

FGF Studies in Small Business and Entrepreneurship

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Dietmar Grichnik
Asta Pundziene
Christine Volkmann *Editors*

Artificiality and Sustainability in Entrepreneurship

Exploring the Unforeseen, and Paving
the Way to a Sustainable Future

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Asta Pundziene • Christine Volkmann
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Contents

Part I Introduction

Artificiality and Sustainability in Entrepreneurship. Exploring the Unforeseen and Paving the Way to a Sustainable Future	3
Asta Pundziene, Richard Adams, Dietmar Grichnik, and Christine Volkmann	

Part II Embracing Digital Transformation and Opening Up New Business Opportunities

Digitalization and Its Impact on the Internationalization Models of SMEs	19
Aleksandra Gawel, Katarzyna Mroczek-Dąbrowska, and Maciej Pietrzykowski	
Born Digitals: Understanding the Sustainable Competitive Advantage Across Different Markets	41
Mirosław Jarosiński, Jurgita Sekliuckiene, and Miklós Kozma	
The Value Chain Configuration in the Digital Entrepreneurship Age: The Paradoxical Role of Digital Technologies	61
Zulima Fernández and Alicia Rodriguez	
Entrepreneurial Thinking and Acting in the Context of Great Transformations in Germany: How to Approach Entrepreneurial Personalities and Organizations in Order to Actively Shape Transformational Challenges?	83
Ulrich Braukmann, Dominik Bartsch, Larissa Sternkopf, and Thomas Schauf	

Part III Building New Capabilities and Learning Mechanisms to Enhance Competitiveness in the Market Predominated by Artificial Environments	
The Evolution of the Dynamic Capabilities Framework	113
David J. Teece	
Transforming a Highly Tactile Entrepreneurship Course “Ideas to Innovation” to an Entirely Online Delivery Model: Lessons for Theory and Practice	131
Egle Vaiciukynaite, Orsolya Ihasz, Sergey Portyanko, and Shailendra Vyakarnam	
Applying Eye-Tracking Technology in the Field of Entrepreneurship Education	163
Lina Kaminskiene, Kateryna Horlenko, and Ling Yi Chu	
Part IV Setting New Imperatives to Related with the Customers and Stakeholders in the Ecosystems	
Solutions of Brand Posts on Facebook to Increase Customer Engagement Using the Random Forest Prediction Model	191
Egle Vaiciukynaite, Ineta Zickute, and Justas Salkevicius	
Entrepreneurial University and Social Innovation Ecosystems: Do They Support HEIs’ Knowledge-Based Economic Development? . . .	215
Nibedita Saha, Tomáš Sába, and Petr Sába	
Cultivating the Impact of Sustainable Entrepreneurship: A Discussion of Upscaling Approaches in Entrepreneurial Ecosystems	241
Kristin Krebs, Christine Volkmann, and Marc Grünhagen	

Part I
Introduction

Artificiality and Sustainability in Entrepreneurship. Exploring the Unforeseen and Paving the Way to a Sustainable Future



Asta Pundziene, Richard Adams, Dietmar Grichnik,
and Christine Volkmann

Abstract This edited collection explores the past, present, and future of artificiality and sustainability in entrepreneurship, the unforeseen consequences, and how to head forward to a sustainable future. First, we integrate the concepts of entrepreneurship and artificiality. We propose that entrepreneurs produce artefacts of entrepreneurship—new ventures, entrepreneurial firms, etc.—that have functions and goals set to respond to the conditions of the diverse environments in which they operate. Second, we contend that the prevailing technological environment can be perceived as an artefact that significantly impacts entrepreneurs, new ventures, and entrepreneurial firms. Digital technologies effectuated new forms of ventures such as born-digital and transformed incumbents to adopt them. Digital technologies come with virtualising our everyday environments and induce behavioral and cognitive changes, which call for new capabilities, e.g., dynamic capabilities. Finally, we conclude with further research questions to be addressed by the entrepreneurship, technology management and sustainability scholars.

Keywords Artificiality · Entrepreneurship · Sustainability · Unforeseen consequences

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1 Introduction

This edited collection explores the past, present, and future of artificiality and sustainability in entrepreneurship—the unforeseen consequences and ways forward to a sustainable future. In particular, we link artificiality, sustainability and entrepreneurship, and the adaptation that is characteristic of the artificial with the specific phenomenon of those novel digital technologies that provoke continuous and significant change in our lives and business. While digital entrepreneurship research focuses on digital technology development and management, this book covers processes and mechanisms of sustainable adaptability of entrepreneurs, start-ups’ business logic, and the collaborative behaviors in the context of digital transformation, including the prevalence of Artificial Intelligence.

The term “artificial” has, in recent years, almost by default, become associated with the science of Artificial Intelligence. Herbert A. Simon’s ideas, as presented in *The Sciences of the Artificial* (Simon, 1996), remind us that the artificial exists as synthesized things—artefacts—which may or may not imitate natural phenomena. Further, artefacts have functions and goals designed in response to the environmental conditions in which they exist. As such, the artificial has a special resonance with the concept of entrepreneurialism. Daily, entrepreneurs design novel and adapted products, services, processes, business models, organizational designs, ventures, relationships, collaborations, ecosystems, discourses, and practices; these may be considered the artefacts of entrepreneurship.

Simon (1996) argued that the core intellectual activity of devising artefacts to attain goals is to change existing situations into desired states. The sustainability agenda, digital transformation, and economic recovery in a post-Covid-19 world indicate possible future desired states. As JG Ballard noted in his novel *Empire of the Sun*, “reality itself is a stage set that can be dismantled literally overnight. Our day-to-day routine, our home life, schools. Nothing is as secure as we like to think it is.”

How has entrepreneurship reacted to such challenges previously? What lessons have been learned and need to be carried forward? How can entrepreneurship and the artefacts of entrepreneurship respond to current challenges? What should be the mindset of the entrepreneur to assure sustainable adaptation? How can we embrace and embed new business logics?

This edited collection contributes to the theory of entrepreneurship in two ways. First, we integrate the concepts of entrepreneurship and artificiality. We propose that entrepreneurs produce artefacts of entrepreneurship—new ventures, entrepreneurial firms, etc.—that have functions and goals set to respond to the conditions of the diverse environments (e.g., business, political, cultural, and technological) in which they operate. This notion helps to translate the principles of artificiality into the framework of entrepreneurship. Second, we contend that the prevailing technological environment can itself be perceived as an artefact that significantly impacts entrepreneurs, new ventures, and entrepreneurial firms. Digital technologies effectuated new forms of ventures such as born-digital and transformed incumbents to adopt them. Digital technologies come along with virtualization of our everyday

environments and induce behavioral and cognitive changes in daily entrepreneurial activities.

Furthermore, the collection contributes to discussions on artificiality by proposing that not only can new ventures and entrepreneurial firms be regarded as artefacts of entrepreneurship, but also their external environment, such as prevailing digital technologies, are an artefact of the innovation economy. To date, external environments, themselves comprised of artefacts, have been regarded as natural or at least not conceptualized as artificial. However, our preceding argument opens a novel perspective that external environments fall under the principle of artificiality on a more macro level. As a result, new research questions arise: how do different artefacts interact? How do higher aggregation level artefacts such as technological environment affect lower aggregation level artefacts such as new ventures and entrepreneurial firms? What are the new challenges entrepreneurs face acknowledging that they create both artefacts—new ventures and their external environments? Finally, what is the typology and hierarchy of the artefacts?

We have organized our chapter to spotlight the phenomenon of artificiality which is less discussed in management and entrepreneurship in particular. Next, we interlink artificiality and sustainability with the theory of entrepreneurship. Finally, after we have defined and explicated the key concepts of the edited collection, we provide analyses of the current research represented by the chapters of the book—the analysis results in distilling the unforeseen consequences of artificiality in sustainable entrepreneurship future research avenues.

2 Defining the Concept of Artificiality

Simon (1996, p. 4) defined artificiality as “produced by art rather than by nature; man-made as opposite to natural.” Simon and Barenfeld (1969) identified four main features which distinguish artificial from natural: (1) artificial things are made by human beings; (2) artificial things can imitate the outlook and presence of natural things; however, they still differ from natural things in different aspects; (3) artificial things are functional, purposeful, and adaptive (molded by the environment); (4) artificial things are described in terms of imperatives and are descriptive. Simon (1996) further argued that when discussing artificial things, we need to consider the purpose or mission as well as features of the artefact, and the environment itself in which artificial things perform. For example, a new venture or an entrepreneurial firm as a human-made artefact can be defined by its mission, which can be in general terms to serve society or earn profits for owners and investors. When we describe the features or characteristics of a new venture or an entrepreneurial firm, we might focus on the number of employees, size of revenues, design of the organization, culture, or other factors. Finally, new ventures and entrepreneurial firms operate in specific environments that mold their performance and impinge on the internal features of an organization (Krippendorff, 2011; Hein & Hein, 2000). For instance, start-ups operating in venture capital intense environments such as Silicon Valley need to

develop an organizational design suitable for rapid scaling: such a requirement is not necessarily echoed for start-ups establishing in less investment intensive regions. Furthermore, with the prevalence of digital technologies in recent years, new ventures and entrepreneurial firms need to adapt to changing technological and thus business, cultural, and political environments. This adaptation brings in several changes in the firm's internal environment—fine tuning the organizational design and relationships with customers, including developing a broader ecosystem, building capabilities, and learning mechanisms to embrace significantly new imperatives (e.g., Simon, 1988; O'Rourke et al., 2020; Milleville-Pennel & Charron, 2015).

3 Artificiality in Entrepreneurship

As discussed above, new ventures or entrepreneurial firms are man-made artefacts. Thus, they comply with all the principles of artificiality. Furthermore, firms interact with artificial environments created by human-made digital technologies. However, there is little research on what happens when artefacts collide, mainly when the second artefact represents an external environment bringing new imperatives to the firm: the meeting of internal and external artefacts.

For example, Milleville-Pennel and Charron (2015), investigating driving simulators versus driving a real car, have distinguished several indicators to measure differences in driver behavior in the different environments. They monitored: (1) behavior validity (the extent to which an actor behaves the same in both “virtual” organization and conventional settings); (2) cognitive validity (similarity of the cognitive functions that are deployed in virtual organization compared with conventional settings); (3) validity of affecting feelings (similarity of feelings [e.g. stress, anxiety, pressure, and feelings of mastery that are boosted in a virtual organization in contrast to conventional settings]); and (4) feeling of presence (a subjective feeling of place illusion and plausibility illusion). These four indicators could be easily translated to entrepreneurship research, to compare born-digital or go-digital firms against conventional start-ups. Most “born-digital” or “go-digital” firms are based solely on the digitalized value chain and business model empowered by digital technology infrastructure (Vadana et al., 2021; Sarasvathy, 2003; Pundziene & Geryba, [Forthcoming](#)). Consequently, the organization itself, relationships, and intra- and inter-unit communications, products and services, and interaction with customers and ecosystem may occur virtually. Thus, considering behavior validity, cognitive validity, and the validity of affecting feelings and feelings of the presence of entrepreneurs (founders and co-founders), investors, boards, and employees more generally is a relevant research question. However, to the best of our knowledge, the field remains under-researched.

4 Sustainability in Entrepreneurship

Most commonly sustainable development is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” according to the United Nations (WCED, 1987). This definition encompasses intra- and inter-generational justice in terms of social, ecological, and economic factors. This combination makes the concept of sustainability highly complex and hard to grasp. The 17 Sustainable Development Goals (SDGs) proposed by the UN (2015) serve as a roadmap towards a global sustainable future for all. Achieving these goals will require an immense effort, nothing short of a “great transition” of our society in numerous ways involving all societal actors.

At the micro-level of this great transition toward a sustainable world, sustainable entrepreneurs are stepping up to advance change alongside political, civil, and other business actors. The genuine economic role of entrepreneurs establishing sustainable ventures and business models will be to provide “future goods and services that sustain the natural and/or communal environment and provide development gain for others” (Shepherd & Patzelt, 2011, p. 632) as well as “promoting sustainable development through entrepreneurial corporate activities” (Lüdeke-Freund 2020, p. 667). However, this will not merely be a conventional function of economic supply. Rather, sustainable entrepreneurs, among others, serve as change agents in this process.

Sustainable entrepreneurs support the above transition via bottom-up “[i]nventions with the potential to create positive ecological and social effects, [however, they] need to leave their niches to turn into effective sustainability innovations” (Lüdeke-Freund 2020, p. 665). To extend their impact from local niches to the regime level (and potentially beyond), sustainable entrepreneurs may cooperate with stakeholders with a sustainability mission in the ecosystem around them acting as “an interconnected group of actors in a local geographical community committed to sustainable development” (O’Shea et al. 2021, p. 1097). The society-wide sustainable transition of, for example, production methods, value chains, or entire industries necessitates change of structures and institutions emerging from institutional entrepreneurs acting as the above change agents (Beckert, 1999). This requirement directly connects the entrepreneurial and the artificial, the inner- and the outer environments, through the notion of designing in respect of a desired future state (Simon & Barenfeld, 1969).

Sustainable development and digitization rank amongst the two greatest challenges, but also opportunities, our society is presently facing. Hence, they are often brought together under the term “twin transition.” The digital age could provide essential technical innovations to achieve decarbonization. However, while digitalization offers a plethora of opportunities to advance sustainable development, if both challenges are not solved with the other in mind, the long-term consequences could also be highly disadvantageous.

A key strategic ingredient of transforming bricks and mortar industries and their traditional supply and value chains will be the accompanying technological

innovation and ongoing digitalization of industrial routines, for example, employing IoT (Internet of Things), VR (virtual reality), or AI (artificial intelligence) technologies in sustainable new venture ideas or sustainable business models at the corporate level. The twin transition towards more sustainability and artificiality in social and economic life is the central arena of sustainable entrepreneurs who merge sustainable business ideas and digital technologies. Yet how entrepreneurs integrate both sustainability and digitalization into their processes remains poorly understood.

Considering this complex transition, entrepreneurs are adopting the role of suppliers of novel sustainable goods and services as well as being agents of change. In addition, sustainable entrepreneurs are also tasked with bearing the risks of exploring alternative promising, yet uncertain, sustainable problem solutions in the decarbonization of different domains of society such as mobility or food production. Towards this end, novel virtual and digital technologies carry great potential, but also encapsulate substantial uncertainty in terms of technical feasibility, societal acceptance, and commercial use. Navigating this unknown future is, and has always been, at the heart of risk-taking sustainable and general entrepreneurship.

5 Unforeseen Consequences of Artificiality in Sustainable Entrepreneurship

Current research on sustainable entrepreneurship in the context of artificial environments such as digital platforms and collaborative virtual environments, media spaces, video conferencing, and telepresence, in general, can be classified into three significant narratives: (1) new venture and entrepreneurial firms adapting to digital transformation and embracing it to open up for new business opportunities; (2) building new capabilities and learning mechanisms to enhance the competitiveness of a new venture or an entrepreneurial firm operating in the market predominated by the artificial environments, and finally, (3) setting new imperatives to relate with the customers and stakeholders in the ecosystems. The most ambitious sustainable entrepreneurs, in contrast to those who aim simply to do less harm or salve consciousness through optically aware CSR activities, intentionally seek net positive environmental and social impacts. As George et al. (2021) indicate, this commitment to transformative change “empowers a system view” that directly connects the inner and outer environments of the firm.

5.1 Embracing Digital Transformation and Opening Up New Business Opportunities

Digitalization and its impact on the internationalization models of SMEs by Aleksandra Gaweł, Katarzyna Mroczek-Dąbrowska and Maciej Pietrzykowski

Digitalization became a game-changing innovation in many aspects, including internationalization of the SMEs. The chapter poses an important question—how has digital transformation affected internationalization models of Polish SMEs? Based on a quasi-focus group study, the authors explore the unexpected consequences of digitalization in building competitive internationalization models. Several insights are offered at this point: digitalization shifted the notion of network from relatively small and co-dependent circle of partners to limitless, platform-like network of stakeholders; SMEs pursuing internationalization are keen to create and maintain excellent reputation, especially in that way addressing potential and still unknown partners; finally, digitalization shifted the focus from market knowledge and business experience to digital capabilities and maturity. The authors conclude that based on their exploratory study, Polish SMEs less acknowledge “stage model” and more appreciate “resource-based” internationalization model. This can be explained by increasing value of the digital capabilities and proficiency in contrast to operationally defining consecutive steps of international expansion.

Born digitals: understanding the sustainable competitive advantage across different markets
by Jurgita Sekliuckiene

The digitization of business is one of the driving forces in today’s environment and appears to be an irreversible trend. Currently, we are seeing a digital transformation of companies and the emergence of companies that are digital from the start. Such born-digital companies have characteristics that enable them to expand rapidly in international markets and remain competitive in the long term. *Born digitals: understanding the sustainable competitive advantage across different markets* aims to analyze the characteristics of born-digital companies that lead to sustainable competitive advantage and develop a conceptual model that will serve as a basis for future research. Several sources of competitive advantage for digital companies are identified, such as innovativeness, creativity, responsiveness, digital technology, and digital workforce capabilities. A key finding relates to the role of creativity in the responsiveness of born-digital enterprises in times of change—a characteristic that supports their sustainable competitiveness. The newly defined characteristics and sources of competitive advantage of born digitals should conceptualize the approach of their competitive advantage across different markets as a complex dynamic construct that includes technology advantages, human capital advantages, and differentiation advantages.

The Value Chain Configuration in the Digital Entrepreneurship Age: Location Decisions and the Paradoxical Role of Digital Technologies by Zulima Fern Ández and Alicia Rodríguez

The Value Chain Configuration in the Digital Entrepreneurship Age: Location Decisions and the Paradoxical Role of Digital Technologies examines the relationship between Digital Entrepreneurship and Global Value Chains (GVCs). The analysis of the configuration of GVCs in the digital entrepreneurship age is presented by clarifying past contributions, examining work resulting from the Covid-19 pandemic, and outlining suggestions for future research. The chapter provides a

conceptual framework to understand the impact of Digital Technologies (DTs) on Digital Entrepreneurship, and how this impact is driving the transformation of GVCs. The framework also considers the impact of Covid-19, the new opportunities created for Digital Entrepreneurship, and consequences of Covid-19's on various other factors impacting GVCs.

The digital transformation of the global economy represents a shift to a new technological paradigm and, so, opportunities for the *creative destruction* that Schumpeter wrote of. In other words, a new landscape in which entrepreneurs can discover and launch new value-creating opportunities. At the heart of the chapter is a discussion of what the authors regard as the paradox the digital technologies bring to global value chains: the facility to extend or contract value chains. This is framed as the location paradox, the idea that digital technologies help firms to expand their geographical scope and reduce co-ordination costs in large and dispersed networks (which favours offshoring) while reducing the importance of the location of activities and shortening supply chains (which favours reshoring).

This chapter critically reviews the research on value chain configurations that has appeared as a result of the Covid-19 pandemic. And it also presents that Covid-19 has accelerated digital transformation upon which many sustainable competitive advantages for firms may depend. Further, it proposes that examination of the intersection between the literature on Digital Entrepreneurship, GVCs and Sustainability could be hugely important for the configuration of more sustainable value chains.

This chapter concludes with identifying promising areas of research that could yield insights that will advance the understanding of value chain configurations in the digital entrepreneurship age. The areas of research opportunities are presented in three sets: the specificities of different DTs and locations; new digital business models; and digital sustainability.

Entrepreneurial Thinking and Acting in the Context of Great Transformations in Germany—On the Relevance and Potential of Erschließung as an Integrative Approach by Ulrich Braukmann, Dominik Bartsch, Larissa Sternkopf and Thomas Schauf

Digital and sustainability transformation as an artefact of the global innovation economy inflict changes on the level of economy, politics, and society in Germany. Entrepreneurial mindset is seen as relevant measure to address these changes. The authors of the chapter aim to answer the question of how entrepreneurs and entrepreneurial organizations in Germany can effectively and legitimately engage in the Great Transformations of digitalization and sustainability and proactively shape them. As a result of the study four characteristics of the Great transformation are defined: a long-lasting nature which leads to the fundamental changes; big complexity and interdependencies; significant impact on societal changes; global reach of the Great Transformations. Consequently, digitalization and sustainability transformation cause “fundamental, intergenerational, intertemporal and international” challenges that are non-trivial. The solution can be offered by innovation intensive, sustainable entrepreneurial ventures that shift challenges into opportunities and develop new products, services, and processes that can drive less sustainable

products and service out of the market. Finally, the authors propose a number of future research avenues leading to a deeper understanding of the impact of Great Transformations on macro and organizational levels.

5.2 Building New Capabilities and Learning Mechanisms to Enhance Competitiveness in the Market Predominated by the Artificial Environments

The Evolution of the Dynamic Capabilities Framework by David J. Teece

David Teece's Dynamic Capabilities Framework has changed the way research looks at the innovation potential of companies. What distinguishes this framework from other perspectives on innovation is the dynamic nature with which we look at resources and capabilities of companies. And this is where entrepreneurship comes in. In this chapter "The Evolution of the Dynamic Capabilities Framework," Teece speaks of dynamic capability management, which must be entrepreneurial. Entrepreneurship takes place in a highly complex and dynamic context. Sustainability and artificiality in entrepreneurship are emerging relevant concepts that bring these dynamics in their ongoing evolution. Therefore, we cannot dive deeper into the different areas of these concepts without applying the flexible perspective that the Dynamic Capabilities Framework offers us.

Transforming a Highly Tactile Entrepreneurship Course "Ideas to Innovation" to an Entirely Online Delivery Model: Lessons for Theory and Practice by Egle Vaiciukynaite, Orsolya Ihasz, Sergey Portyanko and Shailendra Vyakarnam

Long-lasting sustainability requires that practices can be adapted and flexibly adjusted to continue their success. However, maintaining successful practices was particularly difficult during Covid-19. Most importantly, new ways of learning had to be devised. This was particularly difficult in entrepreneurship education, where physical interactions to share ideas and expand one's network are crucial. In this chapter "Transforming a Highly Tactile Entrepreneurship Course 'Ideas to Innovation' to an Entirely Online Delivery Model: Lessons for Theory and Practice" Vaiciukynaite et al. detail how the Ideas to Innovation course was redesigned for a remote online environment, yet achieved the same goals as physically collocated entrepreneurship training. The authors describe their journey, the obstacles they faced, and their recommendations for how digital interaction and collaboration can be facilitated to promote entrepreneurial self-efficacy and the development of an entrepreneurial mindset.

Applying eye-tracking technologies in the field of entrepreneurial education by Lina Kaminskienė, Ling Yi Chu and Kateryna Horlenko

Eye-tracking application in social sciences, including entrepreneurship education, has increased significantly. Traditional research with eye-tracking applications mainly concentrates on visual aspects in the learning process, including text

comprehension. A growing area of eye-tracking technologies is focused on entrepreneurship education, including teacher education, as schools are considered an essential stage for developing entrepreneurial competencies. However, as the field has evolved, it is time to take stock of the research that has been conducted and examine the growing methodological challenges associated with eye-tracking technology. The chapter in this book attempts to synthesize the current state of research, including its application and limitations, and offers fruitful ideas for future research.

5.3 *Setting New Imperatives to Relate with the Customers and Stakeholders in the Ecosystems*

Solutions of brand posts on Facebook to increase customer engagement using the Random Forest prediction model by Egle Vaiciukynaite, Ineta Zickute and Justas Salkevicius

Arguably, social media platforms have become the de facto archetypical artefact of the digital transformation of social and economic activity, both disrupting business models and providing opportunities for new. The context for the chapter *Solutions of brand posts on Facebook to increase customer engagement using the Random Forest prediction model* is the dilemma presented to businesses in managing the increasing use of social media platforms for a variety of purposes and the concurrent lack of predictability of the outcomes, in terms of customer engagement, of those efforts.

To address this, the authors look to predict Customer Engagement Behaviour (CEB), comprising of likes, shares, comments, and emoji reactions, by users of social media platforms on brand posts (posts by businesses) on social media platforms—in this case, Facebook in Lithuania. Specifically, the authors address the question “How to predict Customer Engagement Behaviours on Facebook based on features of a company’s posts (e.g., content types, media types, emotional cues)?”

Empirical data were collected from a sample of 1109 brand posts on Facebook pages of businesses based in Lithuania. The data were used to train models, based on the Random Forest method, to predict customer engagement behaviour based on features of brand posts, including time frame, content, and media type. A collection of nine binary classification models is created that can predict the popularity of a company’s post. Learning from the extant literature, a predictive model of CEB on Facebook is created and is trained based on the gathered data set. The study provides evidence to suggest that both the time frame and content types of brand posts matter for CEB on Facebook prediction. The findings support different drivers of posts that influence the number of likes and comments on Facebook and identify features that can be added to existing classifications of brand posts for improved customer engagement.

The chapter concludes that this approach to features of brand posts might be applied to other social media platforms such as Instagram and LinkedIn. The findings from this research may help organizations strategize to increase customer

engagement on social media and guide scholars for future research on brand posts on social media.

Entrepreneurial University and Social Innovation Ecosystems: Do They support HEIs knowledge-based Economic Development? by Nibedita Saha, Tomas Sáha and Petr Sáha

In general, universities and Higher Education Institutions (HEI) are shifting toward active players in the innovation and entrepreneurship ecosystem. University–Business interaction creates a mutual benefit through sharing knowledge relevant to advancing the entrepreneurial university’s social innovation ecosystem and sustainability. The authors aim to explore the nexus of the entrepreneurial university and the social innovation ecosystem that produce knowledge spillover. The study provides insights into how HEIs knowledge development approaches enact mechanisms that stimulate entrepreneurial mindset and spirit through leadership and governance.

Cultivating the impact of sustainable entrepreneurship—a discussion of upscaling approaches in sustainable entrepreneurial ecosystems by Kristin Krebs, Christine Volkmann and Marc Grünhagen

The Chapter seeks to build a discussion around the research question—how do entrepreneurial ecosystems support upscaling sustainable ventures and help them overcome associated barriers and dilemmas? The authors integrate existing knowledge on upscaling sustainable innovations and entrepreneurial ecosystem support for sustainable ventures. In the context of artificiality and sustainable entrepreneurship this chapter draws attention of the reader to engage stakeholders of the entrepreneurial ecosystems to support upscaling of the sustainable innovations in all its phases. Authors contend that, at present, the main focus of scholars has been on the early-stages of the formation of the sustainable ventures and their economic success. However, to upscale sustainable innovations new metrics of sustainable performance are needed to ensure the attention of all stakeholders in the entrepreneurial ecosystems. The chapter suggests that entrepreneurial ecosystems need to embrace non-economic performance of the sustainable ventures and appreciate their contribution in solving societal challenges. The unexpected consequences of the artefact of the sustainable ventures is that entrepreneurial ecosystems stumble to build and maintain sustainability orientation through the long term, especially when sustainable ventures require significant support in all phases of the upscaling.

6 Paving the Way for the Sustainable Future of Entrepreneurship in Artificial Environments

In their Academy of Management Review article Reflections on the 2010 AMR decade award: whither the promise? Moving forward with entrepreneurship as a science of the artificial, Venkataraman et al. (2012: 30) suggest that “Artefacts resulting from entrepreneurial actions and interactions embody knowledge combined with use in ways that transform the extant world into new opportunities.

These opportunities allow us not only to fashion new ways to achieve old ends but also to fabricate new ends.” In this edited collection, we have sought to illustrate these possibilities with an exploration of the past, present, and future of artificiality and sustainability in entrepreneurship, the unforeseen consequences, and how to head forward to a sustainable future. The concept of “Artificiality” was introduced by H.A. Simon, in his book “The Science of the Artificial” in 1969. Since then, the concept has been rooted in humanities, psychology, design and information and communication theory. However, much less the “Artificiality” concept was applied in management and business, including entrepreneurship. Simon himself was very limited in mentioning entrepreneurship in his works. Despite that, the concept of artificiality makes a significant contribution to the entrepreneurship literature by drawing the attention of entrepreneurs and other stakeholders in the entrepreneurship and innovation ecosystem to the possible consequences of the human-made artefacts (Benford et al., 1996). This calls for more attention to be paid to the sustainable entrepreneurship concept that, according to Shepherd and Patzelt (2011) and Lüdeke-Freund (2020), acknowledges innovative products/ services that sustain natural environments and assure development gain to other.

Consequently, the Edited collection based on the results of the diverse studies posed new questions that can serve as future research avenues. For example, how to assure sustainable internationalization of SMEs while shifting the focus from *market knowledge* and *business experience* to *digital capabilities and maturity*? How *born-digital enterprises* in times of change can build and maintain sustainable competitiveness? What is “Great transformation” and how innovative enterprises can help to diffuse more sustainable approach into the entrepreneurship and innovation ecosystem? Furthermore, still we need to explore the specificities of different digital technologies, new digital business models and digital sustainability.

Another robust set of future research question is around the capabilities sustainable entrepreneurs and ventures need. Still we have limited understanding in what are dynamic capabilities that assure competitiveness of born-digital ventures, ventures shifting towards digital and successful growth of the digital ventures. How we can better use digital technologies to educate a new generation of sustainable digital entrepreneurs?

Finally, despite the growing body of research on ecosystems, still there is room for new insights on sustainable customers’ engagement, the role of entrepreneurial university and how to develop social innovation ecosystem. Last but not least, how to maintain sustainable orientation of the ventures over longtime horizons? What is the role of each stakeholder of the entrepreneurial ecosystem in assuring long standing ventures’ sustainability focus?

