$

Table 4 provides the dynamic panel model results that served to evaluate the study hypotheses.

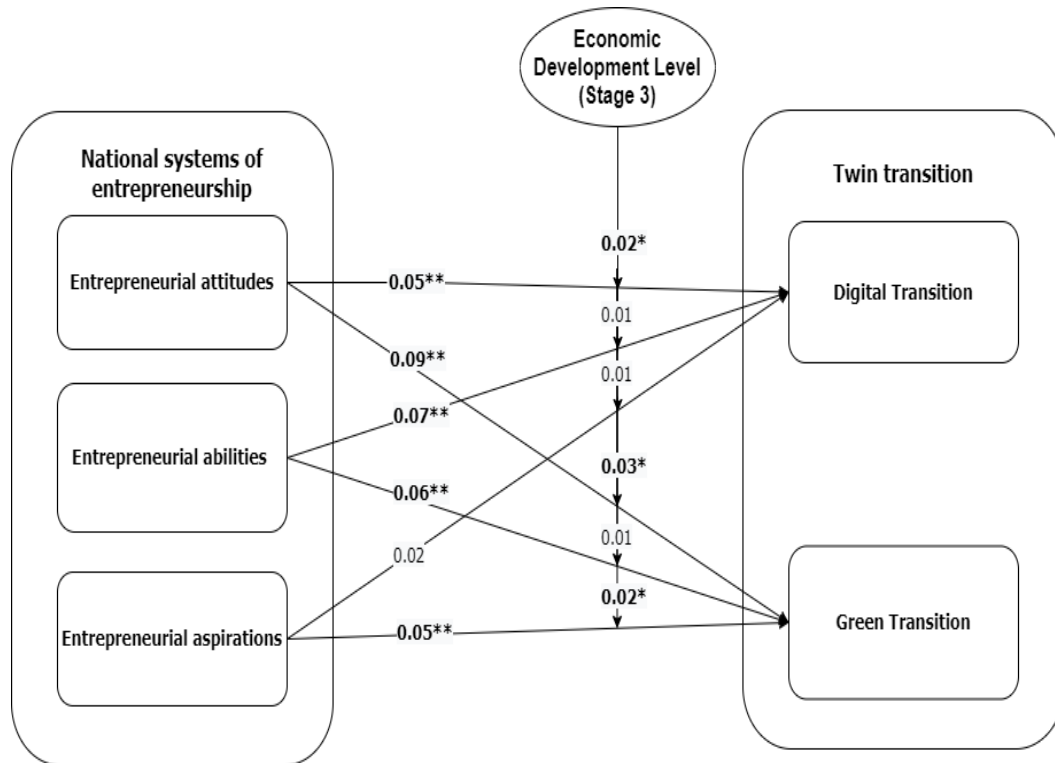
**Table 4 – Models estimated**

|                            | Digital Transition |               | Environmental Transition |               |
|----------------------------|--------------------|---------------|--------------------------|---------------|
|                            | Model 1            | Model 2       | Model 1                  | Model 2       |
| DV(-1)                     | 0.25* (0.12)       | 0.30** (0.12) | 0.75** (0.10)            | 0.90** (0.11) |
| GDP_pc                     | 0.12* (0.06)       | 0.09** (0.03) | 0.11* (0.05)             | 0.09 (0.00)   |
| GDP_growth                 | 0.21** (0.10)      | 0.30* (0.15)  | 0.22** (0.12)            | 0.02* (0.01)  |
| Pop                        | 0.18 (0.15)        | 0.01 (0.02)   | -0.03* (0.01)            | 0.03 (0.03)   |
| Pop_growth                 | -0.14 (0.09)       | 0.19 (0.23)   | -0.53 (0.28)             | -0.29 (0.27)  |
| Stage 3: Innovation-driven | 0.09 (0.10)        | 0.34 (0.33)   | 5.23 (5.12)              | 0.15 (0.16)   |
| ATT                        |                    | 0.05** (0.01) |                          | 0.09** (0.01) |
| ABI                        |                    | 0.07** (0.01) |                          | 0.06** (0.01) |
| ASP                        |                    | 0.02 (0.01)   |                          | 0.05** (0.01) |
| ATT*Stage 3                |                    | 0.02* (0.01)  |                          | 0.03* (0.01)  |
| ABI*Stage 3                |                    | 0.01 (0.01)   |                          | 0.01 (0.01)   |
| ASP*Stage 3                |                    | 0.01 (0.01)   |                          | 0.02* (0.01)  |
| ATT(-1)                    |                    | 0.02* (0.01)  |                          | 0.03* (0.01)  |
| ABI(-1)                    |                    | 0.03* (0.01)  |                          | 0.02 (0.01)   |
| ASP(-1)                    |                    | 0.01 (0.01)   |                          | -0.02 (0.02)  |

**Note:** \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; DV – Dependent variable

The coefficients reported attaining statistical significance at both the 1% and 5% levels. Based on the results, we may report that GDP per capita and GDP growth generate a statistically positive impact on the levels of environmental and digital transition while the population returns a statistically negative impact on the levels of environmental transition.