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Part II
Embracing Digital Transformation
and Opening Up New Business
Opportunities

Digitalization and Its Impact on the Internationalization Models of SMEs



Aleksandra Gawel, Katarzyna Mroczek-Dąbrowska,
and Maciej Pietrzykowski

Abstract In the European Union, SMEs represent as much as 99% of businesses, but only 3 out of 10 companies have some international involvement. EU policy makers perceive SMEs internationalization as a desired path for global growth; thus, they have put forward certain tools which aim to boost the pace and scope of internationalization, i.e., by creating and facilitating access to support activities, sharing information, promoting cluster and networking initiatives, making support schemes consistent throughout the EU, etc. (Della Corte, Handbook of research on strategic Management in Small and Medium Enterprises. IGI Global, 2014). However, a vital point in creating a successful internationalization framework requires understanding that SMEs internationalization models may and do differ from those of multinational enterprises (MNEs). SMEs have a different structure, and they act differently, since their aims vary from those of MNEs (Knight and Liesch, Journal of World Business 51(1): 93–102, 2016; Buckley, Journal of World Business, 51(1): 74–82, 2016).

Former studies of European SMEs indicate that there are specific traits of company characteristics that determine their internationalization process. Amongst the distinguished factors, size, activities performed, age, and experience counted as the most significant determinants of the expansion. However, these findings refer to occurrences dating back at least 5 years. In the era of rapid digitalization and—still—ongoing globalization, the impact of these factors might have diminished, making place for others. Therefore, the rising importance of digitalization calls for the need to identify new barriers and opportunities for SMEs to become international.

The aim of this chapter is to see whether and how digitalization has influenced the internationalization models of Polish SMEs. We do not provide quantitative analysis that would allow us to statistically verify hypotheses on that matter; however, given the recent developments of the business world and internationalization trends, we assume that digitalization has had an impact on how companies expand abroad nowadays. The study has a screening aim and should allow us to determine whether,

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19

in the case of the Polish context, the matter requires further pursuit. The remainder of this chapter is structured as follows: first, we discuss the internationalization models which commonly referred to the international expansion of SMEs. Secondly, we discuss how digitalization can influence the process and its determinants. Finally, we present our research results based on quasi-focus group discussion with Polish SMEs. The study concerned the impact the digitalization has on the internationalization experience of those companies.

Keywords Digitalization · Internationalization · SME · Poland

1 Selected Internationalization Models of SMEs

Internationalization means having some international involvement. Scholars distinguish between active internationalization, which means expanding the geographical range of the company, and passive internationalization, which refers to sourcing goods and services from abroad. The internationalization models discussed here concern the active approach, since such activities are said to boost growth, reduce unemployment, and enhance competitiveness. Internationalization is a phenomenon that accelerated in the 1920s (Ruzzier et al., 2006) and, due to globalization gained, strength and impact. Therefore, observing the business reality, scholars conceptualized the internationalization processes into models that were (and sometimes still are) specific to certain company groups.

One of the models that played a key role in explaining the internationalization process is the so-called Uppsala model, otherwise known as the dynamic sequential model. This framework, conceptualized in the 1970s, explains the process of a firm's internationalization; namely, how organizations learn and how their learning path impacts companies' international expansion. The dynamic model claims companies undertake expansion in a stepwise and orderly manner. They increase their commitment in both markets and operations. Firms are expected to start their operations in close markets, i.e., markets close to the domestic one in terms of psychic distance. They are also said to start with modes that do not require much investment, which means they start with the non-equity modes and later turn to equity ones. In time, organizations would change by learning from their experience. They would also extend the scope of their operations, starting with sales and marketing, and later moving on to production, R&D, finance, and others. Incremental expansion also concerns the number and types of products and services offered in foreign markets, which increase over time. The sequential model assumes that in time, companies deepen their dependence on their business functions, like marketing, production, finance, personnel, and administration in international markets. Along with the new entries, they also deepen the degree of penetration in already acquired markets. The Uppsala model was criticized for its deterministic nature. Companies said to internationalize in stages would have no real strategic choices (Chetty, 1999). Also, the appearance and spread of the so-called born-globals seems to prove that the model is losing its bearing on contemporary businesses.

Table 1 Determinants of internationalization process—cross-comparison of chosen models

Determinants of internationalization process		
Stage approach	Resource-based approach	Networking approach
Geographical distance	Network-oriented resources	
Cultural distance		
Time		
Firm-oriented resources		Reputation
		Industry pressure
Knowledge		

Source: own elaboration

The business network internationalization process model was developed as an answer to the changes in business practices and theoretical advances which have occurred since 1977. Companies are embedded into a business network, and therefore, market entry should not be considered as a decision of modes of entry, but instead as a position-building process in a foreign market network. Anything that happens does so in the context of a relationship. International expansion “is pursued within a network.” Internal network relations are characterized by specific levels of knowledge, trust, and commitment, which vary between the network members, and therefore, they may differ in how they approach the internationalization process. The speed, intensity, and efficiency of the learning processes, knowledge creation, and trust building depend on the existing level of these factors, and especially on the extent to which the partners find given opportunities appealing. The business network ceases to see the firm as a production unit and starts perceiving it as an exchange unit. Therefore, for them, we no longer talk of the internationalization of a unit, but of the entire network. The network may also be driven to internationalization by environmental push factors, which aim to increase the competitiveness level of the entities involved (c.f. Kania, 2019).

The resource-based view originates from strategic management, where a company seeks a source of competitive advantage in its competences and resources. Likewise, a company’s ability to seek, seize, and attain position in international markets can also stem from the company’s unique capabilities and resources (cf. Conner, 1991). The importance of intangible, knowledge-based resources is especially emphasized. In reference to SMEs, however, some scholars point to the fact that it lacks explanatory power. SMEs tend to be heterogenic, and identifying the resources critical for internationalization is difficult to achieve.

As Table 1 indicates, the internationalization models draw on one another. The stage approach and resource-based approach both emphasize the importance of experience and knowledge in venturing abroad. It is also vital to stress the dependence between knowledge and resource commitment. The resources committed will translate into a greater degree of internationalization and complexity and that in return should result in accumulated knowledge on the internationalization process. Similarly, one can also indicate commonalities between the resource-based internationalization approach and the networking approach. Some claim that both

perspectives evolve hand-in-hand (Ruzzier et al., 2006). Companies create their resource not only internally, but especially through network interactions. Therefore, the control over and interdependence of the resources crucial for internationalization can be network-based.

To give a fuller perspective on the internationalization models of the SMEs, it is crucial to mention the international entrepreneur approach where the time of internationalization is emphasized. Since entrepreneurship by nature is size-limited, internationalization is normally driven by the entrepreneur's abilities to innovate. In the internationalization process, what counts is not only the innovation's feasibility to be introduced; the key element is also the timing, which needs to be quick (c.f. McDougall & Oviatt, 2000). That links directly to the concept of born globals, companies which internationalize quickly after launching their market activities.

Given the fact that the discussed models have been developed mostly based on MNEs, there is a lasting doubt as to their fitness for SMEs' internationalization path. The SMEs suffer from the "liability of smallness" (Aldrich & Auster, 1986), "liability of newness" (Freeman et al., 1983), "liability of foreignness" (Mezias, 2002; Zaheer, 1995), and "liability of outsidership" (Johanson & Vahlne, 2009), meaning that they have fewer resources, lower reputation reach, lower knowledge of international markets, and a lesser position in the international networks. This used to mean a greater shock when expanding abroad (Morais and Ferreira, 2020). Morais and Ferreira (2020) conducted a systematic literature review which indicates that SMEs—depending on the context—seem to follow different internationalization models. It is, however, impossible to pinpoint which of the perspectives—in case of SMEs—is superior in comparison to others. Therefore, scholars recognize the need to combine ideas stemming from different frameworks and not base their assumptions on one approach only (c.f. Vahlne & Ivarsson, 2014). It is also commonly acknowledged that although MNEs and SMEs differ structurally, they need to overcome similar internal and external barriers in the process of internationalization (García-Álvarez de Perea et al., 2019). They are also all prone to the pressure of globalization that makes the internationalization processes more alike. Some scholars claim that MNEs are no longer viewed as big global monoliths but rather as subunits of MNEs that follow their own internationalization paths and in this regard are similar to SMEs (Borghoff & Welge, 2001). Therefore, although the discussed models—and the stage model especially—are well-recognized approaches in discussing MNEs' expansion, they are equally suited for analyzing the SMEs internationalization processes. The Uppsala model is known for its general validity which makes it both its strength and weakness at the same time, but this unambiguously points to the fact that it can be applied to SMEs as well. The networking approach, on the other hand, is also applicable as the network is generally seen as a tool allowing the SMEs to combat size-related disadvantages when entering the foreign markets. However, recently, a more pressing issue has emerged as to which of the factors discussed as determinants of the internationalization process were influenced by the digitalization effect.

2 Digitalisation Impact on Business

Digitalization and digital transformation have a variety of definitions and dimensions. Gartner (2018) defines digitalization as “the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.” Mazzone (2014) treats digital transformation as the intentional and continuous process of digital evolution of a company business model at strategic and tactical levels. PwC (2013, cited in Schallmo et al., 2017, p. 3) perceives it as “the fundamental transformation of the entire business world through the establishment of new technologies based on the internet, with a fundamental impact on society as a whole.” Boueé and Schaible (2015), cited in Schallmo et al., 2017, p. 3) consider it as a “consistent networking of all sectors of the economy and adjustment of the players to the new realities of the digital economy. Decisions in networked systems include data exchange and analysis, calculation, and evaluation of options, as well as initiation of actions and the introduction of consequences.” Although digital transformation might be similar to Business Process Reengineering, as it aims to reduce costs, changing the determinant of competitive advantages (within value chain) and improving the quality of goods and services, there are some distinct differences between those two notions (Schallmo et al., 2017). As we refer to digitalization in the manufacturing sector, with embedded sensors in virtually all product components and manufacturing equipment, ubiquitous cyberphysical systems, and analysis of all relevant data, we come to the concept of Industry 4.0 (McKinsey and Company, 2015). Industry 4.0 is a collective term for “technical innovation” and the concept of value chain organization. Industry 4.0 is based on two fundamental foundations: the “Internet of Things,” allowing for global access to data and machines, and “machine intelligence,” enabling full autonomy of the production processes. It is nothing more than implementing solutions which allow collection of data and the aim of process optimization, which links this notion to business process reengineering. This is also a combination of the production machines operating in real world with the virtual world of data. This continuous exchange of information between the real and virtual worlds enables the reengineering of processes that should result in higher efficiency in production.

The digitization of the global economy certainly is a process which dynamically changes the conditions for the functioning of enterprises on a global scale and challenges the competitive advantages of well-established business; it also creates conditions for transforming the existing business models and creating new ones. This process creates a great opportunity for the implementation of new solutions—innovations—but it also carries a number of threats for those companies that cannot find themselves in the new reality, or are unable to generate or buy new technological solutions. The digital transformation affects individual industries to a different extent. According to research conducted by The Global Centre for Digital Transformation among 1200 business leaders, presented in the Digital Vortex report (Yokoi et al., 2019), the most radical changes await data-driven industries, such as Media &

Entertainment, Technology Products and Services, Telecommunications or Retail. In turn, the sectors most resistant to digital transformation include real estate, construction, energy, utilities, manufacturing, health, and pharmaceuticals. What is more, the impact of the digital transformation grows—in 2019, 88% of executives believed that digital disruption will have a major or transformative impact on their industries, while in 2015, only 27% of managers had such an opinion (Yokoi et al., 2019).

What primarily drives the pace of the digitalization are: internet of things, cloud computing, big data analytics, automation of production processes, and robotization, together with hyperconnectivity. The Roland Berger consulting group in its 2015 report identified four levers of the digital transformation process, supported by enablers and propositions (Roland Berger BDI, 2015):

1. Automation (with additive manufacturing and robotic as enablers)
2. Digital data (with internet of things, big data, and wearables as enablers)
3. Digital customer access (with social networks and mobile apps as enablers)
4. Connectivity (with cloud computing and broadband as enablers)

Enablers serve to enable services or process applications to be used for the transformation of business models. All these supporting technologies and propositions prepare the ground for a disruptive development of the business and accelerate its pace. The faster the pace and the larger and more synergetic the combination of individual technologies is, the greater the combination of individual technologies; thus, investing in a wider number of digital technologies increases the chance of achieving a competitive advantage. The main areas in which enterprises benefit from participation in digital transformation are as follows:

1. Efficiency and process optimization—due to networking and cross-linking of production, enterprises can produce more economically and respond faster to individual customer needs – greater automation and robotics, fast data exchange enabling almost immediate decision-making, improved productivity; reduction of costs (optimized manufacturing process, fast information about possible and real breakdowns, customer expectations, wider variety of deliverers, robotics and automatization of many production processes), optimized decision-making process due to accurate analysis of data, and the higher agility of the company's operations.
2. Innovativeness – digitization forces investments in modern technologies, while increasing the effectiveness of both basic and applied research. This results in new technologies, new operating models, new methods of communication with customers, faster response to changes and customer expectations, and faster adaptation to market conditions.
3. Access to a wider market—digitalisation of products and services together with wider marketing options offers an opportunity to go beyond local and national markets.

4. Employment—digitalisation gives an option of remote working which together with wide specialization and possibility of subcontracting employees from distant countries guaranties much more options in HRM.

In 2015, McKinsey asked 300 experts from all relevant industries about the impact of digitization. The most profound conclusions were as follows (McKinsey and Company, 2015):

- (a) Companies are still careful as far as investing in industry 4.0 is regarded—it is about 15% of all R&D spending.
- (b) 80% of respondents expect the impact of digitization on the current business model.
- (c) Companies expect an increase of productivity by 26% and revenues by 23% in the next few years.
- (d) Labor, quality, and development time are considered to be the main areas of improvement, mostly in knowledge work, advanced analytics, and touch operations/interfaces.
- (e) The biggest obstacles are: process and control know-how for employees, data security and safe-guarding systems, a uniform standard for data transfer, and end-to-end connectivity via wireless networks.
- (f) Companies are reluctant about hiring foreign IT providers because of cybersecuri-ty concerns.

The effects of digitization are visible not only at the level of processes, but also management. As a company wants to benefit from digital transformation, it must first diagnose which areas have the potential for implementing new solutions. Only after identifying these areas can the company search for a technological partner and appropriate tools, tailored to the scale of the operation. The search for the right technology and partners is also a matter of operational and strategic management. It is a matter of calculating risk and matching financial patterns. Modern technologies are expensive, so implementing temporary solutions will certainly not bring the expected benefits. Entering modern technologies is a strategic decision that must result from far-reaching plans for production planning, but also the choice of markets, customer segments, sales policies, logistics partners and distribution networks. There is potential for change in all of these areas, but decisions must be well-thought-out, and in particular, comprehensive and integrated, embracing the company's overall policy, in pursuit of the strategic vision.

3 Digitalization Impact on the Internationalization Process of Companies: Evidence from the Past

The advance in digital technologies has inevitably led to the transformation of business models that are now based on usage of data and online systems (c.f. Hervé et al., 2020). The increased significance of digitalization has caused a

change in how one perceives internationalization, though studies on the matter are still relatively scarce (e.g., Brouthers et al., 2016; Wittkop et al., 2018). The use of digital tools—especially through e-commerce—may impact a company’s choices of location and entry modes, internationalization speed and degree, resource accessibility, and company’s learning and adaptation curves (Coviello et al., 2017).

This draws attention to the issue of whether the so-far established internationalization models are still valid, or whether they should be adapted to the challenges and opportunities of the digital world. With the “dematerialization” of borders, the issue goes so far as to question the essence of internationalization, since trade can be performed with minor adjustments on a global scale without much hassle. Companies may mark their international presence not only by establishing tangible links to certain markets, but by offering their products and services via online platforms. However, the issue is more complex. Digitalization affects not only the way companies attract new customers (pull effect), but also the way they attempt the internationalization steps in more traditional approach towards internationalization. Digitalization should enable companies to establish themselves among the local networks with more ease and shorten the time companies require to analyze markets or increase the efficiency of executing transactions (Neubert, 2018; Witten et al., 2016).

Neubert (2018) explores how digitalization impacts international marketing and international entrepreneurship. With the use of multiple case studies, he analyzes how beneficial the application of new technologies in companies’ foreign activities may become. Zhu and Qian (2015), and Nummela et al. (2004) look into the determinants of digital companies’ rapid internationalization. In most such studies involving digitalization, however, researchers focus on the internationalization outcome and not the process itself. If they relate to internationalization models, they mostly invoke the stage model(s) and the effect the digitalization exerts on internationalization speed. Still, general research underestimates or rather neglects the impact digitalization has on internationalization and the need for conceptualizing digitalized or digitalizing firms (Neubert, 2018). The reason is quite simple—the issue is still novel and the data on the matter is lacking. Scholars suggest (e.g., Vahlne & Johanson, 2017) introducing qualitative analyses to explore the relationship between digitalization and foreign market entries that would enable us to find a starting point for discussion on the internationalization models’ adjustment to the digitalization effect.

In the remainder of our study, we address the gap identified by Neubert (2018), and with the use of an empirical, qualitative study, we focus on establishing what impact digitalization has on the established internationalization models. We do not focus on determinants of rapid foreign expansion, nor do we question the degree of internationalization or performance. By analyzing the companies’ approach toward the digitalization and internationalization process, we verify whether the main assumptions of the stage models, networking, and resource-based models changed significantly and in what way. It is vital to stress that so far, most research focusing on the digitalization-internationalization co-dependence paid little attention to company type. In our research, we include only SMEs, which will also impact the

conclusions we draw about the internationalization model's validity. Based on the theoretical discussion, the following research questions are asked:

RQ1 How does digitalization impact the internationalization process of companies?

RQ2 To what extent should the main assumptions of the stage models, networking, and resource-based models be changed while internationalization is supported by digitalization?

4 Methods and Research Assumption

4.1 Method and Data Collection

The nature of the research problem determined the choice of the qualitative research method. Initially, we intended to implement the focus group discussion to deepen discussion and understanding of the problem of impacting the digitalization exerts on the Polish SMEs internationalization process. Preparing for leading the discussion in focus group, we enumerated the main problems to discuss, defined the representatives of SMEs as participants, and prepared the time and space for it. The study was supposed to be conducted on March 25, 2020. However, the lockdown introduced in the middle of March 2020 due to the COVID-19 pandemic forced us to rethink our initial research strategy. When the pandemic situation stabilized in June 2020, before the second wave of the pandemic, we decided to conduct the research with the use of a hybrid research method. We kept the initial topics to discuss with SMEs representatives; we arranged for online quasi-focus discussion, but as the possibilities of free discussion were limited, later on we asked all participants to write down their reflections on the issues raised. As not all initially invited participants were able to join this online quasi-focus discussion, we had several one-to-one online meetings or phone calls to express the main research problem and ask participants to write down their reflections as well. Finally, we collected SMEs representatives' opinions between 15/06/2020 and 04/07/2020.

Using such a hybrid method, we managed to collect the opinions of 16 representatives of SMEs in Poland. Over half of participants were between 41 and 50 years old (9 of 16), 5 persons were between 31 and 40 years old, one person was less than 30 and another was more than 51. The group was represented by 6 women and 10 men, which also reflects the existing gender gap in entrepreneurship in Poland. All participants had higher education, and half of them reported more than 21 years of professional experience, while six participants were slightly less experienced (11–20 years). Not all participants claimed knowledge of foreign languages, but among those who did, most can communicate in English or German, and almost half of participants claimed to speak at least two foreign languages. Regarding the participants' experience with internationalization, they represented three groups. The largest group of participants (seven participants out of 16 in total) were actively internationalized and worked as export and/or import managers, or managers of

international companies, being responsible for international sales across Europe and out of Europe, mostly Asia. The second largest group (five participants of 16 in total) consisted of participants with minor internationalization experience, but who were considering going abroad with their market activities or had just started to go international. Their experience was mostly related to global market analyses, or to making some preparations to become international or already obtaining their first two international clients. The third group of participants (four participants of 16 in total) were consultants specializing in supporting other companies in becoming international by delivering strategic or financial consulting services. To sum up, the participant group in Poland consisted of well-educated and highly-experienced representatives of SMEs.

4.2 Issues in Focus Group

Before we started the discussion, we made some clarifications about the meaning of internationalization and digital internationalization, as they are broad concepts and we wanted to be well understood. We explained that in our quasi-focus research, internationalization meant any activity undertaken abroad by a company, mostly in the context of selling products or services in international markets. Digital internationalization was understood here as company's activities in international markets undertaken with the support of digital tools, for example, selling products abroad with the use of an e-commerce platform.

Within our quasi-focused research, we discussed seven issues related to two groups of topics. First, we wished to get the opinions of participants on internationalization in general, to get a starting point for understanding their perspective, and to be able to compare it with internationalization supported by digitalization. Specifically, we explored the following themes:

1. Participants' opinions on factors supporting internationalization
2. Factors limiting internationalization
3. The skills and competences needed to become international

The second group of topics was crucial for the research, as it concerned the impact of digitalization on companies' internationalization. We discussed the following issues:

4. To what extent digitalization can support the internationalization of companies
5. To what extent digitalization can limit the internationalization of companies
6. How internationalization can benefit the most from implementing digitalization
7. Which digital skills and competences are most needed to support internationalization

The topics discussed referred closely to the assumptions of the commonly acknowledged internationalization models, i.e., the sequential dynamic model, the networking approach, and the resource-based perspective.

4.3 Data Analysis

Due to the hybrid manner of conducting the research, we made transcriptions of the discussions but we also asked participants to write down their opinions and send them to us. The analysis was based on an inductive approach with qualitative content analysis and was divided into three steps. During the first step of the analysis, we read participants' opinions several times to realize the main meanings and to code them. Then, in the second step, we combined them into categories. Finally, we analyzed the frequency of similarities and differences in participants' opinions. Details of themes of quasi-focus discussion, opinions, and categories are presented in Table 2.

5 Digitalization in Shaping the Process of Internationalization: Research Results

5.1 Internationalization Process in Opinions of Participants

The first part of the quasi-focus research was to collect opinions on factors determining internationalization both positively and negatively. According to our participants, such factors can be divided into the following categories: global trends (i.e., macroeconomic trends, unification, liberalism, decentralization and globalization, economic growth, e-commerce); the business global environment (i.e., formal environment of contracting, law and taxes, support for both local and governmental institutions, easy logistics), the company's resources (i.e., competitive products, the international network and local agent, skilled employees, communication skills, market knowledge and understanding, knowledge of foreign languages, awareness of cultural differences, and business experience), and the company's behavior (i.e., gathering and sharing information, use of ICT technology, online sales and marketing, and participation in international fairs). Among those factors, the most frequently indicated are awareness of cultural differences, knowledge of foreign languages, and formal environment (contracts, law, taxes). There is one more factor mentioned by participants, but surprisingly only as a factor limiting the internationalization; namely, the institutional factor, explained in the context of informal institutions such as religion, stereotypes or conservatism, and formal institutions, such as a poor educational system, politics, trade protectionism, or time shift.

Based on the participants' answers, four groups of skills and competences are indicated as essential for a company to become international. The first group is related to the personality factors of entrepreneurs, managers, and employees, which consists of such traits as being open-minded, courageous, curious, well-organized, flexible, optimistic, independent, being quick learner. The second group involves skills developed by education and learning, which include: foreign language skills, communication (also cross-cultural), emotional intelligence, cultural awareness,

Table 2 Overview of issues, opinions, and categories

Themes	Opinions	Category
Factors supporting internationalization	Skilled employees; knowledge exchange; market knowledge; knowledge of foreign languages; knowledge of cultural differences	Knowledge
	Business experience; deep understanding of target markets	Understanding
	Formal aspects (law, taxes, contracts, law, taxes); support of local authorities; support of governmental institutions; easy logistics	Business global environment
	Macroeconomic trends; unification; liberalism; decentralization; economic growth; globalization; global market for digital services	Global trends
Factors limiting internationalization	Religion; stereotypes; poor educational system; politics and political factors; time shift	Institutions
	Legal aspects; lack of local support; lack of institutional support; custom duties; currency; small foreign market potential;	Business global environment
	Lack of foreign language knowledge; communication gaps; lack of business experience; cultural differences; lack of market knowledge; lack of knowledge of client buying behavior; lack of knowledge on customers; lack of negotiation knowledge; lack of negotiation experience	Knowledge
	Financial constrains; costs	Resources
	Unwillingness to travel; lack of ICT technology use; searching for cost advantage; fear; mind-set	Behavior
	Unfavorable macroeconomic trends; conservatism; trade protectionism	Global trends
The skills and competences needed to become international	Foreign language skills; communication skills; negotiation skills; cross-cultural communication; cultural awareness; emotional intelligence; collaboration skills; cooperation abilities; sales skills	Skills
	Knowledge of international business rules, techniques, and customs; knowledge of international finance; knowledge of commercial law; preparation of documents in international business; knowledge of risk management; knowledge of global online services; long-term perspective of company development; adoption of strategy to local, foreign market; ICT competences; usage of new communication tools;	Knowledge

(continued)

Table 2 (continued)

Themes	Opinions	Category
	marketing competences; promotion abilities; knowledge of customer needs; analyses of competitors; understanding of local culture; understanding of local market	
	Open-minded; courage; curiosity; patience; well organized; flexibility; optimism; quick learner; independence	Social and personal treats
Digitalization in supporting the internationalization	Digitalization as a key for internationalization; no time and space limits; easier to transfer knowledge; “a must” in 4.0 revolution; push to be innovative	Feature of digital internationalization
	Makes easier; easier contacts; faster contacts; easier documentation arrangements; easier to build trust with social media support; easier access to foreign customers; faster duty; similarity of digital services across the world; availability of information about company and products; digital marketing; e-commerce; many services can be delivered; availability in internet in real time; lower costs	Benefits
	Cultural differences are less important; digitalization: a bridge fir the cultural divide; less formal contacts; standard global operation	Cultural issues
	English used worldwide in online communicators; language support; online meetings; overcoming communication gap	Communication/ language
Digitalization in limiting the internationalization	No limits; needed to be correctly checked	
Benefits from implementing digitalization into internationalization	Digitalisation is the key, the most crucial in internationalization; internet knows no time or space limitations	General
	Digitalization as often the only way to approach and scale quickly in an international market—Assuming that products are “digital” ready and so are the distribution channels; lower cost by simplifying target selection and unifying access to information; remote management	The effect of scale
	Reach the customer faster; easier to reach clients; easier to create and maintain relationships with customers; common daily contacts and exchange of information between international partners is much faster, easier, and complete	Fasten the process

(continued)

Table 2 (continued)

Themes	Opinions	Category
	Communication may become more rapid and even live; the improvement of the communication process with the client; bridging gaps between two companies	Improvement of communication process
	Increase of sales without traveling; streamlines the sales process	SALES general
	Digitalization as a prerequisite condition for e-commerce; online tradeshows and exchange platforms; online & social media advertising to promote products locally, while managing and monitoring costs at a distance; local legal, cultural aspects and preference are key to successful e-marketing; local digital agencies are more effective; new opportunities of a digital platform; necessity to build an e-export platform, which makes some duty processes faster	SALES specific issues
Digital skills and competences needed to support internationalization	Ability to work online; daily use of e-mails, word, excel spreadsheets; knowledge of digital tools; knowledge of building and delivering digital tools; knowledge of cyber security	General digital skills
	Communicating through different digital platforms and devices; knowledge of communication tools; skilled in preparing digital presentations, power point, videos, films and marketing materials	Digital communication
	Searching for information on the internet, networks, and websites; ability to find right channels to target the right segment of the market in the given country; online data acquisition and use of online marketplaces	Searching information
	Social media skills; social media savvy in particular on platforms; planning of online media; understanding and implementing web-based or software based solutions for business processes; ability to create content in local language and fitting cultural preferences; ability to build www pages, online shops, internet communicators	Digital marketing
	Digital payments and banking systems	Digital finance

cooperation skills, negotiation skills, and sales skills. The next group of competences is related to possible knowledge to be gained; for example, knowledge of international business rules, techniques and customs, knowledge of international finance, knowledge of commercial law, the skills to prepare documents in international

business, knowledge of risk management, knowledge of global online services, knowledge of strategy (long term strategy and strategy adoption to local market), ICT competences, marketing competences, knowledge of customer needs, and analyses of competitors. The last competence discussed by participants is the understanding of local cultures and of local markets.

All these factors, skills, and competences affecting the process of going international led to the conclusion that generally the participants' perception of internationalization reflects on the Uppsala model and related stage models. Being internationally active appears to be an indication of a company's maturity regarding their business processes and competences. Combining this business maturity with institutional factors and some skills mentioned by participants supports the point of view of starting internationalization with the culturally and geographically closest countries.

5.2 Implementing Digitalization into the Process of Internationalization: Participants' Opinions

Treating this general opinion on internationalization as a starting point for discussion, we asked questions about how digitalization can shape internationalization to refer to our RQ1. The first step was to discuss to which extent digitalization can support the internationalization of companies. Our participants noticed that nowadays, digitalization is a key facilitator of internationalization, as, thanks to it, there are no time and space limits and it makes it easier to transfer knowledge and develop innovation. It is, however, important to stress that digitalization was perceived as a tool to make the internationalization process more efficient (or even to determine the process's success probability), not as a factor enabling the internationalization to take place. Therefore, it was not perceived as an internationalization factor, but as a "changer" of the characteristics of the contemporary internationalization models.

Participants discussed several benefits of using digitalization in the process of internationalization. The most frequently noticed aspects are that digitalization makes the process of internationalization easier and faster (according to nine participants). Implementing digital tools makes easier such aspects of internationalization as making contacts, documentation preparation, access to customers, and building trust with social media support. Digital services are very similar across the world; many services can be delivered online. Digitalization is a supporting tool; thanks to the availability of information about companies and products, it supports digital marketing and e-commerce, availability on the internet in real time and reduces costs.

Cultural aspects of internationalization were highlighted in the earlier discussion; four of the participants also pointed out this issue. Thanks to the implementation of digital tools in the process of internationalization, cultural differences are less important, as all international contacts become less formal, and this leads to

standardization of the global operation. Digitalization allows for the bridging of cultural differences. Another important aspect of internationalization is the knowledge of foreign language. Four participants noticed that digitalization also supports internationalization thanks to the English language being used worldwide in online communicators, the language support available online, and the possibilities to arrange online meetings and overcome the communication gap.

The next aspect of our discussion was related to the limits of digitalization in the process of going abroad. Half of participants (8 out of 16) claimed that digitalization does not limit the internationalization process at all. However, others mentioned several aspects. The foreign market should be mature enough to use digital tools in supporting internationalization process. Digitalization can create misconceptions about the company and the local support of institutions present in the target market is key in assessing the actual integrity and business experience of the local contact with whom we are dealing. Lack of proper ICT tools or applications can limit promotion and sales possibilities; lack of knowledge of modern ICT solutions can create risks connected with cyber security, or the risk of hacker attacks. The lack of direct contact with the customers can limit the knowledge of their real needs and opinions about our products, while face-to-face communication may create a stronger trust that is not induced directly in online meetings.

There is also an important shift in the competences needed to become international with the support of digitalization. Our participants mentioned general digital skills, digital skills related to online communication, skills needed to gain and create information and skills related to the usage of digital tools as crucial in digital internationalization. Among the general digital skills, the ability to work online, technical efficiency, computer and smartphone savviness, artificial intelligence, knowledge on cyber security, coding and/or no-code approach, and knowledge on digital payments and banking systems were mentioned. Online communication is related to such competences as knowledge of communication tools, communication through the use of different digital platforms and devices, daily use of E-mails, word, excel spreadsheets, using websites, video conference tools like Skype, Microsoft Teams and Zoom platforms, skill of preparing digital presentations, power point, videos, films and marketing materials and the usage of language and translation-based tools. The ability to gain and create information online is related to knowledge of search engines, competences to search for information on the internet, networks and websites, ability to find right channels to target the right segment of the market in the given country, online data acquisition and use of online marketplaces, and ability to create content in local language and fitting cultural preferences. The use of digital skills requires the knowledge of building and delivering digital tools; the ability to build user-friendly systems; the ability to build www pages, online shops, and internet communicators; understanding and implementing web-based or software-based solutions for business processes; social media savvy in particular on platforms that are in use in target markets; and ability in online media planning and general social media skills.

To sum up our discussion, we asked participants about the most important aspects of implementing digitalization in the process of a company's internationalization.

Participants agreed that digitalization is key and the most crucial aspect of internationalization. As the internet knows no time nor space limits, digitalization reduces the cost of internationalization and fasten the process, especially in reaching customers, in creating and maintaining the relationships with customers, in daily contact and informational exchange between partners, in sharing knowledge on the product among customers, and making information flow, data analyses and the decision-making process faster. Digitalization improves the process of communication, which become more rapid and even live. Digital internationalization allows gaining the effect of scale quickly.

5.3 Changes in Internationalization Models Because of Digitalization

The analyses of how digitalization impacts the process of internationalization lead to a contribution to all models of internationalization (see Table 3) and answer RQ2. When considering the stage models of internationalization, it is assumed that internationalization expresses the company's learning process and its business maturity, starting with foreign markets geographically and culturally close and later expanding to more distanced countries. However, when digitalization is implemented into the internationalization process, geographical distance is not important anymore, while cultural distance is less important, as digital means of communication, digital marketing media, and online meetings make all contacts more standardized and uses the same online business etiquette across the world. Business maturity, experience, and learning processes are less important, as digital maturity and digital experience become the key competences.

The resource-based theory of internationalization assumes that the unique set of a company's resources are key factors in going abroad, including human capital resources related to knowledge on global markets, cultural awareness or linguistic skills, or financial resources allowing a company to invest in internationalization. However, when digitalization is implemented, there is also a shift in the resources needed for internationalization. Cultural and linguistic competences are replaced by digital competences, related to digital communicators, standardization of texting and sending information online. The importance of market knowledge is shifting because of the availability of online information, and is replaced by the knowledge of the use of public databases, searching for information online and the use of digital tools in gathering and creation knowledge. The possibilities for arranging online meetings, the use of sales digital platforms, online databases and availability of information, and marketing on social media also reduce the importance of the financial resources needed to be invested in the internationalization process.

The next group of models, the networking models of internationalization, assume that internationalization depends on the participation in a network of suppliers and customers and business contacts within the network with the reputation in the

Table 3 Impact of digitalization on models of internationalizations

Aspects	Models of internationalization	Digital impact
<i>Stage models of internationalization</i>		
Geographical distance	It matters—First, internationalization is begun at close neighboring countries	No matter
Cultural distance	It matters—First, internationalization is begun with countries of close cultural distance	Less important: <ul style="list-style-type: none"> – Digital means of communication make all contacts more standardized. – Online meetings get the same business etiquette across the world. – Digital marketing media are standardized across the world.
Knowledge and business learning process	International as the process of business matures	Business mature is less important; digital maturity is the key competences
Business experience	The next stages of internationalization are taken when business experience is gained at first stages of internationalization	Business experience is less important; digital experience is the key competence
<i>Resource-based theory of internationalization</i>		
Human resource	Key competences: cultural awareness, linguistic skills	Shift in competences: digital competences as key; cultural and linguistic competences are replaced by digital communicators, digital translators, standardization of texting and sending other online information
Knowledge	The uniqueness of a company's knowledge on global markets	Information available online, use of public databases, searching information online
Areas of knowledge	Knowledge on global and target markets (specific for a country of internationalization)	Knowledge of building and creating digital tools (the same no matter the country of internationalization)
Financial resources	Financial constraints to going abroad	Almost no costs to go abroad (online meetings, sales digital platforms, online databases and availability of information, marketing on social media is standardized across the world)
<i>Networking models of internationalization</i>		
Network	Network of companies—a key for being international	Use of digital platforms: instead of position in the network of companies, the possibilities to use a sales digital platform is a key for being international
Reputation	Reputation in the network	Reputation in sales digital platforms

(continued)

Table 3 (continued)

Aspects	Models of internationalization	Digital impact
<i>International entrepreneurship</i>		
Time of internationalization	The main pattern distinguishing companies based on the speed of internationalization	Time does not matter; digitalization hastens the process of reaching customers

Source: own elaboration

network as a key factor. The use of digital platforms shifts this dependence, as instead of the position in the network of companies, the possibilities to use a sales digital platform is key for being international. Instead of the reputation in the network, the reputation gained on sales digital platforms determines the possibilities of internationalization.

The last analyzed group of internationalization models is related to the speed of internationalization being a main pattern for distinguishing companies. Digitalization seems to support international entrepreneurship, as it hastens the process of reaching customers abroad, and, in consequence, hastens the speed of internationalization.

6 Conclusions

The Covid-19 pandemic situation accelerated many of the processes that we observed in the global economy, including the need for and speed of the digitalization process. Even before the pandemic, companies were gradually experiencing an intensified pressure to run their businesses with use of digital tools. Digitalization impacted most of the spheres of a firm’s functioning: the choice of business models, interactions with clients, marketing, and also internationalization models. However, the recent global developments shifted the rate of those changes from gradual development to intensified rush.

All these aspects let to formulate RQ1, asking how the digitalization impact the process of internationalization of companies. Previously, many studies have indicated that the competitive advantage that had driven internationalization could have numerous sources: human-based, knowledge-based, market-based, or even financial. Due to digitalization, the advantage can now be mostly gained again through digital maturity. This also applies to the advantage understood as the position in the network. Digitalization has shifted the network perspective from a small, co-dependent circle of companies toward an unlimited, platform-based network of companies. Companies willing to internationalize seek to uphold an excellent reputation, not within the “old network” but within the vast number of potential still unknown partners. That is achieved through the use of a digital platform. The least-affected framework seems to be the concept of rapid internationalization stemming from international entrepreneurship stream. Digitalization has not really

altered much of its basis, only stressing that time is not of the essence anymore, as digital transformation accelerates the rate at which companies internationalize.

With that in mind, one might ask the question of whether the internationalization models we know and observed are still relevant. Our RQ2 let us to discuss whether digitalization has changed the concept to a degree where we need to seek new internationalization models or are the “old” concepts still valid but slightly changed? It is first crucial to stress that, according to various research, we cannot unambiguously claim that one of the existing models is more relevant than the other. The models emphasize different approaches to internationalization and seek to explain what drives the decisions and the method of internationalization. Digitalization seems to accelerate the internationalization process, as it shortens the time lapse between consecutive stages of internationalization. It makes geographical and cultural distance lose its meaning in deepening internationalization. The study suggests that we shift from appreciating market knowledge and business experience to recognizing digital aptness and maturity. In fact, the most essential aspect of the stage model seems to be questionable; internationalization is dependent on the digital awareness and proficiency, not on consecutive steps that deepen international expansion. Likewise, we can also observe intensified changes toward the resource-based approach.

Since our study had only an initial screening aim and the sample does not allow us to draw final conclusions, we can clearly indicate that the research gives meaningful grounds for further studies on the validity of the known internationalization models. The data gathered clearly indicates that they required updating, at the very least, and we could go so far as to hypothesize that some of them are gradually losing importance. Based on the initial conclusions drawn from the study, we see potential to explore the matters of:

- How digitalization helps to overcome internal barriers in the internationalization process of SMEs
- Whether digitalization strengthens the globalization effect or if globalization rather forces the digitalization process
- If and how digital competences and experience replace other key resources in the internationalization process
- How digitalization changes the meaning of the network in the process of SME digitalization
- Whether digitalization per se has become an element determining the internationalization process, or whether it remains a moderating factor that changes the significance of other internationalization factors.

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Born Digitals: Understanding the Sustainable Competitive Advantage Across Different Markets



Mirosław Jarosiński, Jurgita Sekliuckiene, and Miklós Kozma

Abstract Digitalization of business is one of the driving forces in today's environment and seems to be an irreversible trend. At present we can observe not only a digital transformation of firms but also the emergence of firms that are digital from inception. The born digital firms have characteristics that allow them to quickly expand on international markets and stay competitive for sustained periods of time. The purpose of this study is to analyze the characteristics of born digital firms that lead to sustainable competitive advantage and to develop a conceptual model that will serve as a basis for future research. Various sources of born digitals' competitive advantage are revealed, such as innovativeness, creativity, responsiveness, digital technology, and digital skills of their employees. One of the key findings is highlighting the role creativity plays in how responsive born digital firms can be in times of change, a characteristic that supports their sustainable competitiveness. The newly defined born digitals' characteristics and sources of competitive advantage should embrace the approach to their competitive advantage across different markets as a complex dynamic construct that is presented, which includes technology advantage, human capital advantage, but also differentiation advantage.

Keywords Born digitals · Digitalization · Competitive advantage

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1 Introduction

Digitalization is believed to have undermined the foundations of international business (Eden, 2016, Banalieva & Dhanaraj, 2019). In the current times, digitalization stands at the core of international business dynamics in highly uncertain environment. Digitalization is understood as “the process of transforming the essence of an organization’s products, services, and processes into Internet-compatible data packages that can be created, stored, and transferred in bits and bytes, along with the information associated with them, for marketing, sales, and distribution” (Banalieva & Dhanaraj, 2019, p. 1373).

The internationalization of entrepreneurial firms, supported by innovation and digital technologies, causes the rapid and continuous transformation of the global business landscape. Therefore, due to digital transformation, internationally active entrepreneurial firms are competing globally for the customer experience and therefore participate in changing the behavior of both virtual and off-line communities (Dambrin & Valck, 2007). Among those active entrepreneurial companies, one can identify born digital firms. Born digital firms can be defined as “the firms whose core value proposition is enabled by digital infrastructures” (Shaheer, 2020, p. 2). Born digital firms instantly access globally dispersed resources for the development of novel digital products that are made available to the whole world with just a few clicks (Shaheer, 2020).

Digitalization is a general trend proliferating across industries and geographies. It has the potential to create disruption in existing business models and fundamentally change the competitive positions of firms in different areas of economic activity, including international entrepreneurship (Reuber & Fischer, 2011; Vadana et al., 2019). Nevertheless, there is still little knowledge available to understand digitalization’s impact on internationally active entrepreneurial firms’ behavior. This fact highlights the importance of studying technologically innovative and digitally determined international entrepreneurship (Welter, 2005; Smolka & Heugens, 2020) in a scholarly setting. There is a lack of a conceptual frameworks for understanding how born digital firms achieve sustainable competitive advantage. Development of such a conceptual framework would be the first step to more focused research on entrepreneurial firms that are digital from inception. According to Banalieva and Dhanaraj (2019, p. 1383) digital service enterprises’ internationalization “remained underexplored and digitalization provides new ways to reconceptualize both theory and practice in this arena.”

In this study we will generate new insights for international entrepreneurship theory integrating entrepreneurial focus with strategic management’s position approach. Vadana et al. (2019) revealed the need for the application of strategic management and competitive position issues in international entrepreneurship and suggested future research directions toward internationalization strategy that born digital companies use and the role of internationalization strategy on international performance.

There are already many studies on the competitiveness of large enterprises (e.g., Porter, 1990a, 1990b, Dyer et al., 2008, Porter, 2011), but the topic of competitiveness of born digital firms is still subject to scientific discussions. Other perspectives are needed, as in recent works the born digital phenomenon has been analyzed through studying only large firms (Vadana et al., 2019). In this study, the competitiveness of enterprises will be understood as the enterprise's ability to build a competitive advantage and maintain this advantage in the long term. The sources of competitive advantage are resources or access to them, or the possibility of using extant resources effectively, for example, in the network in which the firm operates.

Thus, we formulate the following research questions: What are the contemporary global changes related to digitalization that affect the competitiveness of born digital firms? What are the idiosyncratic characteristics of born digital firms that potentially lead to sustainable competitive advantage?

The primary aim of this chapter is to analyze the characteristics of born digital firms that lead to sustainable competitive advantage and develop a conceptual model that will serve as a basis for future research.

The chapter contributes to international entrepreneurship theory development, particularly to the new phenomenon of international born digital firms and their competitiveness. In this sense, it reflects to the Baier-Fuentes et al. (2019) future research call to continue nurturing the theoretical foundations to give international entrepreneurship field the legitimacy. This is in line with Monaghan et al.'s (2020) research, in which the authors emphasized the impact of digital technologies on international environment in many ways, which might offer many opportunities for future research on firms that may be going digital, gone digital, or born digital.

The chapter is organized as follows. First, the study method is presented. Second, a description of the phenomena taking place in the macro-environment of enterprises in the recent period is introduced, with particular emphasis on changes in the technological environment and their impact on enterprises. Third, the review of the literature regarding digital internationalization and born digital firms is presented. Fourth, a conceptual framework for the analysis of the phenomenon is developed. Finally, the theoretical and practical implications of our work are discussed and the limitations of our study are highlighted while providing suggestions for future research directions.

2 Methods

We have conducted the theoretical research using the research conversation set by Matthews et al. (2018) and Thornhill (2018). We have conducted a literature review concerning born digital firms.

As digitalization of economy sped up recently and we find "born digitals" as a new phenomenon, we decided to restrict the literature review to the last 5 years (2016–2020). Later the period of analysis was extended to the current year as well.

Because we perceived born digital firms as new ventures within international environment for the first, we decided to check what was published on them in the most important journal within International Business field, i.e.: *Journal of International Business Studies*. Then we searched through Scopus, ProQuest, and EBSCO databases. We limited our search to peer-reviewed journal articles, English language, and full-text availability through filters. At first, we searched the term ‘born digital’. At the next stage we used terms “digital,” “digitalization,” and “digitally native.” All the search was done within the article title, abstract, and keywords. In each search we went carefully through top 50 search returns sorted by relevance reading through abstracts and selecting articles for further careful reading. Eventually we came up with six journal peer-reviewed articles. At the next stage we used the snowballing technique checking bibliographies of already identified articles on our topic and this way we included some more relevant peer-reviewed articles, one book chapter, three reports on digitalization of economy, and two texts from Financial Times.

3 Global Changes that Affect the Firms Nowadays: The Role of Digitalization

Hard-to-predict critical events, uncertainties, and continually emerging crises that affect global and national economic, technological, demographic, political, and social well-being (Ahlstrom et al., 2020) are becoming extremely difficult challenges for internationally oriented firms, especially for small and medium-sized enterprises. The last few decades have been a period of major changes in the macro-environment of enterprises compared to even the first eight decades of the last century. The advancement of globalization, the development of the Internet, the development of the ICT sector – Information and Communication Technologies, changes in Central and Eastern Europe, the emergence of emerging markets, the rise of China’s political and economic importance, the development of nationalist movements in many countries, the development of terrorism, global warming, growth of public awareness of the need to protect the environment, and also the coronavirus pandemic are just some of the phenomena affecting consumer behavior and the way companies operate. Experts from the Boston Consulting Group (Kimura et al., 2019) indicate that in all areas of business there is a great deal of unpredictability in terms of economic and political factors, and this will continue in the near future. As a result, “competition is becoming more complex and dynamic, industry boundaries are blurring. Product and company lifespans are shrinking. Technological progress and disruption are rapidly transforming business” (Kimura et al., 2019, p. 1). Penetration of digital technologies into various industries has become a catalyst for merging different industries, thus leading to novel product solutions and business models.

One of the most dynamic phenomena affecting enterprises and the way they compete is the development of new technologies such as artificial intelligence or

blockchain and the digitalization of the economy (Nowiński & Kozma, 2017; Caputo et al., 2020). These factors affect all enterprises, in all industries, although the degree of digitalization of activities in individual industries varies. Experts from the McKinsey Global Institute estimate that the highest degree of digitalization is represented by industries such as media and finance, and the smallest by large areas of industrial production, including pharmaceutical production. At the same time, it turns out that the industries with the highest level of digitalization are characterized by the highest productivity gains (McKinsey, 2016). Interestingly, although the first cloud computing commercialization steps started globally a decade ago (Senyo et al., 2018), there is still great uncertainty regarding “how to handle digitalization challenges” (Laudien & Pesch, 2019).

Lansiti and Lakhani (2014) predict that “over time, digital technologies and the Internet of Things (IoT) will transform virtually every sector and every business” (p. 98) and “the ubiquity of digital technologies will have profound implications for the economy as a whole” (p. 99). Also Ng and Wakenshaw (2017) believe that the Internet of Things “will unleash limitless opportunities, both negative and positive, and can fundamentally transform institutions and other socio-technical structures” (p. 3). Also, Accenture in its studies draws attention to the growing importance of data analysis, artificial intelligence and other technologies of the future, such as the Internet of Thinking (Accenture, 2018).

In turn, experts from the Boston Consulting Group point out the need for dynamic learning based on artificial intelligence, sensors, algorithms, data, automated decision making, and digital platforms. In their opinion, this will require greater involvement in digitalization and building hybrid ecosystems based on digital and physical infrastructure. The latter action will apply to both traditional (bricks-and-mortar) and digital firms (Kimura et al., 2019).

Verhoef et al. (2021), speaking about the digitalization of business, distinguish three stages. The first one, consisting in digital mapping of data previously saved in an analogue format (in paper form), is called digitization. The second stage, consisting in the use of digital technologies in existing business processes, is referred to as digitalization of business processes. The third stage is digital transformation, which is a complete change covering the entire enterprise and leading to the creation of a new business model. It is therefore a strategic change aimed at increasing the company’s competitiveness (Verhoef et al., 2021).

Laudien and Pesch (2019) have conducted a 3-year-long (2014–2017) empirical qualitative research in order to understand the impact of digitalization on service enterprises’ business models, and have identified four business model archetypes of digital service enterprises:

1. Digital beginner service enterprise—its business model’s main purpose is efficiency.
2. Customization-focused service enterprise—its digital business model’s aim is to match customer needs.
3. Distance-bridging service enterprise—its digital business model’s purpose is an extension of the geographic scope.

4. Full-scale digital service firm—its business model's main aim is flexibility and ability to respond to market needs.

The first two archetypes were more common in 2014; later on, closer to 2017 and later, the third and the fourth archetypes started to dominate (Laudien & Pesch, 2019).

Verhoef et al. (2021) list four digital assets and capabilities necessary in the digital transformation of an enterprise: digital assets, digital agility, digital networking capability, and big data analytics capability (p. 892). Digital assets are, e.g., the data storage, firm's ITC infrastructure, and other accompanying digital technologies. Digital agility is "the ability to sense and seize market opportunities provided by digital technologies" (p. 893). Digital networking capability is the skill to connect remote network users and to provide them with an offer that meets their common needs. Big data analytics capability is self-explanatory, but it's worth underlining that this ability is crucial to achieving full digital transformation (Verhoef et al., 2021).

Monaghan et al. (2020) draw attention to two features of digital firms: having digital infrastructure and relying on "digital infrastructure to accrue communication, collaboration and/or computing capabilities, capabilities that allow the firm to both create and sell its offering online through a digital business model" (p. 13). They emphasize that if a company sells physical products, even if its business processes are highly digitized, it cannot be considered a digital company (Monaghan et al., 2020).

Smailhodžić and Berberović (2021) highlight that in this changing environment even traditional companies go through the process of digital transformation and adopt new ways of applying digital solutions as well as develop digital business models in an effort to sustain competitiveness. The creativity of these solutions is a key feature of the digital firms, as the challenges they are responding to provide an ever-changing context to their effort, requiring new ideas and approaches.

Digital transformation of an enterprise does not always bring the expected results. In order for its effect to be better, experts from the McKinsey Global Institute (McKinsey, 2019) list five principles that must be met at the same time: full mobilization of the company, clear commitment to digital transformation showing that it is the company's main organizational priority, allocating sufficient funds for it, employing technology specialists digital and data analysis led by CAO (Chief Analytic Officer), and CDO (Chief Digital Officer), as well as great flexibility in implementing transformation. McKinsey research shows that this is not an easy process and only 10% of companies manage to meet all five rules (McKinsey, 2019).

The digital transformation of enterprises therefore seems inevitable. According to the McKinsey Global Institute (McKinsey, 2016), the flow of data across national borders is rapidly increasing and globalization is increasingly taking a digital form. This, in turn, changes the structure of actors involved in globalization. The digitalization of the global economy has resulted in a greater number of countries and entities participating in it, especially small businesses and start-ups. As the authors of the McKinsey Global Institute report state, we are currently at the initial stage of the

“convergence of globalization and digitization” (McKinsey, 2016, p. IV), which opens up unlimited opportunities for us to act in the future. Already at the time when the McKinsey Global Institute report was written, data flows across borders generated greater added value than flows of goods and services, which is also confirmed by other reports on globalization (Altman & Bastian, 2019).

The 2017 World Investment Report on the digital economy shows that multinational enterprises (MNEs) that have undergone digital transformation are doing better in international markets than other multinational enterprises. However, 100 percent digital enterprises perform best (World Investment Report, 2017).

Digitalization creates new opportunities not only for companies but also for individuals, such as access to information, social networks, or financial resources, which in the case of entrepreneurial people can translate into setting up new enterprises (Fossen & Sorgner, 2019). At the same time, digitalization makes it easier for small and medium-sized enterprises to participate in the processes of globalization and thus increases competition in individual industries (McKinsey, 2016). These processes are slowly transforming the traditional economy into a digital economy. Small and medium-sized enterprises with limited financial, human, and other resources are forced to look for unconventional ways of operating in order to establish themselves and maintain in global value chains (Gao & Ren, 2020).

Eden (2016) identifies three characteristics of the digital economy: “mobility, network effect and data use” (p. 5). Digital products are mobile because the cost of their dissemination is close to zero, especially when compared to the cost of their production. “The network effect arises when the value of a product to its user increases with the number of other users of the product” (Eden, 2016, p. 5). Data usage is gaining in importance; and the costs of collecting, storing, and analyzing data decrease as the amount of data increases.

According to Mettler and Williams (2011), the digital economy creates many opportunities for small and medium-sized enterprises. Researchers mention network technologies, new online platforms, and network services that allow them to run their business processes at a low cost and operate in international markets from day one. They believe that in the future, the importance of small and medium-sized enterprises on international markets will increase in creating new jobs and meeting customer needs. However, this does not mean that large multinationals will lose their relevance. According to Eden (2016), small multinationals will successfully compete with large multinationals and, like them, will be able to achieve profitability.

Applying digital technologies and possessing dynamic capabilities does not, however, justify the success of these smaller firms. A strong market-oriented strategy is also required, built on capabilities related to the particular knowledge about the markets (Knight & Cavusgil, 2004). These firms can turn their knowledge and adaptability to local needs into a source of competitive advantage.

According to the World Investment Report, 2017 devoted to the digital economy, three-quarters of the world’s population uses the Internet and even in developing countries penetration is approaching 50%, in developed countries and emerging economies, almost two-thirds of the population make purchases online, the

administration of 90 countries offers one comprehensive public information portal and in 148 countries there is at least one online payment system (World Investment Report, 2017, p. 156).

Although the digitalization of human activities has been progressing for two decades, researchers in the field of International Business and International Entrepreneurship have only recently started to look at it closely. According to Verhoef et al. (2021) they only look at the areas of digital impact on business, while “the usage of new digital technologies can easily become the new norm and completely change traditional rules of doing business” (p. 891). New approaches to business emerge at unprecedented speed, and the new digital technologies have allowed social data (market networks) and intellectual data (market knowledge) about different markets to become available easier and quicker, making a positive impact on the firms’ attractiveness and decision-making capabilities (Piqueras, 2020). In this context, born digitals are inherently more agile and responsive than traditional businesses (Monaghan et al., 2020). Summarizing, technological advancement and falling cost of computing processing capacity, data storage, and connectivity speed, have fundamentally shaped and influenced business models, winning value propositions, and essentially, underpinned drivers of competition in many industries (Jameaba, 2020).

The analysis of the literature carried out by the authors of this study confirms the above opinion of Verhoef et al. (2021) and encourages to look closer at businesses using new digital technologies.

4 Born Digitals and Their Internationalization

Monaghan et al. (2020) define born digital firms as “digital from inception” (p. 13). This means that born digital companies have been creating and using digital infrastructure from the very beginning and fully rely on the Internet for their production, operating and delivery processes (p. 12). Their activities are based on a digital business model, which gives them great flexibility and scalability. This distinguishes them significantly from ordinary physical firms (bricks-and-mortar), which started the digitalization process sometime after their inception and, as previously indicated, cannot be considered as digital firms. Importantly, born digital firms are characterized by operating in the Internet, thanks to which they have immediate access to all markets in the world. This means that they are not only digital but also global from the very beginning. Monaghan et al. (2020) note that early and fast internationalization is intended in born digital firms. Of course, not all born digital firms have to be international from the outset. The research of Domurath et al. (2020) shows that some born digital firms undertook internationalization only 2 years after their inception.

Monaghan et al. (2020) distinguish a number of aspects of the functioning of born digital firms: direct engagement with stakeholders, automation, network effect, flexibility, and scalability. Digitalization gives these companies the possibility of

direct contact with their stakeholders and thus may bring the effect of being rooted in the network in which, for example, certain stakeholders already exist. It also gives the possibility of direct contact with users of their services around the world, thanks to which you can quickly acquire knowledge about individual national markets. Moreover, these contacts are quick and direct. Born digital firms achieve the benefits of increased productivity and efficiency thanks to the automation of business processes. Process automation also allows accelerating the interaction between the company and users thanks to the automation of trust mechanisms. These mechanisms allow saving time and reducing financial outlays for managing the company's operations, thanks to which it can accelerate the internationalization of the company (Monaghan et al., 2020).

The network effect, discussed earlier, gives born digital firms the ability to quickly create and coordinate user networks. Flexibility allows born digital firms to easily and efficiently configure and coordinate their international operations thanks to a physical infrastructure smaller than in the case of traditional companies. This also applies to various functions of the company, including human resource management. Scalability, on the other hand, is possible thanks to the almost zero cost of acquiring new customers and the ease of multiplying the way of operating in new markets (Monaghan et al., 2020).

Vadana et al. (2019) concentrate on value chains of born digital firms and state that born-digital firms are "a distinct type of internationalizing firm with an Internet-enabled, inward-outward digitalized value chain from day one or soon after inception (p. 212). Similarly, Monaghan et al. (2020) view born digital firms as undertaking internationalization immediately or almost immediately after their inception, and add that this process is "compressed in time, much wider in scope and requiring much less physical involvement" (Monaghan et al., 2020, p. 19) than in a case of traditional firms. The difference is that Vadana et al. (2019) distinguish between domestic and international born digital firms. However, in their study of 19 "unicorns" they have found out that most of them are international born digital firms.