Figure 2 presents the model estimated that served to evaluate the study hypotheses. On consideration of the results for H1a: Entrepreneurial attitudes return positive impacts on digital transitions ( $\beta = 0.05$ ;  $p < 0.01$ ), we may verify the statistical support. Furthermore, we may also confirm hypothesis H1b, in which the focus on entrepreneurial attitudes and the digital transition is stronger in countries at higher levels of development ( $\beta = 0.02$ ;  $p < 0.05$ ) (H1 b).



Note: \*  $p < 0.05$ ; \*\*  $p < 0.01$

Fig. 2 Model estimated (Standardized coefficients)

As regards H1c: Entrepreneurial attitudes generate a positive impact on environmental transition ( $\beta = 0.09$ ;  $p < 0.01$ ), the results come out in support of this hypothesis. They also confirm that entrepreneurial attitudes and the environmental transition are more strongly positive when countries are at higher stages of development ( $\beta = 0.03$ ;  $p < 0.05$ ) (H1d).

As regards hypothesis H2a: Entrepreneurial abilities return positive impacts on digital transitions ( $\beta = 0.07$ ;  $p < 0.01$ ), we may report support from these results even while there is no statistically significant moderating effect from the national level of development on the relationship between entrepreneurial abilities and digital transitions ( $\beta = 0.01$ ;  $p \geq 0.05$ ) (H2b)

In the case of H2c: Entrepreneurial abilities provide positive impacts on environmental transitions ( $\beta = 0.06$ ;  $p < 0.01$ ), our results here register support for this hypothesis. However, there is no statistically significant moderating effect from the national stage of development on the relationship between entrepreneurial abilities and environmental transitions ( $\beta = 0.01$ ;  $p \geq 0.05$ ) (H2d) and hence preventing validation of this hypothesis.

As regards H3a: Entrepreneurial aspirations hold a positive impact on digital transitions, the results obtained ( $\beta = 0.02$ ;  $p \geq 0.05$ ) do not underpin this hypothesis. Furthermore, the prospect that the focus of entrepreneurial aspirations on digital transitions does not rise in accordance with the national level of development did not receive confirmation (H3b) ( $\beta = 0.01$ ;  $p \geq 0.05$ ) and therefore not supporting this hypothesis. Nevertheless, in terms of H3c: Entrepreneurial aspirations have positive impacts on environmental transitions ( $\beta = 0.05$ ;  $p < 0.01$ ), our results do provide backing for this hypothesis.

Finally, we may confirm support for hypothesis H3d: the focus on entrepreneurial aspirations and environmental transitions is stronger when the national stage of development is higher ( $\beta = 0.02$ ;  $p < 0.05$ ), thus, in stage 3 countries, the impact of entrepreneurial aspirations on environmental transition is significantly higher than in countries that fall outside of this category.

## **5. Discussion and Implications**

Our research findings suggest that studying the impact of NESs on the twin (digital and environmental) transition of countries represents an important step in countries improving their entrepreneurial activities (Aghelie et al., 2016; Ferreira et al., 2020):

First, it should be noted that as for entrepreneurial attitudes, we found that they have a positive impact on both the digital transition and the environmental transition. (H1a and H1 c) Thus, like Anderson (2014), we found that entrepreneurial attitudes focused on the digital transition are fundamental to achieving it. Adapting business models to the challenges of the digital transition is crucial to achieving a competitive advantage over their competition (Fichter and Tiemann, 2018; Hornuf et al., 2020; Caputo et al., 2021). Second, regarding entrepreneurial skills, we found that they have a positive impact on the twin transitions (digital and environmental transitions) (H2a and H2c) (Hull et al., 2007; Fellnhöfer, 2021). Through the acumen in identifying opportunities, entrepreneurial abilities can trigger the digital transition of companies, helping them to understand the complex environment in which they are inserted (Sarasvathy et al., 2003; Short et al., 2010; Tang et al., 2012; Fellnhöfer, 2021).

Third, concerning entrepreneurial aspirations, although there was no positive or negative effect on the digital transformation (H3a), we found that they had a positive impact on the environmental transition (H3 c). Like other authors, we also found that it

is through entrepreneurial aspirations that the climate transition is achieved (Shepherd and Batzel, 2011; Swan and Morgan, 2016; Ramadani et al., 2022).