The authors of the McKinsey Global Institute report (McKinsey, 2019) mention the growing importance of companies referred to as digital natives, which are actually digital start-ups. McKinsey experts estimate that digital natives can, on average, reach 12 percent of total revenues in the sectors in which they are developed. This seems little compared to the total, but at the same time a lot, when it turns out that their total digital revenues are at the level of the "digital" part of the revenues of enterprises operating in these sectors for years. At the same time, digital natives account for up to 30 percent of companies in the high technology industries. Moreover, digital natives achieve higher profitability than other companies in the industry. In all industries analyzed by the authors of the report, digital native firms were more agile, bolder in making investments, but also more often failed (McKinsey, 2019). Also, experts from the Boston Consulting Group notice the intensification of competition between traditional and digital native companies (Kimura et al., 2019).

The subject literature also applies to companies referred to as ibusiness firms. Brouthers et al. (2016), while analyzing the literature, found that individual authors

use very different terms to describe so-called “electronic business companies (denoted as E-business companies) as any firm operating online that provides its products/services to customers using the Internet and other computer-based information system (CBIS) technologies” (p. 513). Brouthers et al. (2016) mention such names as “pure internet firms,” “digital information good providers,” or “E-commerce corporations” (p. 514). However, they themselves use the term “ibusiness firms.”

Singh and Kundu (2002) identify e-commerce corporations and describe them as “small or medium-sized firms that strategically use the assets existing in the networks” in which they operate and which are competing on a global level from their inception.

On the other hand, Brouthers et al. (2016) consider that ibusiness firms constitute a specific group of e-commerce corporations “that use the Internet and other CBIS technologies to create special Internet-based platforms which allow users to interact with each other” (p. 514). At the same time, their offer is fully digitized and immediately available worldwide thanks to communication with customers via electronic networks. This does not mean, however, that their internationalization is automatically as immediate as the value co-created by network users in one market is not automatically transferable to the other. The internationalization of such companies requires the development of a network of users in a new market. Chen et al. (2019) confirm that a mere global presence thanks to an online business model does not automatically provide global sales coverage.

Internationalization could be accelerated by addressing the offer to global users, i.e., those who communicate across borders. However, as Ghemawat (2017) claims, there are relatively few such users. The authors of the McKinsey Global Institute report (McKinsey, 2016) also state that the world is still far from true globalization. In addition, language barriers restrict users from communicating across borders (Chen et al., 2019). The report prepared by DHL also confirms that, after all, globalization is not as advanced as we might think (Altman & Bastian, 2019).

Nevertheless, the internationalization of born digital firms is much easier than that of “traditional” companies, as it requires much less capital commitment. However, it must be remembered that their internationalization will depend on Internet development and accessibility of CBIS technologies on foreign markets (Brouthers et al., 2016). At the same time, Ojala et al. (2018) note that modern technologies can create both new market opportunities for digitized enterprises and limitations for their development on the global market.

The second characteristic of this process is its multidimensionality, and one of the important dimensions is the interactions of internet platform users. As noted by Chen et al. (2019) the “collective interaction of users may co-create the internationalization process” (p. 175).

Ojala et al. (2018) believe that digital platform operators undertake early internationalization in the same way as International New Ventures. They are prompted by the search for resources necessary for the commercialization of their venture or for overcoming technical difficulties (technical bottlenecks). However, it is worth noting that their pace of internationalization will actually be influenced by the

availability of resources and technology. The stage of early internationalization can be omitted if all necessary resources are available in the country of origin and there are no technical constraints. However, it should be remembered that commercialization on the market of the country of origin may be a prelude to internationalization and then globalization of the enterprise.

Banalieva and Dhanaraj (2019) prove that a born digital firm can become a multinational company by “granting consumers worldwide access to their products and services through online apps and expand digitally by entering host countries with digital network ecosystems.” (Banalieva & Dhanaraj, 2019, p. 1382). This way, internationalization would take place without investment in “physical” assets in individual countries, which so far is (or perhaps we should already say “was”) a condition for defining an enterprise as multinational, and the ratio of the company’s physical assets located abroad to domestic assets was used in determining the degree of internationalization of the enterprise.

According to Eden (2016) the digital economy creates enormous opportunities for many companies and makes the internationalization of enterprises a much easier task. Eden states that “small firms can now use Web-based platforms to deliver online business services and digital products to customers around the world, going global almost from inception” (Eden, 2016, p. 6). Advances and cost reductions in information and communication technologies were previously considered to be one of the main factors influencing the emergence of early-internationalized firms. Now, with the emerging digital economy, this factor has become even more important and it leads more and more often to the emergence of born digital firms.

5 Competitiveness of Born Digital Firms

Competitiveness remains one of the essential drivers of modern business, and the growing competition determines such relevance both between companies and between industrial sectors and even between countries. The concept of cross-border competitiveness has changed significantly in recent decades. It has been influenced by growing global companies - Facebook, Google, other technology oriented and financial sector’s corporations. Digital technologies have changed corporate governance models, and this makes it possible to set up management companies in countries with the best and most favorable business climate – laws, tax system, “rebates” from governments. Globally, the best examples of such cross-border competitiveness (excluding offshore areas) are Singapore and Hong Kong in Asia, and Dublin in Europe. Estonia and Poland are leaders in the Baltic Sea region. Firms from these regions become successful by using digital business models and expanding to other countries from their inception.

International strategies and actions of companies define their position in global competition. Focus of strategy is important to be able to define at which aspect to create an advantage. According to Banalieva and Dhanaraj (2019) the competitiveness of born digital firms can be viewed through the prism of their specific

advantages (Firm-Specific Advantages – FSAs). In the case of digitized companies, Banalieva and Dhanaraj (2019) distinguish two types of advantages: in the area of technology, where they emphasize the importance of key technologies for competitive advantage, and in the area of human capital, where they emphasize the importance of the advanced skills of employees. Richards, 2016 points out that such key technologies are, for example, “referral programs, fraud detection systems, prognostic tools and applications for predicting customer behaviour” (p. 12), and the advanced skills of employees are those in the field of operating these complex programs and data analysis and deep learning. Other examples of this type of skill include data management and data visualization skills. Moreover, scaling in big data analytics might be defined as separate firm-specific competitive advantage. Digitalization itself paves the way to the research and development (R & D) functional area in the organization. This creates a more intensive effect on testing of the products by employing techniques of big data analytics, virtual simulation, and experimentation, which results in the successful introduction of innovative products introduced into different markets with better efficiency and quality in short time (Oesterreich & Teuteberg, 2016).

It is necessary to have both advantages at the same time, because the mere acquisition of technology is not enough if no one or few people in the company know how to use it. A similar relationship occurs the other way around. Acquiring an employee or employees with specific skills without having technology that these employees could use will do nothing to the company. The importance of the skills of employees and managers seems to be confirmed by Eden (2016) who points out that intellectual property rights are gaining in importance in the digital economy, as value is mainly created at the stage of creating ideas and designing digital products and services. Meanwhile, finding employees with specific skills can be difficult. Anthony Goldbloom, CEO of Kaggle, which runs online data science competitions, believes that only 1% of people who use machine learning techniques have deep learning skills. At the same time, he notes that large companies are reluctant to hire the greatest talents in this area, due to their high financial expectations. However, he concludes that even if large corporations such as Walmart invest in digital technologies on a large scale, they will never become truly competitive with born digital firms (Richards, 2016).

According to Thornhill (2018) the best strategy nowadays is to “focus on delivering the best customer experience and the lowest price via an online platform” (p. 1) because thanks to the data collected about customers, it will be possible to tailor the offer exactly to their needs. Therefore, it can be said that the best competitive strategy will be an integrated strategy, and the new source of gaining a competitive advantage will be access to customer data. The technological embeddedness of born digitals alleviates the excessive need for traditional relationship building, easier access to customer data helps them overcome the liability of outsidership (Monaghan et al., 2020).

Meanwhile, according to Eden (2016) in the near future, the source of competitive advantage should be innovation and product differentiation, not cost reduction. Thanks to new technologies, micro-multinationals can build their global strategies

based on short series of customized products with high value for customers all over the world. This is also the opinion of the authors of the World Investment Report, 2017, who state that highly automated and digitized production carried out in short series favors greater variety and customization of products. This type of production also allows for better adaptation to fluctuations in demand caused by seasonality or changes in trends (World Investment Report, 2017).

In rapidly developing competitive environment, advancement and adaptation to the fast-changing technology make a firm to play dominantly over the competitors in making the production process quicker and safer within the manufacturing plant, achieve efficiency in distributed systems. Usage of information technology in the organization paves the way to the knowledge sharing network and this in turn enhances the organizational agility and exploits innovation capabilities (Dong & Yang, 2015).

Nowadays Internet of Things (IoT), communication technologies, and cloud computing platforms are three major technologies to realize the fine architecture of small and medium-sized enterprises, online business, remote working and disruptive platforms in the business world, and platform ecosystem (Jameaba, 2020).

The pressure for more adaptability and creativity is justified by the developing business environment supporting the disruption of extent competitive advantages of market leading firms in an increasing range of industries. Creativity and constant reinvention become the norm in the emerging digital business models (Smailhodžić & Berberović, 2021), which born digital firms master more naturally compared to the companies they challenge in existing markets.

The aforementioned publication by Thornhill is to some extent consistent with the views of Eden, as Thornhill cites an interview with Viktor Mayer-Schönberger, co-author (with Thomas Range) of the book entitled “Reinventing Capitalism in the Age of Big Data,” who believes that “innovation will increasingly result from feeding data into machine learning systems to understand consumers’ needs” (Thornhill, 2018, p. 1); and this, in his opinion, will hinder the creation of innovative start-ups. According to the authors of this study there is no such risk, because human ingenuity is so great that no artificial intelligence will be able to replace it. Also experts from the Boston Consulting Group believe that in the future companies will have to compete with their imaginations (Kimura et al., 2019).

Overall, the digital business models mitigate many of the barriers that hinder creativity in existing value chains (Fenwick, 2016). All the more, keeping up in the race for adapting the latest digital innovations is a challenging task even for born digital firms; hence, creativity plays an important role in their fundamental business model and daily operations (Medium, 2017). They tend to excel in providing creative and innovative responses to emerging challenges that conventional companies may not solve at all or even if they can they will do it at a much slower pace (Solomon, 2018).

6 Future Research Conceptual Model

In order to explore deeply the competitiveness of born digital firms we have developed a conceptual model – see Fig. 1. The conceptual model derives from a discussion of the literature above and is based first of all on Porter (1990a, 1990b), Eden (2016), Monaghan et al. (2020) and Banalieva and Dhanaraj (2019) works. It is supplemented with some of the findings of Singh and Kundu (2002), Knight and Cavusgil (2004) and Smailhodžić and Berberović (2021). The model will provide a framework for the future analysis of competitiveness of born digital firms.

In the conceptual model we consider the influence of macroenvironmental forces on born digital’s inception and its business model. The forces in power are mostly the rise of the three major technologies identified by Jameaba (2020), i.e., IoT, communication technologies, and cloud computing platforms, as well as Big Data Analytics, and also artificial intelligence, blockchain, and the digitalization of the economy (Nowiński & Kozma, 2017; Caputo et al., 2020).

The born digital’s business model is based first of all on digital technologies (Monaghan et al., 2020; Smailhodžić & Berberović, 2021) and Internet-based operations (Monaghan et al., 2020). We take the point of Monaghan et al. (2020) who say that born digital firms would build digital infrastructure and use it to run its business processes and to operate in the Internet which would allow them for greater flexibility (easier and faster configuring, reconfiguring and coordinating their operations). We add to this the strategic use of assets existing in the networks identified by Singh and Kundu (2002). Put together with the network effect they would make possible bigger and faster scalability of their businesses (Monaghan et al., 2020).

The born digital firms through their digital business model develop sustainable competitive advantages that allow them to achieve outstanding competitive position on their markets. Here we base the idea of competitive advantage on Porter’s works (Porter, 1990a, 1990b) but at the same time we agree with Eden (2016) that the two basic types of competitive advantage proposed by Porter (1990a, 1990b) born digital firms would rather compete on differentiation than costs (Eden, 2016) because digitalization allows all types of firms for minimizing costs which in fact eliminates the cost advantage. We also extend the set of possible competitive advantages achieved by adding a technology advantage and human capital advantage that

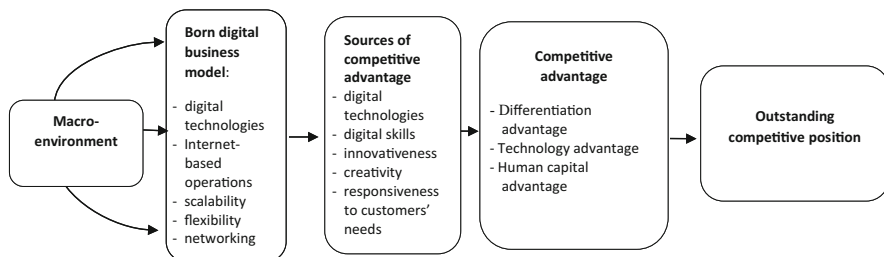


Fig. 1 Conceptual framework

Banalieva and Dhanaraj (2019) identify as firms' specific advantages of digitized companies. All the three types of advantage allow born digital firms to achieve outstanding competitive positions in their markets.

We see that the sources of these competitive advantages in born digital firms rely on their digital technologies (Monaghan et al., 2020) and on what goes together: digital skills of their employees and their innovativeness which transforms into innovativeness of their firms (Eden, 2016). Innovativeness would not be possible without creativity of their knowledge workers indicated by Smailhodžić and Berberović (2021) as a key feature of the digital firms. We also add here firms' responsiveness to customers' needs (Knight & Cavusgil, 2004) because innovativeness and creativity of employees make it possible and more to that responsiveness to customers' needs is also a direct result of born digitals' business models' flexibility.

Examining the idiosyncratic characteristics of born digital firms capitalizing from digitalization forms the basis of understanding the nature and extent of the competitiveness of born digitals.

7 Discussion, Conclusion, and Future Research Directions

The aim of this study was to analyze the characteristics of born digital firms that potentially lead to sustainable competitive advantage and to develop a conceptual model providing a framework for the future analysis of their competitiveness.

The analysis of the literature on International Business and International Entrepreneurship from the last decade, with particular emphasis on the previous 5 years, has shown that new digital technologies are changing global competition in a significant way. Experts on globalization and global competition are unanimous about the impact of technological progress, especially digital technologies, on business. Thanks to digitalization, not only new, strong competitors from emerging markets appear in many industries, but also young digital firms arise that threaten the powerful global companies investing in physical resources in individual domestic markets. Born digitals have an inherent ability to show more creativity and responsiveness to constantly changing challenges by applying digital technologies, such as IoT, communication technologies, and cloud platforms in their newest forms across their markets.

The systematic analysis of the subject literature showed that despite a very small number of publications on internationalization of 100% digital firms, their authors use various terms such as digital platforms, digital natives, e-commerce corporations, ibusiness firms, or, finally, born digitals. All these companies are characterized by 100% digital adoption, Internet-based digital product offering, and digital business model operation. Thus, on the basis of their presented characteristics, we propose to use the terms "born digitals" or "born digital firms" to denominate the above-mentioned categories of firms.

The theoretical implication of this chapter is that born digital firms' competitiveness lies first of all in their digitalization. Thanks to their business model supporting

creativity and responsiveness to customer needs they can understand better and adapt to more quickly and win in the marketplace. Moreover, sustainable competitive advantage of born digitals across different markets might be defined as a complex dynamic construct, which is based on their specific firm's advantages, such as technology advantage, human capital advantage but also differentiation advantage.

The managerial implications of our study are related to the decision makers of both born digital firms and those challenged by them. How born digitals succeed in the market, based on what factors, with what type of business models, is an important consideration for the success of these firms and also of those trying to fend off the challenge provided by them. The conceptual framework presented in our current work supports asking important questions related to understanding the competitive edge of born digital firms, while future studies using that framework will provide empirical assessment of the power of different elements and their interrelations.

Limitations of this study are in both the theoretical and empirical domains. Due to its exploratory nature, the study focused only on the analysis of the literature so far. As it is a conceptual work, there is no empirical validation of the framework presented.

This study needs to be extended in the future; thus, we elaborated future research directions. First of all, we considered only three data basis and there are more. Although they overlap with one another, applying the same search in more data basis may produce more results. Besides this, the future literature review should cover periods next to the considered here, as the discussions about born digital firms and other firms similar to them will certainly continue.

Future research may explore the differences between born digitals and traditional enterprises that expand internationally after some years of their establishment. According to Smailhodžić and Berberović (2021) creativity and constant reinvention are main engines in the emerging digital business models of born digitals' expanding abroad, when traditional firms rather use traditional business models. Based on the studies of Bergsten and Gertzell (2017), who analyzed potential differences of digital firms and traditional manufacturing firms, there are some differences especially in success factors between the two types. Such differences include firm's responsiveness to customers' needs, which we identify in our framework as a source of competitive advantage of born digitals. According to Bergsten and Gertzell (2017) customer-oriented strategy and large user base is very important for digital firms. This was also confirmed in our literature review, with reference to Monaghan et al. (2020) work. However, for traditional manufacturing firms, a large customer base may be detrimental to the quality of the distribution chain. Moreover, our literature review emphasized that one of the sources of born digitals' competitive advantage is innovativeness leading to technology advantage (Banalieva & Dhanaraj, 2019). It was confirmed in Bergsten and Gertzell (2017) study, by emphasizing that new ground-breaking innovations open up new types of products for digital firms, and innovations seem to be most beneficial for the digital firms. Differently, for manufacturing firms' e-commerce provides a way to reach global market and to reduce their costs. Thus, we make a call for research in terms of potential conflicts

and differentiation of born digitals, which use digital business models and expand to other countries from their inception, to the competitiveness of traditional enterprises.

The fourth suggested future research direction addresses the need to empirically analyze the born digitals and their competitiveness in different contextual settings and in particular industries. According to Vadana et al. (2019) country of origin and the dynamism of the industry may influence the evolution of born digitals. As Monaghan et al. (2020) stated there are advantages in identifying the firm-specific advantages of digital firms and the extent to which they are location (or non-location) bound and how they include ecosystem-specific advantages.

Future studies should cover the empirical testing of internationally-active born digitals, their strategies and business models. This is in line with call for future research which emphasizes the need of research, based on examination of internationalization strategies that born digital firms use and the role of internationalization strategy on international performance (Vadana et al., 2019).

To conclude, the suggested conceptual framework develops further understanding of the significant role of global changes to born digital firms' competitiveness and their strategic advantage in the digital era. It is expected that the outcome of this chapter would lead to the empirical testing of the suggested theoretical model in an effort to distinguish the competitive capabilities of born digital firms that lead to competitive advantage.

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The Value Chain Configuration in the Digital Entrepreneurship Age: The Paradoxical Role of Digital Technologies



Zulima Fernández and Alicia Rodríguez

Abstract This chapter analyzes the configuration of global value chains in the digital entrepreneurship age by clarifying past contributions, examining work resulting from the Covid-19 pandemic, and outlining suggestions for future research. First, we provide a conceptual framework to understand how digitalization has driven its transformation. Specifically, we discuss the main changes in the slicing of value chain activities, the control and location decisions of these activities, and the paradoxical role played by digital technologies in shaping the way entrepreneurs organize them. In doing this, we highlight the location paradox, which rests on the idea that digital technologies help firms expand their geographical scope and reduce co-ordination costs in large and dispersed networks (which favors offshoring), while reducing the importance of the location of activities and shortening supply chains (which favors reshoring). Second, we critically review the research on value chain configurations that has appeared because of the Covid-19 pandemic. Lastly, we discuss some promising areas of research that could yield insights that will advance our understanding of value chain configurations in the digital entrepreneurship age.

Keywords Digital entrepreneurship · Digital technologies · Value chain configuration · Offshoring and reshoring

1 Introduction

Digitalization is a key driver of the transformation of global value chains (GVCs) (Cennamo et al., 2020; McKinsey Global Institute, 2019; Zhan, 2021), one that affects the slicing of value chain activities as well as location and governance decisions (Brun et al., 2019). A transformation of this kind presents opportunities for entrepreneurs to discover previously unknown business opportunities and for

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established firms to exploit the restructuring of the value chain to launch entrepreneurial ventures.

The debate over the re-shaping of GVCs has gained even greater importance because of the disruptions caused by the Covid-19 pandemic. In particular, numerous studies argue in favor of bringing offshored activities closer to home and relying—among other measures—on digital technologies (DTs) to reduce the risks of supply shortages (Ivanov & Dolgui, 2020). DTs can, in this way, help firms that have offshored some of their activities to re-focus on neighboring countries or regions or even re-shore them to the home country.

The profound and varied changes that DTs bring to GVCs make it advisable to adopt a comprehensive approach. This is the purpose of this chapter. To do this, we provide a conceptual framework to understand the changes in the configuration of value chains in the digital entrepreneurship age. This analysis leads us to a discussion of the paradoxical consequences that digitalization appears to be bringing to the design of GVCs, especially in regard to the location of activities. The International Business literature views DTs as tools that help firms expand their geographical scope and reduce co-ordination costs in large, dispersed networks of subsidiaries, suppliers, and customers (Alcácer et al., 2016; Chen & Kamal, 2016). Paradoxically, however, the growth of these technologies is an enabler of reshoring (Dachs et al., 2019a), which leads to shorter, less-fragmented value chains and greater geographical concentration of value-added activities (Zhan, 2021).

In addition, we are particularly interested in clarifying the changes Covid-19 has brought to GVCs and how they differ from previous restructurings. The pandemic has presented opportunities to launch new businesses that rely on DTs and take advantage of the restructuring of GVCs (Davidsson et al., 2021).

The remainder of the chapter is organized as follows. First, we define what we understand by digital entrepreneurship and outline the main characteristics of DTs and how these may influence the configuration of value chains. Second, we provide an overview of the configuration of GVCs in the digital entrepreneurship age, with special attention paid to location decisions and the paradoxical role played by DTs. Third, we critically review recent studies on the impact of the Covid-19 pandemic on value chain configurations. We close the chapter by discussing several avenues for further research at the intersection of the digital entrepreneurship and GVC literatures. We hope the discussion of these promising streams will yield insights that will advance our understanding of the value chain configuration in the digital entrepreneurship age.

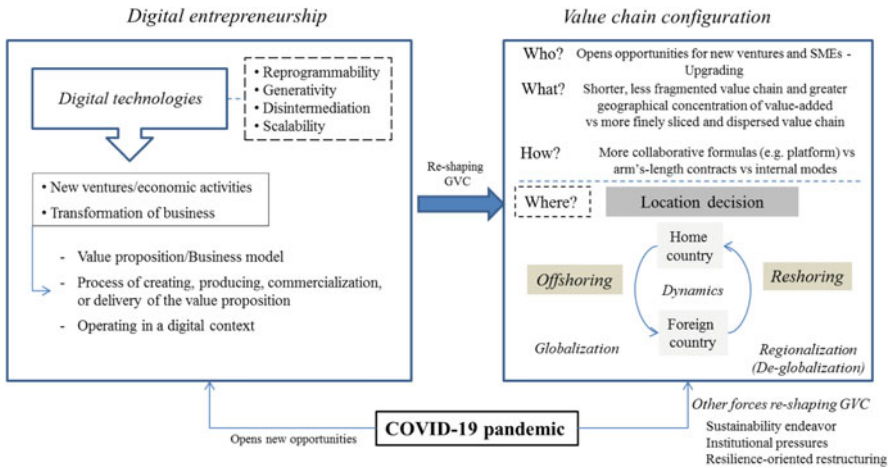


Fig. 1 A framework for understanding the value chain configuration in the digital entrepreneurship age (and the effects of the Covid-19 pandemic)

2 Digital Entrepreneurship and the Value Chain Configuration

We open this chapter by introducing a framework for understanding the value chain configuration in the digital entrepreneurship age (see Fig. 1); this framework will be explained and referred to throughout the chapter. On the one hand, the proposed framework presents the key elements that define digital entrepreneurship (see Sect. 2.1), together with the characteristics of DTs that facilitate the re-shaping of GVCs (see Sect. 2.2). And on the other, it identifies the key decisions necessary to reconfigure the value chain, with particular reference to location decisions (see Sect. 2.3). The framework also considers the impact of Covid-19. The pandemic is a new re-shaper of GVCs, one that also influences the impact of digitalization on them (see Sect. 3).

2.1 Digital Entrepreneurship and Global Value Chains

Digital entrepreneurship has received considerable attention from scholars from different disciplines over recent years, a state of affairs reflected by the numerous special issues and reviews dedicated to it (e.g., Kraus et al., 2019; Lanzolla et al., 2020; Sahut et al., 2021; Steininger, 2019). A multitude of definitions of digital entrepreneurship has been put forward in the last decade (e.g., see Sahut et al., 2021). On the left-hand side of Fig. 1, we summarize the concept of digital entrepreneurship used in this chapter. Specifically, we define digital entrepreneurship as new economic ventures or transformations of current businesses based on the application of

DTs¹ in at least three primary ways (von Briel et al., 2021), namely by: (a) creating a value proposition or business model; (b) producing, commercializing, or delivering the value proposition; and (c) operating in the digital context.

The creation of a digital outcome is not the only manifestation of digital entrepreneurship. In our framework, new and preexisting firms that use DTs to modify their processes (e.g., via the application of Industry 4.0 or additive manufacturing) or that offer physical products accompanied by digital services form part of the digital universe.² In fact, some firms—and new ventures—are more digitalized than others (Monaghan et al., 2020). For example, a “dark kitchen” that exclusively offers food for home delivery and that uses the internet to manage orders and staff, as well as administer review sites, social media promotions, etcetera is more digitalized than a larger restaurant that uses social networks simply to promote the business.

Digital business activity, then, is supported by highly distinct forms of DTs, such as digital artifacts (e.g., digital components, applications, or media content), digital platforms, and digital infrastructures (e.g., cloud computing, big data analytics, online communities, social media, additive manufacturing, digital makerspaces, etcetera) (Nambisan, 2017).

Digitalization opens opportunities for both new players and preexisting firms. DTs positively affect all stages of entrepreneurship, making it possible to identify or create new opportunities; facilitate viability studies; and in many cases get new businesses started. They are especially useful to firms in search of opportunities and eager to operate in an international context. DTs allow new ventures to create value for final markets and more easily insert themselves into GVCs and new types of ecosystems. In the case of small and medium-sized enterprises (SMEs), both the International Business and GVC literatures view these firms as dependent suppliers operating in value chains led by multinational companies (Oliveira et al., 2021). Inserting themselves into GVCs has been the most common way of internationalizing for SMEs, a strategy which places them in a position of total dependency. DTs, though, have increased the autonomy of SMEs when working with leading multinational companies (Sturgeon, 2021; Oliveira et al., 2021). For example, DTs now permit SMEs to gain access to digital platforms and ecosystems as well as establish links with other types of partners (Pananond et al., 2020) and subsequently obtain the resources needed to innovate. In general, DTs give SMEs the opportunity to upgrade what they offer and deliver it to a much wider market.

¹This definition is based on von Briel et al., 2021, who only consider new economic activities. We believe, however, that preexisting businesses that change as a result of DTs should be included, in line with the definition of the European Commission (2015).

²On this point we differ from other authors who argue that products must be available in a digital format (e.g., see Giones & Brem, 2017; Monaghan et al., 2020).

2.2 Characteristics of Digital Technologies and Their Implications for the Configuration of Global Value Chains

DTs offer affordances that can be useful to identify, analyze, and exploit business opportunities. The most prominent of these are reprogrammability, generativity, disintermediation, and scalability (see Fig. 1) (Autio et al., 2018; Monaghan et al., 2020; Nambisan, 2017; Yoo et al., 2010; Zaheer et al., 2019).

Reprogrammability simply means that an asset can be reprogrammed to perform different functions, thereby reducing its specificity and lowering the transaction costs. In fact, digital assets can be used for multiple applications with no loss of value. Digitalization increases the flexibility of the organization while reducing levels of dependency and opportunistic behavior of suppliers or clients.

Generativity relates to the capacity to recombine elements creatively and use them for previously unimagined purposes. The open and flexible affordances of pervasive DTs enable them to develop unforeseen innovations on a constant basis, in many cases involving new actors in an uncoordinated mode (Yoo et al., 2012). In combinatorial innovations, the boundaries of the product are not fixed, but are fluid. Thus, the designers of a component cannot fully know how the component will be used with their product or all the possible ways that the product could be used as a component. In sum, products can be used in multiple ways or in combination with others (Yoo et al., 2010), as occurs, for example, with the smartphone.

Disintermediation refers to the possibility of establishing direct relationships between providers and users, thus eliminating intermediaries and the power they may exert. Marketplaces, for example, present all types and sizes of firms with opportunities for direct access to final customers.

Lastly, scalability is linked to the capacity to grow rapidly and span extremely large markets, without the need to worry about temporal diseconomies or requirements for the same level of resources as traditional brick-and-mortar businesses, thanks to the greater use of lighter assets (Banalieva & Dhanaraj, 2019). A good example of global scaling is provided by Wattpad, a social storytelling platform with a small employee base in Canada that serves more than 70 million users worldwide (for more details see Monaghan et al., 2020).

DTs, then, are versatile tools that boost flexibility and promote innovation, ones that reduce the importance of the location of activities (Autio et al., 2018), grant more autonomy to firms, and allow them to attend to new demand requirements. For this reason, they are particularly useful for insertion into GVCs (Monaghan et al., 2020).

Many DTs are applicable to the design and management of value chains. Additive manufacturing (3D printing), big data analytics, advanced tracking and tracing technologies, cloud computing and artificial intelligence (AI)—along with the internet of things, and mobile telephone-based and social media-based systems (Ivanov et al., 2019; Winkelhaus & Grosse, 2020; Koh et al., 2019)—are all relevant. And yet, not all these technologies are equally advanced or equally applicable to the

internationalization of firms and their value chains (Strange & Zucchella, 2017). Many of them, though, are not only being used to improve the management of value chains, but also to shorten and completely re-design them.

2.3 An Overview of the Value Chain Configuration in Digital Entrepreneurship: The Paradoxical Role of Digital Technologies

The digital transformation is driving changes in firms' boundaries, processes, structures, roles, and interactions (Cennamo et al., 2020). And these changes equally affect new ventures and preexisting firms that seek to transform their business models. In both cases, the incorporation of DTs brings a reconfiguration of value chains (Strange & Zucchella, 2017) and affects decisions on what activities to disaggregate, how to manage them, and where to locate them (see the right-hand side of our framework in Fig. 1). We shall now proceed to discuss some of the main changes that DTs have brought to the value chain configuration, many of which are paradoxical (see Table 1 for an overview).

2.3.1 DTs and Value Chain Activities: The Slicing of Activities

DTs exert an impact on the activities of the whole value chain, ranging from product design and manufacturing to distribution (Koh et al., 2019). They improve the planning and coordination of activities and thus facilitate the disintegration of the value chain, permitting activities to be performed in the most advantageous and efficient locations. This suggests that DTs are crucial tools to manage a more finely sliced and internationally dispersed value chain. Both manufacturing and service activities—especially those based on knowledge—have been offshored across borders in recent decades (Contractor et al., 2010; Pisani & Ricart, 2016).

Service activities are especially benefited by DTs that improve communication, technologies such as teleconferencing, cloud storage, 5G, virtual reality, and augmented reality. These technologies all improve efficiency and interaction among dispersed locations, particularly higher value-added knowledge-based activities, even in sectors such as health care (Buckley, 2021). In addition, DTs make it possible to unbundle manufacturing activities into services that can be supplied independently, thereby enabling greater servitization, which facilitates further fragmentation of the value chain into increasingly finely sliced pieces (Brun et al., 2019).

At the same time, DTs paradoxically allow digital entrepreneurs to shorten the length of these value chains and reduce the fragmentation of the activities included in them (Zhan, 2021). An example of this is additive manufacturing, which has the potential to modify the density of GVCs (as well as geographic span) (Laplume et al., 2016). This re-shaping of the value chain can result in more concentrated

Table 1 The paradoxical role of digital technologies in the value chain configuration in the digital entrepreneurship age

Value chain dimension	Paradoxical effects of digitalization	
Slicing of activities	<p><i>Favor more finely sliced and dispersed value chain</i></p> <ul style="list-style-type: none"> • Digitalization leads to improved coordination and higher efficiency; greater interaction and connectivity facilitate the disintegration of activities • The unbundling of manufacturing-related activities into services makes it possible to deliver them as separate businesses (servitization) 	<p><i>Favor shorter and less fragmented value chain</i></p> <ul style="list-style-type: none"> • DTs favor extended disintermediation • The reprogrammability and scalability of DTs favor simpler and more flexible processes
Control–organizational choices	<p><i>Favor external modes</i></p> <p>DTs help manage more information, increase interaction, and offer greater security and transparency in dealing with third parties.</p> <ul style="list-style-type: none"> • More collaborative formulas (e.g., platforms) • More arm’s length contracts (e.g., smart contracts, greater trust and security thanks to blockchain technology) 	<p><i>Favor internal modes</i></p> <p>DTs lead to extended disintermediation, allowing firms to perform functions themselves.</p> <ul style="list-style-type: none"> • Direct provision (e.g., disintermediation due to supply chain digitization) • Direct distribution (e.g., customers have direct access to digital content) • Disintermediation in supporting industries (e.g., financial services—thanks to blockchain technology and big data analytics) <p>The strategic importance of data increases the need to control information.</p>
Location	<p><i>Favor offshoring strategies</i></p> <ul style="list-style-type: none"> • DTs make it possible to manage finely sliced value chains dispersed all over the world • DTs enable layered and modular products/services • DTs help firms expand geographical scope, reduce coordination costs in large and dispersed networks, and facilitate interaction with third-party foreign partners or between foreign subsidiaries 	<p><i>Favor reshoring strategies</i></p> <ul style="list-style-type: none"> • DTs can equalize cost levels between countries (thanks to automation, efficiency gains, etc.) • Digital businesses are less location-specific • Digital businesses require less investment in physical assets overseas • DTs permit higher efficiency-sustainability production and processes; more sustainable value chains

Relative to the value chain configuration of non-digital business models, which is used as the reference category

value-added in the countries in which the digital coordination of the value chain is performed (Buckley et al., 2020). Moreover, DTs make it possible to minimize waste in manufacturing activities and thereby achieve higher efficiency-sustainability levels.

2.3.2 DTs and Control of Value Chain Activities: Make, Buy or Ally?

Together with the slicing of activities, another important aspect is determining how to organize them. It is important to decide, therefore, whether each activity to be disaggregated will be performed internally (via subsidiaries or affiliates) or externally (via outsourcing contracts or collaboration agreements).

Digitalization reduces transaction costs for both internal and external operations (Banalieva & Dhanaraj, 2019) thanks, among other things, to the fact that DTs help to manage information better (such as those related to big data analytics) and to make transactions more secure (such as those related to blockchain). DTs clearly exert effects—in ways that in many cases are once again paradoxical—on the governance modes.

First, reduced transaction costs for internal operations may persuade firms to perform activities in-house. As explained, DTs contribute to disintermediation, which favors the adoption of internal governance modes and the shortening of the value chain. DTs, then, enable firms to dispense with third parties (suppliers or collaborators) and open the door for them to take on the different functions themselves, both direct provision (thanks to supply chain digitalization) and/or direct distribution to the customer. Instances of this can be seen in digital media businesses with data streaming services that offer digital content directly to customers (e.g., Twitch, a live streaming platform (<https://www.twitch.tv/>)). Similarly, the ease with which large quantities of data can be acquired and managed, along with the capacity to verify the security of transactions, is making it possible to take on supporting activities such as financial services (Brun et al., 2019). Moreover, we must not forget the importance of data for digital businesses—they are often the core elements of the business. Properly controlling and using this information, then, is crucial for the competitiveness of firms and is another factor that motivates them to manage the acquisition, handling, and storage of data internally.

Second, the reduction of external transaction costs facilitates external governance modes. Possessing and analyzing large quantities of data, together with the security delivered by blockchain technology, encourages the use of markets (e.g., via smart contracts). And yet these same technologies are also fundamental for the establishment of cooperative relationships between partners. Digitalization enables the control of assets without ownership and the access to/control of workers without an employment relationship (Gawer, 2020). Cooperative relationships, then, take precedence and favor the creation of ecosystems made up of complementary firms. Likewise, DTs are responsible for the extraordinary proliferation of digital platforms (Cusumano et al., 2019), both transaction platforms that enable exchanges between different sides (such as Shopify, Magento or OpenCart) and innovation platforms (such as Wazocu, Herox or OPEN Ideo).³

³Further information available at <https://crowdsourcingweek.com/blog/10-indispensable-open-innovation-platforms-global-corporations/>; <https://blog.hubspot.es/sales/plataformas-comercio-electronico>.

Lastly, it is important to note that in digital business relationships the distribution and transfer of large quantities of information between different actors increases the need for improved cybersecurity. This need not only influences the choice of partners but is also likely to persuade firms to internalize sensitive activities.

In sum, DTs simultaneously favor the adoption of conflicting governance modes in the configuration of GVCs. On the one hand, they promote vertical integration. And on the other, the same technologies favor and support external modes such as cooperation with customers and suppliers, as well as agreements with independent third parties.

2.3.3 DTs and Location of Value Chain Activities: Offshoring and Reshoring Dynamics

Another key decision linked to the configuration of the value chain is where to locate activities—in the home country or some other country or region. To make the best decision, entrepreneurs should analyze the interaction between the comparative advantages of the country and the firm (Kogut, 1985). In recent decades this analysis has led firms to disperse their value chains internationally, in search of—among other things—more competitive costs and/or higher quality resources. The characteristics of DTs, however, can modify this interaction, favoring both the dynamics of offshoring and reshoring (or backshoring).

The changes brought by digital entrepreneurship have reduced the importance of labor arbitrage in deciding where best to locate value activities and put the spotlight on other elements. Factors like regulatory quality (e.g., the ability of institutions to protect data), the availability of a digitally skilled workforce, and the existence of a digital technological infrastructure are prime concerns. Given the importance of the information and data that are collected in digital entrepreneurship, it is also vital to uphold standards and enforce regulations. For this reason, digital security and cybersecurity have become determining factors in location strategies (Buckley, 2021). The location-specific technological context assumes, then, greater importance, in particular the quality of the digital-industrial ecosystem in a firm's home country versus that offered by the overseas location (Kamp & Wilson, 2021). Accordingly, in recent years digital resonance⁴ has emerged as a decisive factor in location decisions (see AT Kearney, 2021). Lastly, we must not forget to mention other factors such as the strategy of the firm, the need to configure resilience-oriented value chains, institutional pressures, and the requirements of sustainability, all of which play roles in the location decision.

The application of DTs to the design of GVCs appears to be producing a paradoxical effect in the location of value chain activities (i.e., offshoring/reshoring). This location paradox rests on the idea that DTs help firms expand their geographical

⁴Digital resonance is informed by metrics like the digital skills of a country's workforce, legal and cybersecurity, corporate investment in startups, and digital innovation outputs.

scope and reduce co-ordination costs in large and dispersed networks (which favors offshoring), while reducing the importance of the location of activities and shortening supply chains (which favors reshoring). Both options offer a multitude of opportunities for digital entrepreneurs.

DTs favor offshoring strategies because they make it possible to manage finely sliced value chains spread all over the world, one of whose consequences has been the appearance of global factories (Buckley, 2009). The layered and modular character of many DTs (Sturgeon, 2021), the use of big data to program production, and improved capacities to coordinate dispersed activities, for example, facilitate offshoring. In addition, technologies that support remote interaction promote the offshoring of high- and medium-level value-added services. Given the increased need for digital capacity among businesses that rely on DTs for their cross-border activities, digital resonance remains crucial to take advantage of offshoring strategies.

Conversely, the advanced features of many DTs mean that firms can re-locate activities at home or in neighboring countries with no increase in production costs (and lower transport costs). In addition, firms obtain other benefits that are indispensable to compete in many markets, advantages such as the ability to respond in a timely and efficient manner to individual consumer demands. Digital technologies such as additive manufacturing or automation promote reshoring. Indeed, these technologies and others like them not only bring supply chains closer to destination markets, but also oblige an overhaul and reduction of the activities included in them. Thus, DTs enable more efficient and sustainable production and processes, as shortened value chain configurations reduce trade and transport flows and their negative effects.

DTs, then, seem to make the offshoring of manufacturing less attractive by providing alternatives to the international dispersion of production (De Backer & Flaig, 2017). The link between DTs and backshoring strategies is not clear, however (Kamp & Gibaja, 2021). The few studies that have examined this relation to date find contradictory—and therefore inconclusive—results (see Ancarani et al., 2019; Ancarani & Di Mauro, 2018; Dachs et al., 2019a; Fratocchi & Di Stefano, 2019; Müller et al., 2017). It is certainly possible, of course, that the paradoxical role of DTs may have something to do with these inconclusive results.

3 The Current Context: An Overview of Research on the Effects of the COVID-19 Pandemic

The current state of GVCs and digital entrepreneurship is marked by the Covid-19 pandemic. Since international supply chains have been particularly affected, discussion has centered on the international distribution of value chain activities. Supply problems have resulted in shortages of essential products. The lack of components in many industrial sectors, a consequence of cascading “ripple effects” (Ivanov et al.,

2014), has paralyzed production in numerous sectors. At the same time, the demand for many products has plummeted, causing stocks of unsold products to rise in some sectors (e.g., textiles). The combination of a risk demand with a supply risk (van Hoeck, 2020a) has stressed supply chains to an extraordinary degree.

This situation has led academics (Miroudot, 2020; Strange, 2020; Verbeke, 2020) and consultants (Accenture, 2021; McKinsey, 2021) to question and seek improvements to the design and management of value chains. Interest has focused on the risks posed by highly infrequent events with extreme consequences such as pandemics or natural disasters. What has become clear is that in addition to preparing better for tragedies of this kind, a revamp of the design of value chains is called for, particularly in regard to the international distribution of activities.

Supply chain resilience has become a requirement (Strange, 2020), one that may turn into an important strategic weapon (Scholten et al., 2020), not only as a recovery mechanism to unexpected events but, in a more ambitious sense, also as a means of adapting to and improving after changes, and thus reinforcing the viability of firms (Ivanov & Dolgui, 2020; Wieland & Durach, 2021). The question to be answered is how to build this resilience. In the short time that has passed since the beginning of the pandemic, numerous studies have appeared that look for answers (see Chowdhury et al., 2021 for a survey). Many of these studies stress the need to develop optimization and simulation methodologies (Golan et al., 2020; Queiroz et al., 2020). Beyond this, however, a series of responses more related to strategy and management are frequently mentioned, among which the following stand out:

- Considering total costs including sourcing, supply and servicing, and designing new ways of working (McKinsey, 2021; van Hoeck, 2020b)
- Improving relationships with suppliers and customers (McKinsey, 2021; van Hoeck, 2020a)
- Re-locating value chain activities closer to home (Accenture, 2021; Barbieri et al., 2020; McKinsey, 2021; Fratocchi & Di Stefano, 2020; Queiroz et al., 2020; van Hoeck, 2020a; Wieland & Durach, 2021)
- Adopting digital technologies (DTs) such as blockchain, artificial intelligence, Industry 4.0, and additive manufacturing (Chowdhury et al., 2021; El Baz & Ruel, 2021; Queiroz et al., 2020)

3.1 Covid-19 and the Design of GVC Activities. Has Anything Changed in Today's 'New Normal'?

The question to be asked is whether the proposals put forward in recent studies of the value chain configuration in the Covid-19 pandemic are new. To answer this question, we should bear in mind that the fragmentation and spatial distribution of value chain activities caused by offshoring seems to have peaked in 2010, at least in manufacturing activities. In line with this, macroeconomic data confirm that the offshoring of manufacturing has become less common since then (UNCTAD, 2020;

World Trade Organization, 2021). At the same time, the reshoring of value chain activities was already a growing phenomenon (The Economist, 2013). Poor quality, lack of flexibility, unemployed capacity at home, and overly high sourcing costs, including coordination and logistics costs, have become the primary causes of the reshoring of manufacturing activities. Innovation issues such as the proximity of production to R&D seem to be secondary drivers (Dachs et al., 2019b). Some of these reshorings were caused by dissatisfaction with offshoring, while others were the result of a change in strategy (McIvor & Bals, 2021).⁵ Overall, DTs have given a huge boost to the dynamic of re-locating value chain activities (Ancarani et al., 2019; Dachs et al., 2019a; Stentoft & Rajkumar, 2020).

Reshoring, then, was a strategy that numerous firms were implementing before Covid-19⁶ because competitive demands made it a necessity and technology was available that made it feasible. Other contextual changes such as growing protectionism and particularly the non-negotiable need for sustainability are also promoting the decision to opt for reshoring.

Although there has been much talk of the post-Covid era and the “new normal,” how GVCs have changed and will continue to change was already being discussed before the arrival of the pandemic. Indeed, “a new normal” in the configuration of GVCs had already been mentioned in pre-Covid-19 times (De Backer & Flaig, 2017), and Brun et al. (2019) argue that the consequences of the 2008 financial crisis for GVCs were resiliency, regionalization, rationalization, and digitalization.

Covid-19 has speeded up a process that had already been initiated. Firms have accelerated their digitalization processes; their employees are working from home; and their customers have become used to buying online. In parallel, research into DTs continues to grow, along with investment in infrastructure designed to boost global connectivity. Without doubt, the Covid-19 pandemic has hastened the massive use of DTs in society as a whole and in the business world. Firms that take advantage of the spur to digitalize provided by Covid-19 will boost their competitiveness. Likewise, this digitalization process will present numerous opportunities for new digital entrepreneurs.

⁵In essence, the two types of causes of re-shoring can be identified, in both manufacturing and service sectors (Albertoni et al., 2017).

⁶In fact, universal agreement does not exist on whether the present situation requires GVC activities to be re-shored; Miroudot (2020) argues that the literature on risk supply management has not demonstrated that domestic production generates more resilience.

4 Avenues for Future Research: Insights for GVC 'Location Decisions' in the Digital Entrepreneurship Age

The study of the value chain configuration in the digital entrepreneurship age offers many unexplored lines of research. Our objective in this chapter was to present a general framework for the study of the relation between digitalization and the reconfiguration of GVCs, along with the opportunities offered for digital entrepreneurship; this framework can be used as a starting point for future analyses. Specifically, we were particularly interested in the dimension of location, as the notion that “digital affordances are not location specific” (Autio et al., 2018, p. 16) seems to make it likely that DTs will challenge or even alter our beliefs about the location of activities in the value chain. Indeed, the impact of DTs is one of the least investigated yet most promising areas in the study of GVCs and International Business (Kano et al., 2020).

In accordance with the framework discussed, we outline three opportunities for further research: (1) the specificities of different DTs and locations; (2) new digital business models; and (3) digital sustainability.

4.1 The Specificities of Different DTs and Locations: Clarifying the Paradoxical Role of DTs?

To this point, we have referred to DTs in general, but many types of DTs exist, with distinct characteristics and levels of maturity. We need, then, to disentangle the different digital technologies and their implications for the location of activities in the value chain.

An in-depth analysis of each DT may help to clarify their paradoxical roles. In principle, some of these technologies are likely to be particularly useful for coordinating dispersed activities across borders, whereas others will sustain re-shored activities. De Backer and Flaig (2017), for example, suggest that communication technologies will continue to support offshoring, while information technologies will promote reshoring. Each DT, then, requires study to determine how it may contribute to firm competitiveness. Such an examination will also help explain the conflicting results obtained by current empirical research. Although most studies confirm the relation between DTs and reshoring (Ancarani et al., 2019; Dachs et al., 2019a; Stentoft & Rajkumar, 2020), some papers suggest that the importance of DTs for reshoring is questionable (Ancarani & Di Mauro, 2018; Müller et al., 2017).

The business model of the firm along with the value levers that underpin it are key elements that should guide the application of DTs to the design of GVCs. Flexibility, time to market, and superior quality or efficiency are some of the main value levers whose relations with different DTs and GVC designs should be studied in detail. Advancing our knowledge of which lever or levers each DT favors and how they can be used represents a clear source of opportunities for new entrepreneurs seeking to

insert themselves into GVCs or construct their own supply chains. Lastly, research is needed into the impact of a series of contextual elements. Chief among these are the existence of qualified personnel, adequate infrastructure, and a developed legal and regulatory framework.

4.2 New Digital Business Models: Value Chain Upgrading and Entrepreneurial Opportunities

DTs open numerous opportunities for innovation and the development of new digital business models, especially ones with implications for GVCs (Brun et al., 2019; Strange & Zucchella, 2017). They have given rise to less bounded entrepreneurial outcomes and processes that have opened the locus of entrepreneurial agency to a varied and changing group of actors (Nambisan, 2017). DTs produce a distributed entrepreneurial agency, with multiple parties involved in the development of the idea and the supply of the resources necessary for the project via instruments such as crowdfunding, social media platforms, and digital marketplaces, among others—an approach that favors disintermediation and the birth of ecosystems (Zaheer et al., 2019). In short, digital entrepreneurship offers a multitude of opportunities for entrepreneurs (Nambisan & Baron, 2021) via such ecosystems and platforms (Gawer, 2020).

Digital platforms make it easier to set up businesses and quickly break into international markets. The phenomenon of platformization offers many novel research opportunities (Kano et al., 2020). Industrial digital platforms that focus on B2B relationships merit particular attention as this is an area that has not received sufficient study in the literature on platforms (Jovanovic et al., 2021).

Platforms and digital tools in general are making it possible for SMEs to gain more autonomy from multinational enterprises. These tools allow SMEs to create more value, while also giving them increased power to obtain a substantial part of this value. How value is created within GVCs and how it is distributed among partners in the value chain is a crucial question to analyze (Ghauri et al., 2021). Since the distribution of value depends on the relative power of each partner, power relationships in GVCs need to be investigated, along with how the re-design of GVCs has affected these relationships. The literature on the governance of GVCs is particularly interested in how power asymmetries may inhibit or facilitate supplier upgrading (McWilliam et al., 2020). The model developed by Oliveira et al. (2021) throws light on the unaddressed effects of digital technologies on power relationships in value chains, relationships that constrain the ability of SMEs to upgrade. In sum, many questions remain unanswered, and more research is needed to deepen our current understanding of value chain upgrading and digital entrepreneurship.

It should not be forgotten that entrepreneurship comes with a price tag, and that digital entrepreneurship has specific costs that arise from the characteristics of DTs. Many platforms and ecosystems, for example, require input standardization, which

makes suppliers, especially SMEs, more interchangeable and consequently vulnerable (Nambisan et al., 2019). Platforms bring other limitations that are the result of lock-in effects (Cutolo & Kenney, 2020). The initial advantages that they deliver for gaining access to international markets (e.g., lower entry costs and reduced risk) can turn into a dependency on the platform owner, another danger to add to the specific risks that new ventures face when internationalizing (Jean et al., 2020). This situation opens several important avenues for future research to concentrate on understanding and calculating the costs of digital entrepreneurship (Nambisan & Baron, 2021).

Lastly, we must mention the impact of the Covid-19 pandemic and the entrepreneurial opportunities that this has presented (Davidsson et al., 2021). The digitalization of the economy and the re-design of GVCs were already research topics before the arrival of Covid-19. And yet, the pandemic has sharpened the focus on digital business models and the changes they have brought to GVCs. Resilience and viability have become key issues in the design and management of the new value chain (Ivanov, 2020), and as such these areas should receive attention from future work. In the end, the most important impact of the pandemic may well be the boost it has given to digitalization in all contexts, to businesses and to other aspects of our daily lives. Digital operating models with exponential growth trajectories have been shown to be highly useful to compete against and outperform incumbents with fixed capabilities (George et al., 2020). Thus, the potential of digital businesses and the entrepreneurial opportunities they create are clear and merit further research.

4.3 Digital Sustainability and Location in Digital Entrepreneurship

The sustainability of supply chains has received extensive attention from researchers over the last 20 years, but almost always focused on the context of large firms. Even though SMEs make up the majority of businesses in all countries and possess huge potential to reach sustainable development goals (Sinkovics et al., 2021), few studies of the sustainability of supply chains in these firms exist. This is a research gap that should be filled.

Since their appearance in the 1980s, GVCs have grown ever more complex and long, resulting in an increase in international—particularly maritime—transport (De Backer & Flaig, 2017), which has in turn had detrimental effects for the environment. And this, of course, is not the only negative consequence caused by the proliferation of GVCs. Pollution and the squandering of natural resources in countries where activities are located are just two more—among many other—of their negative impacts. On the positive front, GVCs have generated employment, upped the standard of living, and even improved the technological endowment of host countries.

The logistical pressure is also ratcheted up by consumers who nowadays expect to receive their orders almost immediately, with the concomitant effects of last mile delivery. Time-to-market has become a key value lever, with all the negative consequences this brings for the environment.

Although reshoring and sustainability are clearly related, up to now this relation has been largely neglected by scholars (Fratocchi & Di Stefano, 2019; Orzes and Sarkis, 2019). Locating activities closer to target markets reduces the need for—and negative effects—of transport. Moreover, production is transferred to countries with tougher environmental standards and laws. Lastly, automation and agile manufacturing, both so important for the efficiency of reshoring, contribute to waste reduction (The Reshoring Institute, 2020).

DTs play a fundamental role in the sustainability of GVCs (Roozbeh Nia et al., 2020). The use of 3D printing, which constructs without generating waste, is a good example. Big data analytics and cloud computing help to identify precisely what each consumer wants, thereby minimizing unsold products and unproductive stock. Indeed, some of the firms that weathered the hardships of the pandemic best were those that produced small batches in response to demand.

Digital sustainability, then, merits attention from future studies. A key issue to examine is how the characteristics of DTs can be used to reach sustainable development goals (George et al., 2021). An examination of the intersection between the literatures of digital entrepreneurship, GVCs, and sustainability could be hugely important for the configuration of more sustainable value chains.

5 Concluding Remarks

In this chapter, we have examined the relation between digital entrepreneurship and GVCs. In doing this, we have highlighted the way DTs have transformed value chains and provided opportunities for new ventures to integrate themselves into them, as well as upgrading the value propositions of the SMEs that are already a part of them.

The characteristics of DTs modify traditional GVC configurations in terms of slice, governance mode, and location of activities, promoting in many cases contradictory—apparently paradoxical—decisions. The dynamic of location is particularly interesting because DTs simultaneously favor offshoring and reshoring strategies.

Moreover, digitalization and reshoring are two of the most commonly mentioned strategies to deal with future supply problems caused by Covid-19 type disruptions. Both strategies were analyzed by scholars and consultants before the pandemic demonstrated their worth. In particular, the incorporation of DTs into business models was on the agenda of many companies long before the pandemic broke out. Covid-19 has accelerated this digital transformation, a transformation upon which many sustainable competitive advantages for firms will depend in the future.

Lastly, we present three areas of opportunity for further research linked to: the specificities of different DTs and locations; new digital business models; and digital sustainability.

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Entrepreneurial Thinking and Acting in the Context of Great Transformations in Germany: How to Approach Entrepreneurial Personalities and Organizations in Order to Actively Shape Transformational Challenges?



Ulrich Braukmann, Dominik Bartsch, Larissa Sternkopf, and Thomas Schauf

Abstract Great Transformations like the Digital Transformation and Sustainability Transformation, their challenges and their consequences for society are increasingly discussed in theory and practice. In this context, especially the issue of dealing with fundamental and profound changes in economy, politics and society is coming to the fore. In countries with liberal democratic systems such as Germany, an entrepreneurial mindset is granted an important role in dealing with these transformations in a proactive and formative way. Thus, the issue as to how more entrepreneurial individuals and organizations—and therefore more “out of the box thinking”—can systematically be tapped and developed in Germany becomes essential. To this end, this chapter proposes a newly conceptualized interdisciplinary and integrative approach, which was distinctly designed for the addressing and winning of entrepreneurial individuals and organizations in a systematic and targeted manner. Because it is specifically tailored to the prevailing circumstances and structures in Germany, the approach emphasizes enlightened, voluntary and self-sustaining actions. Doing so, it offers an effective, but also legitimate way to address and win entrepreneurial personalities and organizations to contribute to actively shaping the Digital and Sustainability Transformation.

Keywords Great Transformation · Digital Transformation · Sustainability Transformation · Entrepreneurial mindset · Erschließung

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1 Introduction

In recent years, the notion of transformation has become omnipresent in societal debates in everyday life in Germany. Especially when referred to in media as well as in politics, the term “transformation” is often associated with profound medium- to long-term change, which is accompanied by essential challenges in the areas of environment, technology, economy and society. Two transformation occasions, which have become explicitly apparent and are still dominating until the present day, are digitalization on the one hand and sustainability on the other hand. Due to their significance not only today but also in the future, these developments as well as their multifarious theoretical and practical implications, interdependencies and consequences for society are increasingly discussed.

A recent example for the remarkable complexity and controversy of the Great Transformation undertaking with regard to the challenges of sustainability is the heated public discussion about the historic verdict of the Federal Constitutional Court in Karlsruhe as a part of the Climate Protection Act legislation, which was decided in spring 2021 (Bundesverfassungsgericht, 2021). The key question addressed with this verdict was which contribution can and should be made by whom and in which way in the present as well as in the future in order to ensure that climate objectives, e.g., the climate goals, which were set at the COP 21 in Paris in 2015, are met, while the fundamental rights of the federal republic of Germany are still complied with and respected at the same time.

Challenges with a structural similarity can—at least in Europe and Germany—be identified with regard to the Digital Transformation as well. Here too the key issue is who can, should and even must act in which way in the present as well as in the future. The focus thereby is not only on being able to react appropriately to the challenges resulting from digitalization such as the spreading of “fakenews” or the handling of personal data. Generally scrutinizing how digital technology and tools can contribute to a self-determined and sophisticated shaping of the future in the areas of industry, education and mobility is of increased importance too. If values like “digital sovereignty” and “self-determination” are the guiding principles a society strives for in the context of digital transformation processes, the causes and implications of change, especially with regard to the economical and geopolitical dependencies we experience nowadays, as well as major actors in society, politics and economy shaping this change need to be identified.

The fundamental and profound political, economic, social and cultural transformational processes (Luks, 2019, p. 3; Schneidewind, 2018, p. 11; Reißig, 2014, p. 57), naturally lead to an increasingly comprehensive pressure for changes (or even already fundamental change itself depending on the system structures), that needs to be dealt with by society, politics and economy.

With that being said, entrepreneurial thinking and acting is granted an important role in overcoming present and future challenges. After all recognizing the necessity for change, adjusting to changed surroundings and parameters and even bringing change itself about are the key components of an entrepreneurial mindset

(Schumpeter, 1997). If transformational dynamics and the necessities and also opportunities for change that come with them are detected early, the chances of being able to proactively shape the future are better. If society, politics and also companies cannot keep up with them, it is likely that they only have the chance to react to the new developments and furthermore have to do so on a very short notice. Therefore entrepreneurial thinking and acting in the context of Great Transformations is about two things mainly. On the one hand it is of course—in the sense of Poppers credo “All life is problem solving” (Popper, 1996)—about developing new ideas and finding solutions to already identified or even just emerging problems, but on the other hand it is also about making sure that these solutions—in the sense of Schumpeter’s understanding of innovation (Kurz, 2016, p. 112; Ehrig & Staroske, 2016, p. 174)—are properly implemented by, e.g., adequate decision making and change in behavior.