In keeping with the approach of Acs et al (2014), which proposes the incorporation of entrepreneurial attitudes, abilities and aspirations into NESs, our results confirm that these three dimensions generate positive effects on the twin transitions. Our research thereby contributes to the existing theory and practice on the relationship between entrepreneurship and the twin transitions given the great difficulty in encountering studies analysing the two transitions simultaneously. This also contributes to the application and measuring of NESs across these three dimensions (attitudes, abilities and aspirations) and thus overcoming another latent limitation (Youssef et al., 2018).

### **5.1. Theoretical implications**

The entrepreneur's attitude drives the environmental transition (Vuorio et al., 2018; Muñoz, 2018; Krueger et al. 2020). The link between solving global problems and entrepreneurship, or even entrepreneurship as a solution to these problems, has been extensively studied (Schumpeter, 1934, 1942; Drucker, 1985; Ferreira et al, 2019; Raposo et al 2020). With our research, we found that entrepreneurship should be seen as a vehicle of economic and social transformation, rather than just a topic of study in the literature. Thus, entrepreneurship should be seen as an important channel for sustainable products and services, being an elixir for many environmental and social concerns (Ferreira et al, 2019; Fernandes et al, 2021). For this, it is crucial that entrepreneurs embark on business models that follow environmental transformation as well as their intentions and balance between social, environmental and economic goals (Cohen and Winn, 2007; Shepherd and Patzelt, 2011; Muñoz, 2018; Vuorio et al., 2018; Eikelenboom and de Jong, 2019; Singh et al., 2020).

We also argue that entrepreneurial skills can actively contribute to the environmental transition (Schaltegger et al., 2019). Thus, our considerations are also in line with other researchers who defend the importance of entrepreneurial skills in promoting environmental transition (Cohen and Winn, 2007; Kuckertz and Wagner, 2010; Stål and Bonnedahl, 2016; Schaltegger & Burritt, 2018; Schaltegger et al., 2019). Entrepreneurial success can be promoted through environmental transition, precisely

for the positive effects on the environment and humanity (Hall & Wagner, 2012; Freudenreich et al. 2019).

We found that mitigating climate degradation is an entrepreneurial aspiration, thus managing to reduce this same degradation, preserving natural capital, and improving freshwater supply and agricultural activities (Ben Youssef et al., 2018). Entrepreneurial aspirations in terms of environmental sustainability allow the environmental transition to take place (Harms et al., 2014; Rahdari et al., 2016; Ben Youssef et al., 2018; Horne et al., 2020).

Finally, the positive moderating effect of the level of economic development between entrepreneurial attitudes and aspirations in both transitions (environmental and digital) also shows that the entrepreneurial attitude of individuals comes from the economic level of the country and the confidence they have in institutions (Van Stel, et al. 2007; Acs et al. 2008; Hessels, et al., 2008; Santos et al., 2020). It is argued by several researchers that an adequate institutional environment provides the necessary conditions for individuals to identify market opportunities, start new activities, introduce innovations and new products or services and create employment (Baumol, 2002, Aparicio et al, 2016). Baumol (2002) argued that the quality of the institutional context influences the allocation of different types of entrepreneurship. In this sense North (1990) defined institutions as the rules of the game that guide the behaviour of individuals and provide the incentive structure for agents, reducing transaction problems. In this sense, for Boettke and Coyne (2009) institutions can facilitate economic, political and social interactions, creating incentives for different courses of action and guiding the election of economic actors. These rules are well defined, opportunism decreases, trust increases and the application of long-term contracts reduces transaction costs and leads to an efficient institutional structure (Santos et al. 2020). On the other hand, low-quality institutions reduce the incentive to invest and prevent resources from being allocated to their most productive end (Knowles and Weatherson, 2006).

## **5.2. Practical implications**

The most diverse models of sustainable entrepreneurship hold greater value than that which reality attributes them (Earley, 2016). The relationship between entrepreneurship

and the twin transitions has also gained prominence in the most varied research studies in keeping with the diverse transformations that industries have been experiencing (Zaheer et al. 2019). The fact that traditional businesses, with conventional products, generate levels of revenues and profits, assumed as almost certain, ensures the relationship between entrepreneurship and the twin transitions faces added challenges in establishing its legitimacy within the scope of the different approaches developed (Neumeyer & Santos, 2018; Raposo et al., 2020). One of the implications of this research effectively reflects how, when applying a systemic approach to entrepreneurship, such as the NSE framework, the focus on the digital transition does not exclude the focus on the environmental transition and, on the contrary, this focus can and should be simultaneous.

Hence, it is fundamental for companies to apply an open and transversal organisational mentality toward the new technological challenges to enable the implementation of the digital transition (Palmié et al., 2020; Hornuf et al., 2020). Only in this way, and with synergies for the overall entrepreneurial attitude towards advancing with the digital transition, may technologies perform a transformative role in the world economy, and in particular in entrepreneurial processes (Anderson, 2014; Brynjolfsson and McAfee, 2014).