As a consequence, active and innovative companies play a decisive role when tackling the challenges of Great Transformations such as sustainability and digitalization. By their innovative thinking and acting, which manifests itself in, e.g., creating new products, services or processes (Schumpeter, 1997, p. 100–101), they rise to the challenges and turn them into opportunities. Innovative, sustainable products can, for instance, get less sustainable products driven out of the market or substituted like it is partly happening right now with electro and hydrogen mobility and the traditional combustion engine. But also on a political¹ or individual level, entrepreneurial thinking and acting in the sense of a general mindset can make a substantial contribution when shaping Great Transformations. After all politicians with an entrepreneurial mindset can detect and identify global mega trends earlier and alter the framework conditions accordingly (e.g., by founding a ministry for digitalization). Indeed every single person can adapt or even completely change traditional behavior patterns in everyday life (e.g., reduce CO₂-emission by adapting one’s consumption or using certain digital technologies).

Even though it becomes apparent that an entrepreneurial mindset, especially when understood in a broader sense as drafted above, can make up an essential part of shaping Great Transformations, it has to be conceded that there has not developed a pronounced entrepreneurial culture in Germany so far. This can be seen from numerous studies on entrepreneurial activity (Bosma et al., 2021; Sternberg et al., 2020; Metzger, 2020). The latest reports of the Global Entrepreneurship Monitor (GEM), e.g., show that there still has not established a distinct start-up culture (social values and norms) in Germany (Sternberg et al., 2020, pp. 53–54). On the contrary, the opinion on and attitude toward self-employments is shown to be predominantly rather reserved even in a global comparison. This ultimately reflects in not only a low number of actual start-ups, but also, e.g., in the Germans’ individual assessment of entrepreneurial skills, competencies and opportunities (e.g., Sternberg et al., 2020, pp. 40–41 and pp. 63–64; Bosma et al., 2021, pp. 33–36). The question that naturally evolves from that is how the existing

¹In this context, politics is understood as the representation of the people.

entrepreneurial capacity on the different levels discussed above can be used and how further entrepreneurial personalities and organizations can be made aware, won over and newly developed in order to rise to the challenges of the Great Transformations of digitalization and sustainability.

This chapter addresses this question by presenting the newly conceptualized theoretical approach of so-called *Erschließung* and pointing out the potentials in the context of Great Transformations. This interdisciplinary *Erschließungs*-Approach has the distinction of being designed for the addressing and acquiring of various target groups in a systematical matter as well as being integrative and tailored to the specifics of Germany.

To this end, Sect. 2 conducts a literature review on transformation concepts and outlines the challenges and characteristics of the two Great Transformations of sustainability and digitalization in Germany by shortly sketching their formation and features. Based on this, Sect. 3 presents the *Erschließungs*-Approach for the acquisition of entrepreneurial personalities and organizations in the context of Great Transformations theoretically. In Sect. 4 opportunities and boundaries of this approach for the (pro)active present and future shaping of the Digital and Sustainability Transformation are discussed. Section 5 draws a conclusion and points out further research desiderata concerning entrepreneurial mindsets and Great Transformations.

2 Great Transformations—Challenges and Features

Digitalization and sustainability as occasions for Great Transformations in Germany are discussed in theory and practice from different perspectives. Usually single, definite elements or separate parts, such as digital media competencies (e.g., Heldt et al., 2020) or opportunities for cost-efficient CO₂ reductions (e.g., Kleinertz et al., 2019), are studied.

Although these topics seem to be addressed more and more frequently in academic publications, it must also be conceded that there is still a lot of need for research with regard to general characteristics, special features and implications of Great Transformations. Especially when it comes to the theoretical foundation of what fundamentally distinguishes Great Transformations still reveals some conceptual blank spaces. Therefore, the following section is explicitly designed to take a closer look at Great Transformations as holistic phenomena, their characteristics and implications. After all, knowing their fundamental characteristics as well as the major challenges that go hand in hand with Great Transformations is essential, if we want to recognize transformation processes at an early stage and proactively shape their dynamics.

As a technical term, the concept of transformation has so far found its way into numerous scientific disciplines, including natural sciences (e.g., mathematics or biology), liberal arts (e.g., linguistics or pedagogy) and social sciences (e.g., politics and economics) (Kollmorgen et al., 2015, p. 11). The term has its etymological

origins in the Latin verb *transformare* (= to convert, to reshape, to morph, to change), with *formare* (= to shape, to form) being the foundation. The noun transformation is used to describe both the process of converting/reshaping/morphing/changing itself and the result of the converting/reshaping/morphing/changing (Berlin-Brandenburg Academy of Sciences, 2021). Furthermore, the term “transformation” can be used both actively in the sense of “transforming” or passively in the sense of “being transformed” (Duden, 2021).

Although a broad variety of terms such as “development,” “social change,” “modernization,” “innovation,” which have been discussed by authors like Parsons, Luhmann, Münch or Zapf (Reiig, 2014, p. 51), have been suggested, the term “transformation” in particular has established in everyday and scientific language in Germany over the last decade. In the Sustainability Transformation context especially English papers also frequently use the term “transition,” sometimes even as a synonym for transformation (Kahlenborn et al., 2019, p. 11).

Particularly in sociological and economic discussions of Great Transformations, Karl Polanyi and his work *The Great Transformation* (1944) are repeatedly referred to (Luks, 2019, p. 4; Schneidewind, 2018, p. 10; Becker et al., 2019, p. vi; Blhdorn, 2020, p. 55; WBGU, 2011, p. 5). In his work Polanyi discusses the collapse of the “Nineteenth-century civilization” (Polanyi, 2001, p. 3) and its “political and economic origins” (Polanyi, 2001, p. 3) in retrospect. Polanyi refers to transformation as that historical process that led to an abrupt reversal of the relationship of the social and the economic order (Henesler, 2010, p. 8).

This reversion of traditional relationships and structures identified by Polanyi in his studies is still frequently associated with the essence of transformations today. Kollmorgen et al. (2015) therefore characterize transformation quite generally as a change in the form, nature, shape, character, style or properties of a phenomenon (Kollmorgen et al., 2015, p. 11). Great Transformations as understood in this chapter are thus characterized by the initiation, effectuation and advancement of far-reaching change processes at the structural and functional level, which concern all dimensions of life (such as social, political, economic, cultural and institutional) that are considered relevant in the course of the respective transformation.

In order to make these universal but also relatively abstract remarks more tangible and illustrative, the challenges and characteristics of Great Transformations are discussed below, using the Digital Transformation and Sustainability Transformation as examples. In particular, four basic elements and characteristics of Great Transformations will be examined in more detail.

Kollmorgen et al. (2015) point out that the determination of an initial and final state is semantically included in most understandings of the term “transformation” (Kollmorgen et al., 2015, p. 11). Although the starting points of such transformation processes can vary (among other things these can be new technical developments as well as fundamental system-related insights), what these transformation occasions have in common is that they are not only long-lasting, but also lead to fundamental changes in numerous dimensions of the way of life over time (Reiig, 2014, p. 56–57). Taking a closer look at the emergence of the Digital Transformation

and the Sustainability Transformation highlights this first central characteristic of Great Transformations and the challenges associated with them.

Several interdependent and complementary technological developments, which have gradually led to far-reaching modifications, are significant for digitalization as it is today. In general, innovations in computer technology can be seen as the starting point of digitalization from a technological perspective, even though it was particularly the phase of personal computers—based on innovations in the microchip industry—that ensured a more extensive dissemination of computer technology (Weiser & Brown, 2015, p. 59f). However, these technological possibilities alone did not lead to the global digitalization dynamics we are familiar with today. It was just as important that networking between these computers became possible. The best known form of this networking is certainly the World Wide Web, which was presented to the public by Tim Berners-Lee in March 1989 (Wilde, 1999 p. 13). In the following years, information was gradually made available in real time from all over the world. Most recently, digital data infrastructures have led to an increasingly networked digitalization. Amongst other things, the expansion of further wireless technologies (5G) seems to be leading to a kind of “ubiquitous computing” (Weiser & Brown, 2015, p. 61), which is expressed in phenomena like the Internet of Things and many networked microcomputers.

All in all, these basic innovations have digitized a large number of processes, first in business (e.g., industry) and later in a wide variety of other application areas including, e.g., medicine, mobility and education. Since they can easily be made accessible to an ever-increasing number of users at the same time due to their synergistic nature, there has not only been an increase in digital offerings over several decades, but also an increasing attractiveness for users in business and society can be observed up to the present day.

The development of the music and entertainment industry exemplifies the comprehensive and far-reaching effects that have resulted from this technological developments in recent years. Not only have new technologies replaced old technologies and analog products, they have also led to changes in business models, market conditions and user behavior. Separated data storage (e.g., in the form of a CD, MP3 or DVD) and associated processes are, for instance, being replaced by centralized data offerings in the form of streaming services due to increasing (technologically possible) networking and infrastructure availability. Kreutzer and Land (2016) even speak of “Digital Darwinism” in connection with these structural effects. They argue that industries and companies that do not adapt quickly enough to the changing conditions of digitalization will not be able to survive (Kreutzer & Land, 2016, p. 1).

Another example that illustrates the transformative capacity (Dolata, 2008) of these digital technologies in business and society is the mobility sector, which is increasingly coming into focus of the public and scientific discussion. Numerous developments and future target dimensions, including those related to the Sustainability Transformation, like autonomously networked transportation, forms of micromobility and sharing services would not be possible without these digital technologies. Accordingly, looking at digitization as the starting point for numerous transformation processes shows that the combination of various basic technological

innovations has led to the well-known effectiveness of the Digital Transformation at almost all socio-economic levels.

The processes and changes of structural similarity become apparent when considering the genesis of the Sustainability Transformation. However, here it is not primarily leaps in technology, but rather scientific observations and systemic findings of ecological and social phenomena that form the starting points of—initially predominantly political—discussions on comprehensive, long-term transformation challenges.

Ever since the publication of the Club of Rome's report *The Limits to Growth* (Meadows et al., 1979), topics such as resource consumption, pollution control and sustainability have gradually entered the public discourse in Germany and many other Western countries (Hahn, 2006, p. 103–104). Over the course of the next decades, these topics were increasingly debated at the global level (see, e.g., numerous transnational climate conferences and sustainability summits) as well as at the national level (see, e.g., the foundation of the Ministry for Environment in Germany in 1986). Initially these actions focused primarily on the topic of environmental protection, but soon the scope was broadened and the general connection between societal lifestyle, economic growth and the availability of resources (Grunwald & Kopfmüller, 2012, p. 21) as well as other sustainability challenges like education quality, economic growth or gender equality (UN Department of Economic and Social Affairs, 2021) were discussed. Especially within the last decade, the need for a Sustainability Transformation, also known as the “social-ecological Transformation” or the “Transformation to Sustainability” (Bohn et al., 2019, p. 7), has been talked about increasingly in Germany and Europe. By now sustainability concerns and particularly the ecological effects of actions (see, e.g., CO₂ footprint) have become omnipresent in various dimensions of life and also in political debates. These developments as well as the attribution of meaning to transformation processes in the context of sustainability eventually led to the Agenda 2030 and the adoption of the so-called Paris Agreement at the 21st Conference of the Parties (COP 21) at a supranational political level. In this agreement, over 150 countries committed to a coordinated climate policy with concrete targets like restricting global warming to below 2 °C for the first time (BMU, 2017). Although this commitment was considered a historic step by many people and institutions (Martens & Obenland, 2017, p. 7), discussions on how and on what terms the agreed climate targets could be realized were soon raised in Germany. After all, these sustainability targets have numerous implications (including additional costs or reduction necessities) at different levels in economy and society. Therefore, even though 80% of the Germans rated sustainability as an important issue in their lives in 2018 (Statista, 2018), there is still controversy about who can and should bear which costs of such a transformation and when. Especially when it comes to the decision which path should be taken and at which pace the Great Transformation should be happening, there are very much differing opinions. At the same time, more and more ecological and social changes, e.g., due to climate change are being observed, which is why fundamental change processes appear to be inevitable. As a result, protest groups such as *Fridays for Future* or *Extinction Rebellion*, which are calling on

society, businesses and politics to finally address the pressing challenges of Sustainability Transformation more seriously and more quickly, have formed in many countries such as Sweden, England and also Germany.

These cursory overviews of the pathways of the Digital Transformation and Sustainability Transformation display that there are crucial developments and influencing conditions at the onset and throughout the courses of Great Transformations that lead to fundamental effects on numerous dimensions of life over a sustained period of time. The long-term nature of the multifarious effects stands out in particular, because it shows that these transformational dynamics will be of long-term significance and thus require a fundamental, deep-structural need for change in order to be dealt with properly. In terms of shaping Great Transformation, this leads to the conclusion that engaging in ongoing transformational dynamics in an early and anticipatory manner offers opportunities to ensure scope for action and influence the course of events in a self-determined manner. Nevertheless the starting and tipping point as well as the crucial momentum for change, which are responsible for a Great Transformation happening, can usually mostly only be identified in retrospect.

All of this leads to a second characteristic of Great Transformations: their highly complex nature. As shown above, more and more areas of politics, economy and everyday life have encountered digital or sustainable transformation processes in recent years. Both digitalization and sustainability have gained momentum as well as ubiquity in socio-technical systems. Great Transformations thus do not only concern a delimited (geographic) space in the sense that only a specific industry, a specific target group or a certain country is being affected. Rather—as the terminology Great Transformation itself already indicates—they are accompanied by a certain mightiness and intricacy in terms of dealing with and also shaping these transformational developments. This also means that there are both inhibiting and dynamizing interactions effects between Great Transformations.

Consequently the challenges accompanying Great Transformations cannot simply be solved by individual measures in politics or in society or substituting (individual) innovations. Furthermore, not everyone in a society is aware of the breadth and depth of the interdependencies and effects of action, mainly also because every individual has different points of contact with and perspectives on the Great Transformations. After all the exact national costs or global impacts of a Sustainability Transformation initiated too late are not—or at least not in toto—tangible for every individual. Therefore it is not surprising that divergences between postulated and actual action in the German economy and society can be observed (Umweltbundesamt, 2019, p. 11). Similarly, the consequences of a delayed digitalization are only beginning to become apparent in small sections. A good example for this is the recent discussion about the market power of Huawei and its economic and geopolitical effects in the context of the 5G network expansion. Thus, such developments are not only relevant for economic policy but also for numerous other areas (including data protection and personal freedoms). Ultimately, also in Germany this raises the question in which kind of digital world people want to live in the future, i.e., what changes in both private and professional contexts are acceptable to

them. This question is the basis of a necessary debate about a strategic goal of the transformation process.

In order to be able to deal with transformations with such characteristics in a formative way, it needs acceptance for fundamental and profound changes, out-of-the-box-thinking as well as the willingness and ability to actually implement these changes.

Against the backdrop of the complexity and the multifarious interdependent implications outlined here, it is not surprising that Great Transformations are also characterized by a highly distinct impact on society as a whole. Although these transformation processes can be ignored in the short run, they cannot be avoided in the medium and long run. However, this inevitably results in a need for every individual to make an effort and to deal with the situation, at least if the aim is to actively participate in shaping the transformation process, instead of having it determined by others. At the same time, it must be taken into account that these fundamental changes occurring in Great Transformations will yield both “winners” and “losers.” Partly because of this varying degree of adaptability (Dolata, 2008), a Great Transformation is naturally approached in very different ways, which in turn leads to a longer, more complex and also more stagnant decision making process on how to deal with its challenges in a democratic social systems such as it is prevailing in Germany.

Krcmar (2018) therefore says with regard to the Digital Transformation at the macro level that it is inevitable, irreversible, tremendously fast and fraught with uncertainty (Krcmar, 2018, p. 10). For the characteristic of inevitability, Krcmar (2018, p. 7) argues that digital technologies are already helping to find solutions to comprehensive challenges such as demographic transition, urbanization and globalization. Regarding the irreversibility, he points out the much better cost-benefit ratio and the profound user loyalty.

In the Sustainability Transformation, this highly distinct impact on society can be seen in the frequently postulated generational conflict, in which consequences of and conclusions for actions are perceived differently by the generations. In order to minimize the negative consequences of past actions and behavior for the future and not to have to bear the costs alone, the younger generation in particular is demanding for the older generation to change its views and behavioral norms (like reducing meat consumption or frequent flying). In a speech at a UN climate conference in Poland in 2018, the well-known youth climate activist Greta Thunberg said: “You say that you love your children above everything else. And yet you are stealing their future. Until you start focusing on what needs to be done rather than what is politically possible, there is no hope” (Thunberg, 2018, p. 15–16). Regardless of whether these demands are considered justified, fundamental changes to a (traditional) system of values and norms are, however, not easy to implement.

The preceding remarks already indicate the fourth characteristic of the Great Transformation: the global reach. It becomes apparent that the transformative dynamics of digitalization and sustainability are not spatially limited, but have global significance. With regard to the global climate challenges, for instance, it is not sufficient to address them in Germany alone. Instead global interdependencies must

also be taken into account. After all, the way these transformations are handled in Germany has an impact on the world, but vice versa global developments also affect the way in which Germany deals with the subject of Great Transformations, regardless of whether one's looking at the political, corporate or social level.

In the case of the Digital Transformation, these interaction effects can, e.g., be seen in goods, which have been decoupled from the physical production location. Digitalization and technical progress give rise to products² that can be offered with marginal costs = 0 (Pätzold, 2019, p. 45). The interaction of globalization and digitalization thus becomes an acceleration factor. On the one hand, increased globalization leads to more competition and higher cost pressures. On the other hand, increased digitization leads to falling costs, which initially stimulates competition and cost pressure. This disembogues into a spiral (Petersen, 2020, p. 27). As proprietary ecosystems companies that have already undergone technological leaps in development often do not only dominate essential internet offers and markets. As operators of the central infrastructures, they are also key drivers of innovation, regulate access to the network, structure users' communication and as major employers also shape working conditions (Dolata, 2018, p. 101). Therefore digital-technological sovereignty and handling different actor constellations are key. Particularly US internet corporations have obtained a global supremacy over the past two decades. For Europe, this means that there is an increasing global power shift, to which it must respond according to its own interest (Schauf, 2021, p. 7). Therefore, it is not surprising that there is more and more discussion in society and politics in Europe and Germany about how such developments (e.g., digital tax) and dependencies (e.g., data security) can and should be handled in terms of sovereignty.

These central characteristics of Great Transformations, which could of course only be outlined briefly here, show that they are typically accompanied by fundamental, intergenerational, intertemporal and international challenges for numerous dimensions of life in Germany. In retrospect, it is apparent that digitalization and sustainability as the two main drivers of the Digital and Sustainability Transformations in the present have not only put pressure to change on the economy and its players. There are also more and more points of contact with the processes and goals of these transformation contexts in politics and everyday life as well.

At the same time, however, the actual action observed in society, politics and businesses also shows that the ability to adapt is not (yet) cumulatively developed enough to move from a reactive to an active position when it comes to shaping transformation processes. This becomes evident in Germany in, e.g., the current discussions on achieving its self-imposed climate targets. Existing traditional structures and procedures in particular are stretched to their limits when it comes to actively shaping Great Transformations instead of just "letting them happen." However, considering that the realization of economic prosperity and the creation

²The assumption of diminishing marginal costs applies primarily to digitally represented goods, i.e., those goods that come in a purely digital form (Pätzold, 2019, p. 46).

of social justice are two important categories of socially accepted political governance goals in Germany, learning how to take a more active perspective is inevitable.

With this objective, entrepreneurial thinking and acting is predestined to be relevant in dealing with Great Transformations. In this context, the way of acting does not only refer to entrepreneurs and their innovative economic activities like creating new products or services however. Instead an entrepreneurial mindset can also help in politics and society in order to be able to break out of traditional patterns of action, which might inhibit transformational dynamics. In particular, the willingness to embark on new paths, to create new structures and to align one's actions with transformation goals are abilities that can be helpful in actively shaping transformation processes. Especially in liberal democratic social systems, entrepreneurial thinking and acting can thus be a key factor in actively dealing with Great Transformations in a socially desired and legitimized way.

With all that being said, the question as to how the existing potential in Germany can be exploited and maybe even new potential can be generated arises. How can more entrepreneurial individuals and organizations—and therefore more “out of the box thinking”—be systematically recruited or developed in Germany in order to shape Great Transformation processes in a targeted and systematic manner, while still respecting the prevailing core values and system structures? This key question is the starting point for the newly created *Erschließungs-Approach*, which is presented below.

3 *Erschließung* as a New Concept to Approach Entrepreneurial Personalities and Organizations

As shown before, a wide variety of challenges at different societal levels go hand in hand with Great Transformations. In the context of both the Sustainability Transformation and the Digital Transformation, increasing pressure to change has become apparent for players in economy, politics and society. Although the need for change has been increasingly recognized and publicly discussed in Germany in recent years, the adaptability and the actual behavior toward the object of Great Transformation have not changed at the same pace. Intention and willingness on the one hand and the factual acting and doing on the other hand continue to diverge cumulatively.

In order to be able to realize a change in behavior, e.g., in the Sustainability Transformation, binding guidelines and regulations are therefore increasingly called for in Germany. The recent Covid-19 pandemic has shown that such an approach appears to be purposeful and appropriate in the short term, especially in acute crisis situations. Even though Great Transformations are often even rightfully depicted as urgent and necessary, pushing them forwards (only) by enforcing new and even more restrictive laws usually encounters some resistance in Germany. There are various reasons for that, which can be traced back not only to global interactions, but also to normative constituents and traditions in particular. A few of them will be

briefly discussed, as they form the axiomatic baseline of the approach presented below.

Firstly, the German polity is based on a free democratic fundamental order. The freedom of action of the individual is anchored in the constitution itself (Deutscher Bundestag, 2020, Sect. 2). The freedom of the individual person as well as the free development of the personality is a highly valued good, which must always be taken into account in legislation, as also shown by the current ruling of the Federal Constitutional Court regarding the national Climate Protection Act. Against this background, it is also understandable that new prohibitions restricting this individual freedom are often not approved of easily, especially when affecting personal possessions as well as daily routines.

Secondly, trying to shape transformation exclusively through national laws in Germany will likely lead to difficulties concerning increased global networking and mobility. Particularly with regard to the behavior of companies in the context of the Sustainability Transformation, it is therefore necessary to consider: Germany like many other Western countries has experienced outsourcing and even movement of whole companies or divisions to less developed countries with less strict environmental and labor protection acts within the last decades. Therefore new laws and regulations on businesses are often seen skeptically and not passed without thorough consideration about the impacts for the German economy.

Thirdly, these fundamental norms of freedom and self-determination are also reflected in the traditional education system in Germany. Within the system prevails a certain understanding of education called *Bildung*, which is unique to Germany. Even though education is often used as an equivalent, the scope of the term *Bildung* actually goes beyond that. The idea of *Bildung* was largely conceptualized by the Prussian scholar Wilhelm von Humboldt in the early nineteenth century and has remained the basis for the German school and university system ever since (Konrad, 2010, p. 45, 62). The goal of *Bildung* is for individuals to be in line with themselves and to develop their own personality, which sets them apart from other individuals. In the spirit of the Enlightenment, the focus is on the freedom and self-determination of the individual. Therefore *Bildung* is a mutual process involving the individual as well as its environment (Konrad, 2010, p. 39–40). This educational ideal is omnipresent in Germany schools and universities until today. A permanent and comprehensive external determination, for example, through the sole dominance of state guidelines or laws, would thus naturally be opposed to by people, who were educated in this kind of system.

Therefore, a new approach, which places special emphasis on enlightened, voluntary and self-sustaining actions, rather than primarily or even solely promoting new laws and regulations, will be presented below. This approach could potentially help with shaping Great Transformations more strongly in the medium and long term, especially if it is used to develop and promote entrepreneurial mindsets at the economic, political and social levels. The approach discussed here can therefore be understood as an attempt to offer a way to act here and now, but still in a system-compatible manner. So instead of forcing transformational changes only by regulations and laws, it wants to approach especially entrepreneurial personalities and

organization and win them around to contribute to the dynamics of ongoing Great Transformations. An important objective is therefore that entrepreneurial personalities and organizations do not only recognize Great Transformations and acknowledge their existence, but also actually voluntarily adapt their behavior accordingly, not because they are forced or pressured to do so, but rather because they have come to the conclusion that this is actually what they want to do. The handling of transformational dynamics and behavioral change, which has been more reactive and crisis-ridden in the Sustainability Transformation and Digital Transformation in Germany so far, could thus become more anticipative and proactive.

When focusing on voluntariness and acting on one's own accord, a subject-oriented rather than an object-oriented approach seems more suitable. Thus, instead of starting with all kinds of short-term external stimuli, which are intended to get the individuals' behavior right where the transformation's promoters want it to be for a short while, more attention should be paid to identifying the point the entrepreneurial personalities and organizations are currently at in terms of their knowledge, abilities, perceptions, beliefs and also emotions first. Once the starting point is known, it is much easier to approach the entrepreneurial personalities and organizations in question in the right way and help them to figure out, where they themselves—after a thorough consideration of the ongoing transformation dynamics and its implications—want to and can get to with regard to their competences, traits and values.

A new and integrative approach, which tries to do exactly this, is the approach of so-called *Erschließung*, which was newly developed in Wuppertal and has been continuously refined over several years. *Erschließung* is a German terminus, which can originally be found in various different academic fields like geology, theology, pedagogy or even library science and urban land-use planning. Even though the precise meaning of the terminus varies more or less with regard to the specific area of application, it becomes clear that *Erschließung* in a first general understanding refers to the act of opening to perception of the present, similar like Luhmann's cognitive opening (Luhmann, 1993, p. 83).

Based on this, the *Erschließungs-Approach* takes the terminus and its original meaning and tries to apply it to (in this case) entrepreneurial personalities and organizations in the context of Great Transformations. However, there is no general "Theory of *Erschließung*" in economics or any other discipline yet. Therefore, reference approaches and theories, which are concerned with a similar matter, were harnessed, combined and extended further to create this new and integrative *Erschließungs-Approach*. In particular reference theories, which address the question of how to make someone accessible to, reflect on and change their mind towards something, were considered. *Erschließung* here is understood to be the addressing and winning of individuals or target groups (in this case entrepreneurial personalities and organizations) for a sustainable and (as time goes by increasingly) self-regulated involvement with a hitherto subjectively as irrelevant (or at least not as relevant in the sense that it has not affected their everyday acting and decision making all that much) classified subject area as well as area of accountability and responsibility on a voluntary basis. The overall goal is for the entrepreneurial personalities and

organizations to further establish and deepen some type of commitment or belief and to be both willing and able to make mature and responsible decisions with regard to their behavior.

As *Erschließung* as defined above is a rather abstract concept, it makes sense to briefly illustrate the mindsets of entrepreneurial personalities and organizations before and after the process of *Erschließung* in order to make the general idea more comprehensible. Entrepreneurial personalities and organizations which have not already undergone some kind of natural *Erschließung* for the transformation dynamic in question would typically start from a position where they concentrate superficially on their own microcosms and have at least so far paid little attention to, e.g., Great Transformations taking place. Points of contact with Great Transformations, such as the Digital Transformation, primarily result from individual professional and private experiences. Consequently, there are differences in economy, politics and society as to whether and to what extent transformation processes are taken into account in behavior. Naturally, their decisions would be mainly based on their previous attitudes and own individual short-term goals. Therefore they are not (or at least not knowingly and intentionally) contributing to solving the challenges the Great Transformation in question is posing on them and on the society as a whole.

Entrepreneurial personalities and organizations, which have undergone some kind of natural or systematically and intentionally brought about *Erschließung*, are aware of the ongoing transformation dynamics and their implications. Their decisions, which are of course still geared to their individual goals, are therefore formed in view of the context of the Great Transformation taking place. Therefore they are able to knowingly and intentionally contribute to solving the challenges the Great Transformation in question is posing on themselves and society as a whole. The potential attributed to entrepreneurial thinking and acting in the context of actively shaping Great Transformations can thus be systematically exploited.

The main challenge when trying to address and win entrepreneurial personalities and organizations to engage in ongoing or future transformation dynamics is of course to make out how to design the *Erschließungs-Approach*. The approach should be designed in such a way that the full potential, which entrepreneurial personalities and organizations clearly hold in a liberal democratic society when it comes to tackling future challenges in the transformation context, can be tapped both efficiently and also legitimately. *Erschließung* itself is therefore naturally positioned between the poles of coercion and instruction on the one hand and solicitation on the other hand. Self-evidently no entrepreneurial personality or organization is going to initiate and execute major changes in their routine decision-making paradigm only because promoters of a certain Great Transformation like politicians or scientists ask them to do so. Theoretically speaking the other extreme, which would be to force for changes by passing a large set of new legislations and maybe even altering the fundamental laws, would most certainly be more effective. However, as indicated before, this would not be legitimate in a democratic and free society. The *Erschließungs-Approach* is based on the assumption that legitimate change needs a certain form of genuine inner acceptance that cannot be achieved by force. At the

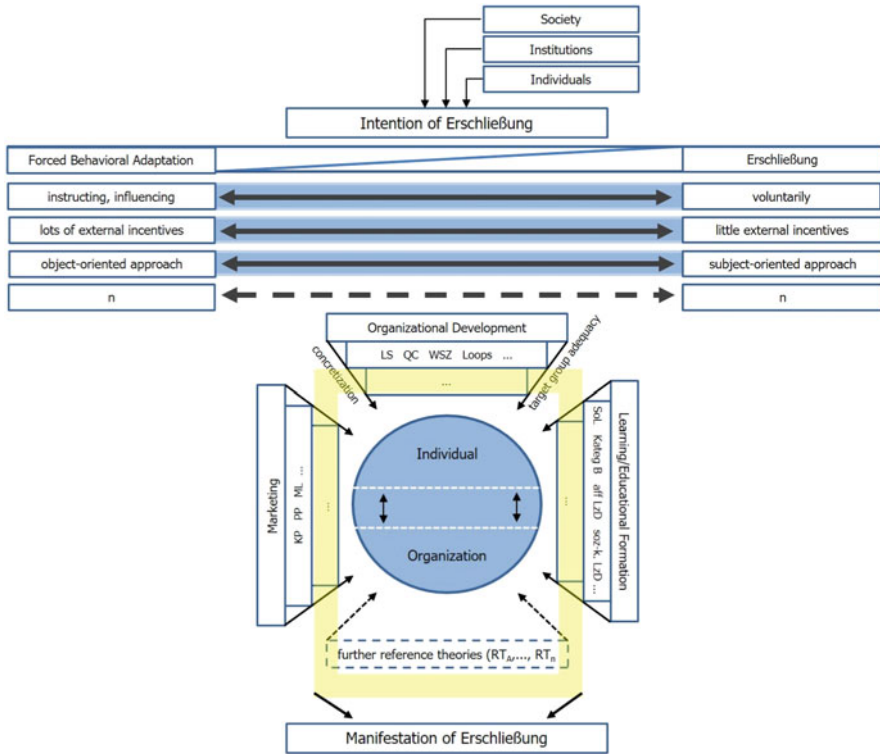


Fig. 1 The process of *Erschließung*

same time, this does not mean that new laws and legislations cannot help to create more structure and orientation as well as an impetus for behavioral adjustments.

Because the underlying axiomatic of the *Erschließungs*-Approach requires the entrepreneurial personalities’ and organizations’ involvement in the subject matter of the selected Great Transformation to be voluntary, enlightened and self-sustaining time also plays an important role. After all genuine inner acceptance is a process that may take even personalities and organizations of an entrepreneurial—and therefore to some extent innovative—nature a while.

But how can the engagement with (and ideally in the end the inner acceptance for) a Great Transformation, its dynamics and implications be created or at least promoted? The road map illustration (Fig. 1) tries to model the process of *Erschließung*. It shows that the intention of *Erschließung* can vary individually in business, politics and society. There are different views on and connections with Great Transformations, which are ultimately evident in the way these transformations are handled. Thus, the intention of *Erschließung* is not just there from the beginning, but negotiated and formed by society, institutions and individuals. Furthermore it is distinguished between two ends of a continuum reaching from “Forced Behavioral Adaptation” to “*Erschließung*.” While “Forced Behavioral Adaptation” is an object-

oriented approach shaped by a rather instructing and influencing manner and lots of external incentives, “*Erschließung*” is a subject-oriented approach shaped by a voluntary matter and little external incentives.

In the lower part of the model, the construction of the theoretical foundation of the *Erschließungs-Approach*, which disembogues in the manifestation of *Erschließung*, is illustrated. As mentioned before, various concepts and theories from different disciplines are extracted, combined and further extended in the sense that they—or at least some of their elements—are used as reference theories. Even though there are for sure even more potential reference disciplines, the three which were selected as main input here are marketing, learning and didactics and organizational development as they offer concepts, theories and models, which have been found to be especially valuable and insightful with regard to the issue of *Erschließung*.

Marketing theory can provide helpful references, especially at the beginning of an *Erschließungs-process*, because marketing generally has the goal of drawing attention to specific matters. Within the field of marketing, there is a variety of established theories and measures, which have goals such as creating a certain image, forming a purchase intention, increasing brand awareness and assuring customer as well as employee satisfaction and loyalty (Esch et al., 2008, p. 27–29). An important concept in this context is commitment. Meyer and Allen understand commitment as a psychological bond between the company and its employees, which can be sub-classified into three dimensions: the affective, the normative and the continuance dimension (Meyer & Allen, 1990, p. 3). While affective commitment refers to the emotional bond between an individual and the organization, normative commitment describes a bond due to a certain feeling of obligation and continuance commitment concerns the bond that stems from rather cognitive factors like the costs of leaving the organization. The affective commitment dimension seems to be highly promising with regard to the *Erschließungs-Approach*, because it is mainly formed through acceptance of and identification with the organization and hence its goals and values (Meyer et al., 2002, p. 21) can therefore potentially do the same for Great Transformations.

As the overall goal of *Erschließung* is for the entrepreneurial personalities and organizations to be both willing and able to make mature and responsible decisions, theories in the field of didactics and learning are bound to offer interesting insights as well. One theory that should definitely be mentioned here is the so-called “*Kategoriale Bildung*” by Wolfgang Klafki. As the name indicates, Klafki assumes that *Bildung* is achieved through categories, which are discovered by the individual (subject) through the engagement with its environment (object). With each discovery of a new category, new aspects of the environment become visible, which in turn can then lead to the discovery of even more new categories (Klafki, 2007, p. 144). As a matter of fact, Klafki even refers to this ongoing process as “*Doppelseitige*³ *Erschließung*.” This is relevant for the *Erschließungs-Approach* presented here, because Klafki’s theory offers an analysis on how individuals deal with factualities

³German word for double-sided.

like encountered problems and their repercussions in a holistic way, which goes beyond intellectual reflection. Thus, an individual-focused learning process is outlined, which on the one hand refers to knowledge and skills regarding the specific learning content and on the other hand offers the individual possibilities to understand new topics, facts and circumstances (Stübiger & Stübiger, 2018, p. 34). Another well-known approach that deals with inner engagement and acceptance from the field of learning is the so-called affective taxonomy of educational objectives. Taxonomies of educational objectives are schemes by which one can organize and hierarchize educational objectives logically (Ott, 2011, p. 153). This approach is particularly interesting in the context of *Erschließung* as it can provide further insights into how to create normative commitment, which was already discussed in the marketing section. According to Krathwohl, the original author of this taxonomy, full internalization is achieved when the individual has taken in certain values, principles, rules and norms to the extent that they become the basis for the individual's perceptions, value judgments and actions (Krathwohl et al., 1964, p. 95–96). This taxonomy is a valuable instrument in the context of *Erschließung*, because it not only helps to understand but also enables to spark and even plan affective learning processes. Even though it is considered possible to change mindsets by, e.g., trying to generate certain emotions toward an object or objective (Fabrigar & Petty, 1999), there is of course a fine line between addressing and trying to win someone for something on an enlightened and voluntary basis and practicing some kind of reeducation. As the latter is explicitly not what *Erschließung* is supposed to be about, it has to be stressed that when theoretic tools from didactics and learning are used, it is important that the learning process is about encouraging the entrepreneurial personalities and organizations to grapple with their own and alternative views in order to clarify for themselves, whether they consider an adjustment in their own canon of values necessary and/or helpful.

Because the aspects from learning and didactics discussed above focus more on the learning process on an individual level, it is important to further also turn the attention to the learning process of entities consisting of multiple individuals. In the field of organizational development, there are plenty of concepts, models and theories that are concerned with change and learning within organizations. These are basically ideas that can possibly be applied to politics or society as a whole. Therefore, it is another discipline that also offers interesting insights for the *Erschließungs-Approach*. A well-known theory, which was developed in the last 1950s, but is still regarded highly relevant in organizational development until this very day, is the three-stage-model on social change by Kurt Lewin. Within the model, there are three phases of change: Unfreezing, Moving and Freezing (Lewin, 1958, p. 210–211). The first phase (Unfreezing) is mainly about the development of a willingness to change, which happens when the old system with its known structures gets out of equilibrium. In the second phase (Moving), this willingness to change is followed by the adaption or development of new attitudes, values and behaviors. Within the third phase (Freezing), these new attitudes, values and behaviors are stabilized until a new equilibrium system has formed (Becker, 2013, p. 747). A simple conclusion with regard to the process of *Erschließung*, which we can draw

from Lewin's model, is, e.g., that real and to some extent sustainable change in attitudes, values and behaviors cannot happen until the old system is perceived to be inefficient, inferior or simply wrong.

Even though only shown in an exemplifying manner here, it becomes clear that there are countless valuable theories and approaches that can be harnessed and combined in order to initiate or advance the process of *Erschließung*. However, how exactly the approach is compounded in each specific individual case depends on many variable factors like the occasion and degree of *Erschließung*, the means and timeframe available and (maybe even most importantly) the anthropogenic and socio-cultural preconditions of the target group. The chances and limitations of the *Erschließungs*-Approach in the context of Great Transformations, especially the Sustainability and Digital Transformation, are therefore discussed in more detail below.

4 Shaping the Digital and Sustainability Transformation— Opportunities and Limitations of the *Erschließungs*-Approach

After the essential features of the *Erschließungs*-Approach have been presented theoretically, it is now time to look at the possibilities and limitations that this approach holds in the context of the Digital Transformation and Sustainability Transformation in Germany.

The line of argumentation presented in this chapter has shown that the challenges, characteristics and implications of Great Transformations in Germany can only be met in a targeted manner with strategic, proactive and anticipatory behavior. The *Erschließungs*-Approach presented here makes it possible to draw attention to transformation challenges in business, politics and society early on and in a systematic manner. Consequently, the *Erschließungs*-Approach has the potential to expand both the scope and the timeframe for action, which is becoming increasingly important, also from a financial standpoint, particularly with regard to the Sustainability Transformation (Stern, 2007, p. xv). Furthermore, this applies just as much if not even more to the Digital Transformation, Germany as well as other Western countries can hardly afford to miss out on these Great Transformations if they want to remain globally competitive in the long run.

Although the *Erschließungs*-Approach could (and perhaps later on even should) in principle also be applied to the general public, the focus is initially on entrepreneurial personalities and organizations here. After all, in a liberal democratic social system with free market, entrepreneurial thinking and acting is understood to play a central role in actively bringing about and shaping progress. With regard to companies in the context of digitalization, Hardwardt and Schmutte, e.g., state that modern organizations require new types of architectures in order to be flexible, agile and fast and that classic hierarchies and functional assignments no longer work (Hardwardt

& Schmutte, 2020, p. 8). As a result, the *Erschließungs*-Approach can help to ensure that precisely this entrepreneurial potential can be incorporated more systematically at an earlier stage with regard to managing Great Transformation challenges.

In addition to creating attention and an initial engagement with the subject, *Erschließung* can also contribute to establish a conscious, well-founded and enlightened behavior with regard to the two Great Transformations discussed here. Previous behavior is questioned, evaluated and possibly modified against the background of these transformation contexts. The newly conceptualized approach of *Erschließung* is thus not just another appellative approach. Rather, it goes beyond that as it is characterized by its enlightening-educational character. Addressing critical moral questions like do we want to, can we and if so, should we be allowed to change people's attitudes and behaviors shows that *Erschließung* is not designed to influence individuals in a one-sided or even suggestive manner. Thus, the *Erschließungs*-Approach offers a great potential insofar that such "re-education" would not be responsible from a pedagogical and didactical perspective when there is an enlightened understanding of education and society like it is the case in Germany—regardless of the transformation context.

On the contrary, with the help of the *Erschließungs*-Approach, cognitive dissonances or affective divergences on the individual level can be made obvious and conscious. Especially in the context of the Sustainability Transformation, it can still be observed that a large proportion of the population in Germany considers ecological and social challenges to be important (Umweltbundesamt, 2021, p. 2), but their own actions, especially when it comes to active participation as well as mobility and everyday life consumption decisions, are much less often aligned with these opinions (Umweltbundesamt, 2021, p. 6). Moreover, the *Erschließungs*-Approach makes it possible to promote categorical (educational) insights into complex and persistent phenomena that cannot be ignored or shirked from in the medium and long run like the Digital Transformation and the Sustainability Transformation. Hence, such a critical-emancipatory natured process of *Erschließung* can also form a substantial basis for dealing with future (new) Great Transformation challenges.

In addition to these advantages, another strength of the *Erschließungs*-Approach lies in its subject orientation. *Erschließung* focuses not only on the object of the Great Transformation itself but also on the subject and its preconditions. This way individual insecurities or fears can be addressed and excessive demands can be avoided. With reference to digitalization, Gramß et al., for instance, state that people with few points of contact with digital formats and content in particular are afraid to lose their jobs and are therefore generally closed off to digital transformation processes (Gramß et al., 2020 p. 184). According to Meier and Seufert (2016), this can result in a lack of motivation and interest in adapting to new requirements (Gramß et al., 2020, p. 184–185). Thus *Erschließung* is, as already indicated above, not per se limited to entrepreneurial personalities and organizations, but could potentially also be applied to the various other targets groups on the individual, political and corporate level, which would meet the frequently postulated demand to bring as many people as possible "on board."

The legitimacy of the *Erschließungs*-Approach resulting from the emancipatory basic principle and subject orientation is further strengthened by the fact that it simultaneously includes the established socio-technical and traditional normative framework conditions of a society. Accordingly, Great Transformations are reflected with regard to existing overriding values and norms within the process of *Erschließung*. Applied to Germany and the Digital Transformation, this means, for instance, that digitalization and its implications are not only considered against the backdrop of technical possibilities and future economic prosperity in the *Erschließungs*-Approach. Rather, the fundamental rights enshrined in the constitution, such as humanity, freedom and sovereignty, gain center stage as well. Ideally, this can result in increased acceptance of changing one's individual behavior and thus contributing to the realization of transformation processes, because not only transparency but also a deeper understanding for overriding social values and norms is created. All in all, this can contribute to the formation of conscious and self-determined values as well as cognitively and affectively justified behavior among the subjects of *Erschließung* in a systematic and profound way.

At the same time, the opportunities identified here are of course also accompanied by some theoretical limitations of the *Erschließungs*-Approach. The legitimacy of the *Erschließungs*-Approach, which is shaped by several dimensions, is also characterized by an open-endedness of the process of *Erschließung*. This means that at the end of such a process, there does not automatically have to be a dedication to actively dealing with and shaping the Digital and/or Sustainability Transformation. Even a well-founded rejection of the specific *Erschließungs*-topic must be accepted within a liberal, democratic understanding of society and the above-mentioned critical-emancipatory understanding of education. *Erschließung* thus takes place in between the poles of a need for change in society as a whole and individual goals and actions.

Although it is of course impossible to resolve this tension completely, the *Erschließungs*-Approach can help to meet this fundamental challenge. By taking into account the constituent views, values and norms of a society, transformation phenomena and their often multilayered, reciprocal implications can be reflected systematically and a well-founded position towards them can be taken. With the identification of comprehensive constituent paradigmatic goals and guiding principles, existing structures can subsequently be questioned and possibly changed. Such a transparent, strategic "derivation system" is particularly important, because individual change processes of Great Transformation can have both positive and negative implications for different groups within a society. This becomes apparent when looking, e.g., at change processes in the automotive industry in the context of the Sustainability Transformation. The increasing substitution of gasoline and diesel engines by electric engines results in numerous fundamental changes in the entire socio-technical system of individual transportation, e.g., in supplying industries or production and supply chains.

Despite its systematic nature, an *Erschließungs*-Approach, which is based on voluntariness and sovereignty, has another limitation. Making people aware of and winning them over for the active shaping of Great Transformations is a complex and

challenging task for society as a whole. Accordingly, *Erschließung* requires a certain amount of time. Particularly in transformation contexts such as sustainability, in which the pressure to change is steadily increasing, this amount of time might not (be able to) be granted. Especially in short-term crisis situations or shortly before reaching decisive tipping points, legal guidelines and state control, such as currently evident in the Covid-19 pandemic in Germany, might therefore have to supplement such an *Erschließung* if necessary. However, with that being said, it has to be considered that such ecological and social tipping points are difficult to determine and that systematic *Erschließung* initiated at an earlier point in time could have prevented such a pronounced pressure to change in a reactive and short-term manner, too.

Another thing that might be perceived as a limitation is that the *Erschließungs*-Approach is a theoretical model, and due to its abstract nature, it seems rather difficult to apply it in practice. However, as mentioned before, every situation in which *Erschließung* could potentially be practiced is different and there are many variable factors like the occasion and degree of *Erschließung*, the means and timeframe available and the anthropogenic and socio-cultural preconditions of the target group that have to be taken into consideration when trying to practice *Erschließung* on the economic, political or societal level. Therefore, it is simply not possible to offer some kind of one-size-fit-them-all blueprint when it comes to dealing with such complex things as Great Transformations. However, what is contributable and hence provided in the scope of this chapter is a general model, which offers a formally constant but contentually variable framework of the main dimensions and variables of the process of *Erschließung*.

Despite the discussed limitations, it can be concluded that overall the opportunities outweigh the limitations of the newly created *Erschließungs*-Approach. The concept of *Erschließung* goes beyond existing approaches in theory and practice and combines different ideas, instruments and models, for example, from marketing, didactics and organizational development theory, which can be valuable for addressing, winning for and bringing about the behavioral changes that are significant with regard to Great Transformations. Particularly in light of the challenges and characteristics of the two large-scale transformations outlined above, it therefore seems sensible to use this new approach to bundle existing potential and to approach and address current and future entrepreneurial personalities and organizations in an even more well-founded and systematic way.

5 Conclusions and Future Research

This chapter discussed the relevance of entrepreneurial mindsets on the levels of economy, politics and society in the context of Great Transformations in Germany, using the examples of the Sustainability Transformation and the Digital Transformation. The question that was addressed in particular here was how entrepreneurial personalities and organizations in Germany can be made aware of and won over to

engage in transformational processes in an efficient, but also legitimate way, in order to rise to the challenge of actively shaping these Great Transformations.

As there is still a lack of research with regard to general characteristics, special features and implications of Great Transformations, a general overview of this phenomenon was given. Using the Sustainability Transformation and the Digital Transformation as prominent examples, four characteristics of Great Transformations were derived inductively. The characteristics that could be established were: (1) a long-lasting nature, which leads to fundamental changes in numerous dimensions of the way of life over time, (2) a high level of complexity and interdependencies, (3) a profound impact on society as a whole and (4) a global reach in the sense that Great Transformations are not spatially limited. With the help of these four characteristics, it was demonstrated that Great Transformations are typically accompanied by fundamental, intergenerational, intertemporal and international challenges for numerous dimensions of life.

At the same time, it could be shown that Germany has not managed to deal with Great Transformations in a proactive and formative way but continues to persist in existing, familiar and traditional routines and structures. Although the need for change has been increasingly recognized and publicly discussed in Germany in recent years, the adaptability and the actual behavior seem to lag behind. Deep structural changes are either not carried out at all or are only carried out selectively or briefly in crisis situations. Since adjusting to changed surroundings and parameters, creating new structures and embarking on new paths are attributes, which are typically associated with entrepreneurial thinking and acting in countries with democratic social systems and free markets, it was argued that entrepreneurial personalities and organizations are likely to play an important role in this context not only on an economic, but also on a political and societal level.

Therefore, a newly conceptualized theoretical approach, which is distinctly designed for the addressing and winning of entrepreneurial personalities and organizations in economy, politics and society in a systematical matter, was presented here. The *Erschließungs*-Approach is an integrative approach that extracts and combines a variety of insightful reference concepts and theories from different academic disciplines such as marketing, didactics and organizational development. Because it is specifically tailored to the prevailing circumstances and structures in Germany, the approach emphasizes enlightened, voluntary and self-sustaining actions. Doing so the *Erschließungs*-Approach offers an effective, but also legitimate way to address and win entrepreneurial personalities and organizations to contribute to actively shaping ongoing and future Great Transformations as well as tackling the challenges associated with them.

The *Erschließungs*-Approach has various advantages and opportunities. The first one is the subject orientation, meaning that *Erschließung* is not only concerned with the object of the Great Transformation and its properties, but also with the subject and its preconditions. Another advantage, which is closely linked to this subject orientation, is the voluntary nature of the initial and ongoing involvement, which also implies an open-endedness of the process of *Erschließung*. Although this can be understood as a limitation of this approach with regard to the goal of

transformational change processes, it also points to another important characteristic of *Erschließung* and thus a strength of this approach, its enlightening-educational character. The target person or the target group of *Erschließung* should precisely not be heteronomous or even re-educated, but consciously and reflectively come to grips with the object of Digital or Sustainability Transformation so that they can behave in a cognitively as well as affectively justified manner in the future. This creates a stability of possible behavioral modifications as well as the advantage of being able to draw on these categorical educational insights in the future, in the face of new transformation challenges. Overall, this results in a pronounced legitimacy of the *Erschließungs-Approach*.

Despite these advantages, however, limitations of the *Erschließungs-Approach* must also be taken into account. In addition to the above-mentioned challenge of acting in between the poles of social necessity and individual autonomy, the critical temporal dimension of a *Erschließungs*-process must also be pointed out here. Particularly in the context of Sustainability Transformation, this is often no longer granted for the various reasons outlined above. Overall, however, the advantages outweigh the limitations, which is why the *Erschließungs-Approach* is generally suitable to systematically address and win over entrepreneurial personalities and organizations at an early stage of a Great Transformation in order to shape it actively.

Against this background, the above-mentioned fields and their interrelationships should continue to be addressed in the future research. It would be interesting to have a closer look at how entrepreneurial personalities and organizations on the different levels addressed here have been dealing with the Sustainability Transformation and the Digital Transformation in Germany so far. As established above, the postulated and actual action in the German economy, politics and society with regard to Great Transformations is diverging, which shows that the ability to adapt is not cumulatively developed enough yet to move from a reactive to an active position when it comes to shaping Great Transformations. Thus, there are various research endeavors of potential interest.

Firstly, more foundational research regarding Great Transformations would certainly help to understand the phenomenon as a whole better. Even though there are various models of change or transformational processes, there is still little general theory concerned with the main characteristics of or the typical course of events in Great Transformations like the two discussed here. Also, we do not know yet at which stages and to what degree Great Transformations can even be shaped actively. Analytic research of that kind could offer the knowledge base to develop more concrete recommendations of action and ideally maybe even some kind of early warning system. With the importance of didactics and learning as stressed above, it would also be interesting to see how categorical educational processes could be initiated even more systematically and at an earlier stage. Focusing on the general education system, the school subjects and the educational goals, future research is necessary to, e.g., identify legitimate starting points to discuss further development possibilities for the existing school system.

Furthermore, the role of politics in the context of Great Transformations could definitely be part of further research. As there is a junction between formal

legitimacy and informal legitimacy of decision making processes in democratic countries like Germany, politicians in their representing role of the people might create a decisive interest of the functionality of the *Erschließungs*-Approach as a part of the “will-forming process.” Therefore, in particular the question how politicians can be made aware of the importance and won for the proactive shaping of Great Transformations in a systematic manner seems important and how they understand their role vis-à-vis the electorate in particular and society in general.

Last but not least, entrepreneurship and management theory need to draw more attention to Great Transformations and how they affect businesses and markets. Especially the Sustainability Transformation can be considered as an exceptional challenge for businesses, because it is—as pointed out in Sect. 2—not primarily induced due to leaps in technology, but rather through the scientifically proven need to change the way we operate economically and in everyday life. Of course there already is research in some areas, like sustainable business models or sustainable controlling and accounting tools, but so far little attention has been paid to how the Sustainability Transformation as an external force has been dealt with in business theory and practice so far. After all, businesses are essential when it comes to creating a country’s economic prosperity and businesses need to find a way to adapt to the new circumstances accompanying the Sustainability Transformation in order to survive economically speaking.

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Part III
Building New Capabilities and Learning
Mechanisms to Enhance Competitiveness
in the Market Predominated by Artificial
Environments

The Evolution of the Dynamic Capabilities Framework



David J. Teece

Abstract The chapter sketches the past, present, and potential future of the dynamic capabilities framework. This essay is more by way of a personal reflection on the progress that has been made to date and the work remaining to be done. The dynamic capabilities framework has proved fertile ground for research and there is no evidence its momentum is slowing. In addition, I see the framework having numerous potential applications, several of which I have addressed in my own writing: (1) dynamic capabilities can serve as an overarching paradigm for teaching in business schools; (2) dynamic capabilities can potentially be built into a theory of the firm; and (3) dynamic capabilities is a policy tool for industrializing economies to help them understand the difference between accumulation and assimilation. Finally, innovation, including digital transformation, corporate entrepreneurship, and organizational behavior also contribute to the theoretical soundness of the dynamic capabilities framework.

Keywords Dynamic capabilities · Evolution · New applications

1 Introduction

In 1997, my first major publication on the dynamic capabilities framework, co-authored with Gary Pisano and Amy Shuen, appeared in the *Strategic Management Journal* (Teece et al., 1997). The article had actually been in the works (and making the rounds) for quite a while, with a working paper version appearing in

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113

1990 (Teece et al., 1990) and an introductory version (Teece & Pisano, 1994) published in *Industrial and Corporate Change*.

Along with Jensen and Meckling's paper on the agency theory of the firm (Jensen & Meckling, 1976), it's one of the two most cited papers in all of economics and business. This coincidental linkage is ironic because the two articles take such divergent views of the roles of management (Teece, 2012a), which I would characterize as "managing opportunism" (agency theory) versus "harnessing and managing opportunity" (dynamic capabilities).

The 1997 article provides a concise (and widely cited) definition of dynamic capabilities. They are "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997, p.516). Since then, I have come to understand that dynamic capabilities are vital not just for understanding competition in the presence of rapid technological change but also for addressing deep uncertainty about technological and market opportunities and changes in regulatory environments at home and abroad more generally (Teece et al., 2016).

In this chapter, I will briefly sketch the past, present, and potential future of the dynamic capabilities framework.¹ While I will touch upon some of the key literature, no attempt has been made to be comprehensive. This essay is more by way of a personal reflection on the progress that has been made to date and the work remaining to be done.

2 Origins of the Dynamic Capabilities Framework

Early in my career I found myself teaching microeconomics to MBA students at Stanford and Berkeley, including the standard microeconomics "black box" model of the firm that assumed optimized responses by firms all using the same technology and responding to a common, exogenous set of prices. Some of the business students asked why the obvious differences between firms that were of great interest to them were virtually ignored by economic theory. And they questioned whether marginal costs increased with volume, as implied by the classic upward-sloping supply curve. Inter-firm differences, and the ability of managers to choose particular strategies and unique paths, were inherent in the news stories they read and in the business cases they studied; but economists mostly ignored the disconnect between theory and practice.

Meanwhile the dominant approach to strategy, Michael Porter's (1980) Five Forces model, was largely an application of the industrial organization branch of economics, which analyzed the sources of "the monopoly problem" but focused on a limited range of the elements of firm-level advantage. In particular, the origins of Five Forces in the industry-level analytics of the Mason-Bain industrial economics

¹See Augier and Teece (2008) for a related discussion of how the framework relates to other theories of firm behavior and strategy.

traditions of the 1930s–1950s meant that it ignored most of what makes particular firms unique.² As a result, the approach urged managers to focus on positioning the firm favorably (generally by limiting competition) with regard to its customers, suppliers, and existing or potential competitors. While Five Forces analysis remains relevant in terms of assessing a firm’s place in an industry, it provided managers little guidance with respect to what resources they needed to compete or how they stood with regard to complementors (i.e., partner firms) in alliances and ecosystems. It also tended to assume that complex tactics (e.g., aggressive pricing strategies) are the way to limit competition. The use of innovation as a driver to build firm-level distinct assets was basically ignored, leading managers to focus on limiting competition rather than on sharpening it through innovation-enabled disruption (i.e., Schumpeterian competition).

It was clear to me early on that successful firms derived their advantage from the capabilities that they could bring to bear (Teece, 1980, 1982). This was in keeping with the Resource-Based View (RBV) of the firm that was emerging around that time and which built on Penrose (1959), Rubin (1973), and others. The RBV emerged in the 1980s, when a number of strategic-management scholars, including Rumelt (1984), Wernerfelt (1984), and Barney (1986), began theorizing that a firm earns rents from leveraging its unique resources, which are difficult to monetize directly through contracting arrangements that would allow other firms to utilize the resources in exchange for service fees.

However, the resource approach offered little or no explanation of how firms develop or acquire new resources and manage them over time. The long-term viability of a firm requires not just the amassing of a war chest and clever strategic positioning but also a continuous learning process, periodic pruning, and ongoing orchestration of intangible assets and other resources. For the health of the enterprise, the (strategic) management of resources is at least as important as their mere possession. In the view of economist W. Brian Arthur (2009), the technologies that dominate much of the economy are no longer single-purpose machines but flexible functionalities that can be brought together first in one way then later reconfigured into new combinations. Strong capabilities to create and capture value in this way are needed if an organization is to develop a sustainable competitive advantage with regard to its existing and potential rivals.

The RBV took a static view of competitive advantage; the advantage was implicitly obtained by amassing the right resources (e.g., Peteraf, 1993). The right resources are VRIN: valuable, rare, inimitable and non-substitutable (Barney, 1991). However, these attributes are all very context-dependent, and contexts change. Firms

²Edward Mason at Harvard during the 1930s and Joe Bain at Berkeley during the 1950s were key developers of the structuralist paradigm (sometimes referred to as structure-conduct-performance). In this view, the performance of firms in particular industries or markets depends on the conduct of buyers and sellers in matters such as pricing practices, advertising, investment, etc. Conduct, in turn, depends on the structure of the relevant market, as determined by features such as the ratio of fixed to variable costs associated with the industry’s technology, the number and size distribution of buyers and sellers, and the existence of barriers blocking the entry of new firms into the industry.

have increasingly had to shift from a focus on “steady-state operations to constant adaptation” (Arthur, 2009, p.210).