However, the twin transitions face challenges: in the case of the environmental transition, the ignorance and lack of knowledge about the underlying concept of sustainability and, in the case of the digital transition, as regards what this actually incorporates (Munoz and Dimov, 2015). Despite the various efforts to clarify these concepts by the most diverse institutions, the results of these actions and the existing research demonstrate that they remain insufficient (Radosevic, 2007; Gustafsson & Autio, 2011; Raposo et al., 2020). Consequently, one of the most significant practical implications of this study involves how the leaders of countries and their respective different organisations and companies, in general, should in no way ignore the challenges faced in terms of these twin transitions. This should avoid perceptions of the environmental transition as something that hinders competitiveness or even the creation of wealth but rather serves as a driver of competitive advantage. Similarly, the digital transition needs to reach beyond the conviction that companies can resolve all their issues through an injection of technology but rather through constant updating and continuous staff training so that this transition does not emerge as an obstacle.

Our research furthermore demonstrates that NESs enable the progress of the twin transitions. Entrepreneurship as a system assists in implementing the environmental and digital transitions and we may infer that such countries and companies boost their competitiveness. Therefore, entrepreneurship and the digital and environmental transitions need approaching jointly to best guarantee the future development of all of society. This reflects how the last decade has seen a mushrooming of the interest in alternative economic systems that better enable a balance between the environmental and technological questions while simultaneously striving to raise financial and social results (Daly and Farley, 2011; Neumeyer & Santos, 2018). It is our conviction that NESs provide a promising theoretical framework that may broadly contribute to understanding entrepreneurship as a systemic phenomenon and thereby enable its integrated analysis.

## **6. Final considerations**

The main objective of this research was to study the relationship between NESs and twin transitions.

Such study is fundamental for two core reasons. On the one hand, entrepreneurs may become more aware of the crucial nature of incorporating into their business models measures to mitigate climate change and simultaneously accept the challenges posed by the digital transition. On the other hand, to break the myth that we either have an intense level of entrepreneurial activities or we have an environmental transition or digital transition, our results demonstrate how these concepts are not mutually exclusive and, on the contrary, the three may coexist together and, in accordance with that already stated by various other studies (Aghelie et al., 2016; Cohen & Winn, 2007; Ferreira et al., 2020; Fernandes, et al., 2017; O'Neill et al., 2006), entrepreneurship represents a path towards securing both the environmental transition and the digital transition.

Furthermore, our study opens the scope for researching and measuring entrepreneurship at the national level and the simultaneous effects of these two transition processes and thereby representing an important step forward in the existing research. In this context, entrepreneurial actions gain increasing recognition as a key vehicle for fostering the future development of all of society. Our research thus generates insights into the importance of entrepreneurship as a systemic phenomenon

made up of the attitudes, abilities and aspirations that impact the sustainability and digitalisation of countries.

As limitations, we may identify the following aspects. The first derives from not having tested the impact of each of the three pillars on the twin transitions of each country in the sample and therefore not identifying potential differences in terms of the level of economic development of each country. Our study instead focused on the overall level of the countries. Another limitation relates to the limited number of years incorporated into the sample. Panel data with a greater span of years might return other types of results, including higher levels of reliability.

Both limitations also establish the grounds for future research. Studies should investigate the operations of NESs, including broader timeframes for analysis and specifically scrutinising the differentiations emerging in the results for these three pillars in an attempt to identify those with the greatest impact on the twin transitions.

Another future line of research involves grasping which pillars attract the greatest level of attention from political decision-makers and even entrepreneurs. We correspondingly accept, despite the contribution we know our research makes to this academic field, that we still know very little about the contributions and restrictions of entrepreneurial actions in different systemic contexts. This same lack of knowledge requires further future research.

Another future focus of study involves the regional level. Countries are not homogeneous when compared either mutually or even within their boundaries. Within countries, there are diverse regions with distinctive characteristics and needs. This reflects the extent of the inequalities existing both between regions and between countries. Such inequalities impact more greatly in lesser developed countries with the study of these themes crucial in terms of designing the policies capable of endowing the entrepreneurs in these countries with the tools for engaging in digital and sustainable entrepreneurship. In these terms, we would propose studying the relationship between the NESs and the three pillars of sustainable development put forward by the UNFCCC (2012): economic growth, environmental objectives and improving the living conditions for the people in these countries.

In general, we hope this study serves as a stimulus for the efforts to improve our understanding of the NES interactions with the twin transitions, informing, expanding and encouraging further work on this important and yet little studied research field.

Understanding how and under what circumstances may the twin transitions be best incorporated into companies, regions and countries as a source of competitive advantage constitutes another dimension susceptible to development based on this research.

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