Furthermore, Penrose (1959) noted that, whereas the term “resources” refers to an asset that has a fixed state once it has been brought into existence, the term “capabilities” suggests an activity that can be done badly or well and which can improve or deteriorate over time. This allows capabilities to be weak or strong and to be modified, which leads to some obvious questions: Which capabilities should firms create? How should they be created? And when should they be created? These questions need to be asked at the individual firm level, as particular (firm-level) histories and contexts will impact the answer.

In order to capture the richness of actual competition, and the particularities of time and “place,” one needs to sacrifice the transparency and testability of overly parsimonious theories like the RBV. A framework, as opposed to a theory, can encompass many variables with complex interactions. Frameworks “identify the relevant variables and the questions which the user must answer” (Porter, 1991, p. 98). Or, as economist Elinor Ostrom put it in her Nobel Prize lecture: “a framework contains “the most general set of variables that an institutional analyst may want to use to examine a diversity of institutional settings including human interactions within markets, private firms, families, community organizations, legislatures, and government agencies. It provides a metatheoretical language to enable scholars to discuss any particular theory or to compare theories. A specific theory is used by an analyst to specify which working parts of a framework are considered useful to explain diverse outcomes and how they relate to one another” (Ostrom, 2010).

The initial dynamic capabilities article (Teece et al., 1997) organized the framework around processes, positions, and paths. This had the advantage of making the newer elements of knowledge and learning (processes) equivalent in importance to assets and resources (positions). The additional emphasis on the challenges of, and possibilities for, firms transforming themselves and their fortunes placed the emergent framework in an explicitly evolutionary and dynamic context (Nelson & Winter, 1982).

A decade later (Teece, 2007), I restated the framework for applied purposes not using the past (positions), present (processes), and future (paths) for structure. Instead, for practical purposes, I proposed three major clusters of high-level capabilities: sensing, seizing, and transforming. These are the key activities for organizations and management if they are to identify where markets and technology are heading, devise a means to benefit from it, and refashion the organization as necessary to realize the vision.

Additional refinements that I’ve added to the framework include clarifying the need for both organizational routines and entrepreneurial action by individual managers (Teece, 2012b); the division between dynamic capabilities (inherent in the organization and its personnel) and strategy (devised and refined by management to stake out a position and fend off rivals); and the distinction between ordinary and dynamic capabilities (Teece, 2014). These will be discussed further below, after a closer look at the intellectual underpinnings of the framework.

3 The Deep Roots of the Dynamic Capabilities Framework

The intellectual origins of organizational (but not dynamic) capabilities can be traced back to at least Alfred Marshall. In his *Industry and Trade* (Marshall, 1919), he described, for example, how a good manager who inspires loyalty creates a culture that lasts beyond the manager's tenure (pp.326–327). Unfortunately, as Marshall's work was taken up by others, far more attention was given to his use of math than to his deep understanding of how firms really operate and evolve. In the 1970s, Oxford economist George Richardson introduced the term "capabilities," which he defined as the "knowledge, experience and skills" in an organization that were not reflected in the classic production function, but this never became part of a theory or framework (Richardson, 1972, p. 888).

In developing a more dynamic theory of how firms choose, create, and orchestrate capabilities, I found intellectual support from several great economists (and mentors of mine) outside the mainstream who were interested in how technology and firms evolved over time: Richard R. Nelson, Sidney G. Winter, Nathan Rosenberg, and Edwin Mansfield. Nelson and Winter incorporated the key idea of organizational routines into a theory of the capabilities (and limits) of firms. My students and energetic colleagues like Gary Pisano, Connie Helfat, Will Mitchell, Brian Silverman, Giovanni Dosi, and Richard Rumelt helped me, through their assistance and engagement, to craft a framework that brought capability theory and strategic management theory together.

The dynamic capabilities framework that eventually emerged from this work wove together intellectual strands from over 50 years of scholarship in many fields including economics, sociology, marketing, behavioral decision theory, entrepreneurship, business history, operations management, and strategic management. In this section, I list the key early scholars with reference to a representative work for each one. The dynamic capabilities framework draws on all of these.

The intellectual origins of dynamic capabilities as a framework for understanding how firms respond to waves of change can perhaps be traced to Joseph Schumpeter (1934) who observed that incumbent firms were regularly displaced by entrants offering lower prices, better quality, or desirable substitutes for existing products. But Schumpeter's main interest was in larger macroeconomic debates, and he didn't go very far toward developing a firm-level theory. Valuable insights into the mechanisms giving rise to disruptive entry were added by Kirzner's (1973) work on entrepreneurialism. My own work on *Profiting From Innovation* (Teece, 1986, 2006) provided a model of the firm-level factors determining whether an incumbent or an entrant was likely to succeed in the market with a new technology. I subsequently came to realize that Alfred Marshall, Frank Knight, and even John Maynard Keynes had skated near the same subject with their consideration of the managerial and investment implications of deep uncertainty, although they didn't necessarily focus on innovation as the driver of that uncertainty.

Another source of the framework is scholarship that looked at the internal workings of the enterprise with regard to competitive behavior. Edith Penrose

(1959) introduced the notion of fungible resources, including managerial services, as the key source of the growth of firms. Business historian Alfred Chandler, Jr., (1977) produced detailed studies of how the management teams of specific firms built business empires in the golden age of managerial capitalism. Related theoretical insights were provided by March and Simon (1958), whose pioneering work on organizational behavior described, among other topics, how managers search for solutions to problems and reach decisions in the face of uncertainty. The cognitive biases that afflict individual decision makers in the face of risk and uncertainty were explored by Kahneman and Tversky (1979).

The field of strategic management, as such, only started to emerge in the 1970s, when leading business schools began to appoint professors of “business policy” (Rumelt et al., 1994). Scholars who have made contributions that I’ve found particularly helpful include Richard Rumelt, for his work on isolating mechanisms (Rumelt, 1984), and Oliver Williamson (1975), who pointed out the importance of asset specificity for determining bargaining power in market-based relationships. Concepts such as these are central to understanding how managers determine the most promising configuration of assets inside and outside the firm.

Although strategy formation is encompassed in the dynamic capabilities framework, I don’t see it as a direct function of dynamic capabilities (Teece, 2014). Technology and innovation are more central to capabilities. Strategy and capabilities are connected, if not codetermined.

I’ve also been influenced by numerous innovation scholars, such as Giovanni Dosi (1982) for his work on technological trajectories and Michael Tushman for his concept of competence-enhancing and competence-destroying innovation (Tushman & Anderson, 1986). Nathan Rosenberg (1982) highlighted the innovative power of technological complementarity, while W. Brian Arthur (1988) analyzed the sources of increasing returns, which are changing how industries evolve.

Each of these sources, and many others, was influential in the early development of the dynamic capabilities framework. The framework is not intended to supersede them but rather to provide an envelope within which they all fit together and within which their interactions can be understood.

4 The Dynamic Capabilities Framework

We now come to the framework itself, which I will summarize only briefly here. Longer descriptions can be found in my earlier articles, particularly Teece (2007) and Teece (2014). The framework will undoubtedly continue to evolve as less-explored aspects of it are more fully elaborated and integrated.

A capability is a set of learned processes and activities that enable an organization to produce a particular outcome. The types of capabilities that business schools have historically taught discount innovation in favor of greater efficiency. The capabilities needed for efficient operation are what I call “ordinary capabilities.” Even the strongest ordinary capabilities can typically be learned from university courses,

consultants, or targeted hires. The diffusion of an improved process across an industry can be relatively rapid, although with more complex systems it can take decades, as in the case of the Toyota System of Production in the auto industry. Today, digitization is enabling a new kind of ordinary capabilities that are less dependent on traditional operating constraints (Iansiti & Lakhani, 2020). Digital systems are easier to scale and transform, providing rivals a moving target. For the many companies that remain dependent on more traditional labor and physical capital, though, ordinary capabilities are not in themselves a basis for more than transitory competitive advantage and can often be outsourced, at least where there is strong competition and a proper legal framework enabling markets to function.

In sharp contrast, dynamic capabilities are forward-looking. Instead of governing what the firm is currently doing, they involve deciding what the firm should be doing in the future, ensuring access to the resources the firm will need, and implementing the organizational design that will be best suited. I summarize the multiple activities involved as sensing, seizing, and transforming. Each of these categories of capabilities has many separate elements.

These elements, taken in isolation, are what I call microfoundations, or low-level dynamic capabilities (Teece, 2007, 2018). They include narrow-purpose processes such as forming external partnerships, or developing new products. They are strategic and transformative, like dynamic capabilities, but they are, for the most part, repetitive and imitable, like ordinary capabilities.

Whereas ordinary capabilities can usually be upgraded and tuned by accessing public knowledge or licensed proprietary knowledge, high-level dynamic capabilities (i.e., sensing, seizing, and transforming) are more idiosyncratic. They must be built because they cannot be bought. This is partly because they involve managerial cognition (Adner & Helfat, 2003) and learning. They can be partially embedded in organizational routines that are rooted in the company's culture and history. Companies with strong dynamic capabilities also tend to have their own, unique "signature processes" (Gratton & Ghoshal, 2005). The history-bound (and often tacit) nature of these processes makes them difficult for rivals to imitate. Provided that management doesn't allow the advantages of this history to stagnate and become maladapted as the business environment changes, signature processes can provide a foundation for competitive advantage. While outside experts can provide certain elements of dynamic capabilities, such as identifying trends, most elements of dynamic capabilities cannot (and should not) be outsourced.

For dynamic capabilities to be strong, management must be entrepreneurial (Teece, 2016). This means that managers need to be involved in developing and testing conjectures about emerging technological and marketplace trends, devising and refining new business models, and orchestrating the necessary assets inside and outside the organization. And this forward-looking, entrepreneurial approach must be infused throughout the enterprise.

Boards of directors must be capable and ready to engage constructively in matters of strategy. They can play a role in ensuring that managers are thinking far enough

ahead while maintaining the resiliency to face the “black swans” characteristic of business environments fraught with deep uncertainty (Teece et al., 2016).

Strong leadership is also required, especially when difficult organizational changes are implemented, or when corporate culture is being revamped. Leadership is particularly needed to propagate a vision and achieve unity of purpose.

As mentioned earlier, strategy is not a direct outcome of dynamic capabilities. The exercise of a firm’s dynamic capabilities must be coupled with effective strategizing to bring about competitive advantage.

5 Dynamic Capabilities Applied: Digital Transformation

The dynamic capabilities framework is built around concepts of sufficient generality that they can be readily applied in any organizational setting. At the same time, it incorporates sets of microfoundations that can be adopted by practitioners as well as by researchers to address specific situations.

Digital transformation, a relatively recent phenomenon, is a case in point. It is only in the past 10 years, when the combination of 4G wireless communications and powerful smartphones were widely diffused, that networks have become truly pervasive. Now that most humans are connected to a common digital network, the digital transformation of existing business models and processes is an imperative for companies to remain competitive and create new advantages (Fitzgerald et al., 2013). A growing number of empirical studies are adopting dynamic capabilities to frame their analyses of digital transformation across a range of industries, from agribusiness to publishing (Cannas, 2021; Chirumalla, 2021; Ellström et al., 2021; Jantunen et al., 2018; Soluk & Kammerlander, 2021; Warner & Wäger, 2019; Witschel et al., 2019).

Digital transformation often involves the launching of one or more platforms, i.e., digital hubs for an ecosystem that may include suppliers, customers, or complementors. Ecosystems have lives of their own, and, just like a single organization, must adapt to changes in their environment (Teece, 2017).

There are two basic types of digital platform, with numerous hybrid combinations (Evans & Gawer, 2016). A *transaction platform*, such as Amazon Marketplace, facilitates exchanges by otherwise fragmented groups of consumers and/or firms. An *innovation platform*, such as Apple’s iOS, provides a base technology (e.g., the iPhone) and distribution system (e.g., servers) to which other companies can add their own innovations through the App Store (a transaction platform), increasing the value for the ecosystem as a whole.

Platform leaders take responsibility for guiding the ongoing technological evolution of the system and setting the rules for ecosystem participation (Gawer & Cusumano, 2002). Platforms often compete against each other (e.g., Apple versus Windows), so an ability to attract and retain the most valuable complementors as ecosystem partners is crucial (Van Alstyne et al., 2016).

One of the fundamental tasks in digital transformation, whether platform-based or not, is devising and implementing a new business model (Verhoef et al., 2021). A business model encompasses the complete architecture of the value creation, delivery, and capture mechanisms for a business (Teece, 2010). Here I will provide a schematic overview of how the capabilities framework applies, including a small selection of microfoundational activities.

The process of designing a new business model typically begins by sensing the opportunities in new (or not yet adopted) technologies and how they might address unmet (or poorly met) needs of new or existing customers. The value potential of each opportunity must be calibrated, the likely competitive landscape(s) surveyed, and one or more options to pursue chosen. Digital technologies enhance the ability to rapidly test and adjust hypotheses about consumers and/or technologies, which is particularly important for “generative sensing” (Dong et al., 2016).

A firm’s seizing capabilities govern the crafting of a revenue mechanism. To be sustainable, a business model must provide a customer solution that can support a price high enough to cover all costs and yield profit that is at least sufficient to support the business and its growth. This may not, however, be the case initially. If the new business must first build up a user base to generate sufficiently large network effects, it may still be warranted to offer a product in the absence of initial profitability.

Seizing also encompasses planning the organization’s value chain, including the designation of which activities will be internalized and which will be left to outside suppliers. A key microfoundation is the identification of potential “bottleneck” assets that are both scarce and indispensable, which makes them able to demand profit-draining rents if not owned by the focal company (Teece, 1986, 2006). This analysis must also extend to intellectual property, including patents. Just as a key input can be a bottleneck asset, so can a necessary trade secret or a strong patent owned by a rival; the business model ought to include the ability to secure rights to such assets at a sustainable cost (Somaya et al., 2011).

The implementation of the new business model and its associated strategy calls on the firm’s transformation capabilities. Capability gaps must be identified and filled through internal development, acquisition, or alliance. The analysis of existing capabilities in terms of their suitability needs an objective point of view to avoid organizational pride exaggerating management’s beliefs about the fitness of the organization.

The speed of implementation also matters. Being first to market with a new business model is particularly important when it involves a platform that will benefit from network effects. Establishing a large installed base can serve as a potential barrier to entry (Staykova & Damsgaard, 2015).

New capabilities typically mean the introduction of new people. Time must be allowed for newly (re)constituted teams to develop their routines and working relationships.

All the necessary elements must be reconfigured and orchestrated. Part of this task is ensuring the alignment of the organization’s structures with strategy. New activities require sufficient resources and independence to thrive. Yet overall organizational coherence must also be maintained (Teece, 2019a).

This of course is a linear and highly stylized depiction of a few of the microfoundations for what is, in reality, a complex, painstaking, and iterative process. As indicated above, there are many studies diving deep into the application of dynamic capabilities to the digital transformation of specific firms.

6 The Divisions Within the Dynamic Capabilities Literature

The framework described and applied in the previous sections is how I've conceived dynamic capabilities. However, in the two decades since its original appearance, numerous other descriptions have been written, some of which miss key aspects.

A bibliometric study by Peteraf et al. (2013) identified two main strands in the dynamic capabilities literature. The framework proposed by Teece et al. (1997) argued for the relevance of dynamic capabilities to the creation of sustainable competitive advantage even in a business environment of rapid change. A much narrower vision proposed by Eisenhardt and Martin (2000) has found currency in the organizational behavior literature. Examples of each are shown in Table 1, beginning with the initial statements about routines and capabilities by Teece, Pisano, and Shuen. The Eisenhardt and Martin definition, which more or less corresponds to microfoundations, is joined by Winter's (2003) entirely routine-based definition, which has also been influential. These are contrasted with my later definitions of the different types of capabilities.

For Eisenhardt and Martin (2000), Winter (2003), and those who embrace similar views, dynamic capabilities consist solely of repeatable routines governed by "simple rules" (Bingham et al., 2007). Defined this way, they are unstable, especially in a rapidly changing environment, and subject to imitation by rivals, at least in their effects.

By limiting their definition of dynamic capabilities to the narrow-purpose activities I call microfoundations, Eisenhardt and Martin ignored the critical higher-level capabilities in which strategic, non-routine managerial decisions play a larger role, represented by the right-most column of Fig. 1.

In my own writing (e.g., Augier & Teece, 2009; Teece, 2007, 2012b), I have made clear that dynamic capabilities involve a combination of organizational routines and entrepreneurial management. Many of the key managerial decisions in a company's history depend not, in the first instance, on technical analysis and decision rules but rather on creative insight and intuition. As discussed above, the ability of managers to conceive of new combinations is increasingly a key factor in sustaining competitiveness, and no framework for competitive advantage can be complete without including this managerial skill in some form. The sensing and seizing activities in the dynamic capabilities framework flow (or not) from this fundamental, non-routine managerial ability (or lack of it).

Table 1 Leading Definitions of Three Levels in the Dynamic Capabilities Framework

	Teece et al. (1990, 1997)	Eisenhardt & Martin (2000)	Winter (2003)	Teece (2007–2018)
Dynamic capabilities definition	“Dynamic capabilities”—The firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al., 1997, p.516)		“Higher order”—Investments in organizational learning to facilitate the creation and modification of dynamic capabilities for the management of acquisitions or alliances (Winter, 2003, p.994)	“Dynamic capabilities”—Strong dynamic capabilities help enable an enterprise to profitably build and renew resources and assets that lie both within and beyond its boundaries, reconfiguring them as needed to innovate and respond to (or bring about) changes in the market and business environment (Teece, 2014, p.332)
The role of routines	“Dynamic routines” – “Directed at learning and new product-process development” (Teece et al., 1990, p. 12)	“Dynamic capabilities”—organizational and strategic routines by which managers acquire and shed resources, integrate them together, and recombine them to generate new value-creating strategies to match and even create market change. Examples: Product development, TMT decision making, replication, resource allocation, coevolving, patching, knowledge creation, alliance formation, M & A (pp.1107–8)	“first order”—A “dynamic capability” enables a firm to alter how it currently makes its living. Examples: new product development or the opening of new outlets. The definition implies “reliable patterned behavior” (Helfat & Winter, 2011, pp.1244–5)	“Low-level DCs” or “microfoundations”—Processes for forming external partnerships or for developing new products. They consist of (often idiosyncratic) routines that are employed less often than the routines of ordinary capabilities (2018, p. 364). [microfoundations are the “distinct skills, processes, procedures, organizational structures, decision rules, and disciplines that undergird sensing, seizing, and transforming (Teece, 2007 abstract)]
Ordinary capabilities definition	“Static routines”—“Static routines embody the capacity to replicate certain		“Zero order” or “zero level”—the “how we earn a living now”	“Ordinary capabilities”—administrative, operational, and governance-related functions that are

(continued)

Table 1 (continued)

	Teece et al. (1990, 1997)	Eisenhardt & Martin (2000)	Winter (2003)	Teece (2007–2018)
	previously performed tasks (Teece et al., 1990, p.12)		capabilities: producing and selling the same product, on the same scale and to the same customer population (Winter, 2003, p.992)	necessary to the execution of current plans (Teece, 2016, p.204)

Note: definitions slightly edited from original sources

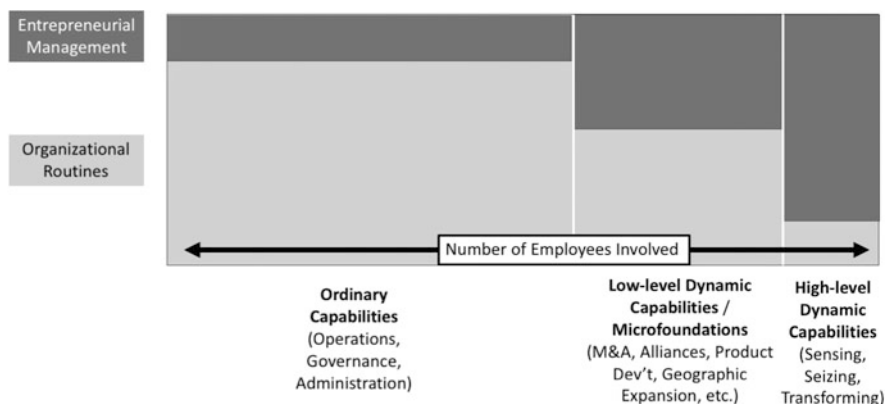


Fig. 1 Capabilities, routines, and managerial decisions. Note: Horizontal width reflects the quantity of organizational resources committed to each category of capability

Viewed this way, dynamic capabilities need not be stable (in the sense of something fixed once for all time) to be strong. They can shift as new managers bring fresh insights to mesh with the slower-changing high-level routines and culture of a given organization.

This ability to steer dynamic capabilities in new directions, despite their need to flow with the relatively deep currents within an organization, is also a major reason that they are not reducible to best practices that can be imitated or approximated.

To some extent, the split in the literature has to do with the disciplinary focus of the scholars involved (Peteraf et al., 2013). While those following the more prescriptive and entrepreneurial path laid out by Teece et al. (1997) tend to have a background in the study of industry-level subjects such as economics and technology, those who take the less expansive approach associated with Eisenhardt and Martin (2000) tend to be focused on organizational behavior or information systems. In other words, the narrow, routines-only approach is most likely to be adopted by

those interested more in internal processes than in industry dynamics. The bifurcation of the literature is thus a manifestation of the well-recognized but persistent problem that business schools are divided into disciplinary silos that privilege different levels of analysis (Teece, 2011).

Although the damage is done and confusion persists, there has been some convergence toward a common definition. Winter, for example, has acknowledged that differences now come down to the balance between routines and decision making (Winter, 2017, p.73). Bingham and Eisenhardt (2011) have recognized that higher dynamic capabilities governed the addition and subtraction of the simple rules that guide the processes they previously identified as dynamic capabilities. However, they still treat intuitive, entrepreneurial decision making as separate “improvisation” (Bingham, 2009).

Convergence around a unified definition of dynamic capabilities may be slow, but the ongoing process has been fruitful, generating, among other things, numerous literature reviews attempting a synthesis of the field. Slowly but surely such efforts bring the dynamic capabilities construct closer to its ultimate promise of unifying the diverse strands of management research in a single theory of how firms build competitive advantage.

7 The Future of the Dynamic Capabilities Framework

The dynamic capabilities framework has proved fertile ground for research, and there is no evidence its momentum is slowing. In addition to the goal of eventually healing the split in the way different scholars define dynamic capabilities, I see the framework having numerous potential applications, several of which I have addressed in my own writing.

One of these is for dynamic capabilities to serve as an overarching paradigm for teaching in business schools (Teece, 2011). As set out earlier, the framework was designed as a portmanteau of earlier theories and multiple disciplines, making it an excellent guide to how the disparate threads of a modern business education come together in the business enterprise. It is what I have referred to as a “workable systems theory” (Teece, 2018).

For economic theory, dynamic capabilities can potentially be built into a theory of the firm (Teece, 2019b). In addition to deepening the economics of why firms exist and the distinctive role of the manager (Augier & Teece, 2008), the framework has the potential to introduce much that is currently absent, including interfirm heterogeneity and a model of how individual firms compete. It is a framework that recognizes complex interactions within a firm, with other firms, and with the business environment in a quest to understand long-run enterprise performance. In that sense, it might be thought of as the strategic management application of the general systems theory that emerged in the 1950s (Teece, 2018). Similarly, it is a practical application of the abstract “complexity economics” that has developed in parallel with dynamic capabilities to build models of the economy that include

heterogeneous agents “responding to ill-defined situations by ‘making sense’ ... and choosing their actions, strategies or forecasts accordingly (Arthur, 2021, p.138).

Another application is as a policy tool for industrializing economies to help them understand the difference between accumulation and assimilation (Nelson & Pack, 1999). Governments often measure the success of the enterprises operating in their territory in terms of their accumulation of assets. The danger of this is that such governments might then fail to support the innovative and entrepreneurial activities at which firms must excel in order to compete effectively.

The framework can also serve as a guide to empirical research. Although it is a framework rather than a disprovable theory, detailed case studies (e.g., Danneels, 2011; Tripsas & Gavetti, 2000) have provided confirmative evidence. Because it is an envelope for many of the management concepts that are constantly being examined, empirical results in areas such as innovation, corporate entrepreneurship, and organizational behavior also contribute to the theoretical soundness of the dynamic capabilities framework.

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Transforming a Highly Tactile Entrepreneurship Course “Ideas to Innovation” to an Entirely Online Delivery Model: Lessons for Theory and Practice



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People who regard themselves as highly efficacious act, think, and feel differently from those who perceive themselves as inefficacious. Self-percepts of efficacy thus contribute significantly to performance accomplishments rather than residing in the host organism simply as inert predictors of behaviors to come
Bandura (1984, p. 231)

Abstract Recent changes in education due to COVID-19 required a shift from classroom to online delivery. This chapter illustrates how a highly complex training program, Ideas to Innovation (i2i), responded to this challenge. i2i is based on experiential learning including a variety of activities carried out both in large and small groups with the intention to raise delegates’ entrepreneurial self-efficacy. In this case study, we illustrate the process by which the program was delivered online for the first time since its existence and how the online delivery of an entrepreneurial program contributed to participants raised level of entrepreneurial intent. We took a qualitative approach by conducting structured (written) and semi-structured interviews with participants. We triangulated the data with insights and reflections of the facilitators engaged in the online delivery. The findings indicate that even when i2i is delivered online, it raised participants’ level of entrepreneurial intent. We also found that digital interaction and collaboration among participants and facilitators on various platforms promoted the development of an entrepreneurial mindset. By highlighting this change in delivery and design, we contribute to the ongoing debate

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of digitally supported education for entrepreneurship and provide insights to redesign entrepreneurial training programs.

Keywords Entrepreneurship education · Entrepreneurship programme · Entrepreneurial self-efficacy · Entrepreneurial intention · Online learning

1 Introduction

Entrepreneurship is a significant behavior critical to economic and social development (Fayolle, 2018). Moreover, it might open “*the door to individual fulfilment, a feeling of freedom and gives room to consider personal aspirations, preferences, values, and objectives, whilst being the key to organizational and institutional transformation and regeneration*” (Fayolle, 2018, p. 8). Entrepreneurship also infuses a wide range of boundaries such as demographic, organizational, socio-economic, geographic, cultural, political, and others (Kuratko & Morris, 2018). Despite these positive outcomes of entrepreneurship, there is no one recipe, situation, or specific conditions that might make a successful entrepreneur (Pokidko et al., 2021). But neither is entrepreneurship an art, which is abstract, nor does success come only to gifted ones (Aulet et al., 2018; p. 4), meaning that entrepreneurship can be learned.

Entrepreneurship education is a relatively new discipline in comparison with law or medicine, finance, accounting, or organizational design (Aulet et al., 2018). The first entrepreneurship course was delivered in 1947 at Harvard Business School (Nabi et al., 2017). The course “New enterprises” was offered for returning veterans (Kauffman.org, 2013). Recently, entrepreneurship is one of the fastest-growing subjects in today’s undergraduate (and graduate) curricula as pointed out by the Kauffman Foundation research report in 2008 (ibid.) with a mission to stimulate entrepreneurial thinking (Klofsten et al., 2021). Indeed, many universities provide majors, minors, certificates, and master’s degrees, and some prestigious institutions offer PhD programs in the entrepreneurship domain (Kuratko & Morris, 2018). Moreover, entrepreneurial education programs can range from more theory-oriented to theory- and practice-oriented and cover a huge variety of pedagogical approaches.

Previous research on entrepreneurship education programs has focused mainly on a face-to-face format (Decker-Lange et al., 2020; Klofsten et al., 2021; Pokidko et al., 2021). Another line of research has analyzed the impact of entrepreneurship programs on participants’ entrepreneurial self-efficacy (see a review by Newman et al. (2019)) or entrepreneurial education pedagogical methods and its effects on various impact indicators (a review by Nabi et al., 2017). However, due to the COVID-19 pandemic, entrepreneurial programs have been modified to online programs. Smith and Muldoon (2021) highlighted that COVID-19 infused challenges to entrepreneurial education that are more significant than in other business domains because entrepreneurial education is based on experiential education.

The online form poses many significant challenges, especially how to maintain attention and focus during the program. Being physically separated from all (group

of participants and educators), not only the type of delivery of entrepreneurship program is important, but some explicit instructions are essential as well. For instance, many students are reluctant to turn their cameras on (Romig & Alves, 2021), meaning that educators might be looking at the mix of blank and non-blank screens or only at blank screens, another aspect that participants cannot easily cultivate social relationships online with each other or with program educators that form intangible assets. Therefore, there is a need to have separate spaces for interactions and diverse social media platforms can substitute this need. All mentioned areas form the rationale for this chapter. The purpose of this chapter is to reveal lessons from taking a long-running entrepreneurship education called *Enterprisers*, originally designed as an intensive residential face-to-face course by faculty from the University of Cambridge and Massachusetts Institute of Technology (MIT). It was, in parallel, researched to understand and raise entrepreneurial self-efficacy among early-stage researchers. The current research set the context for entrepreneurial learning and teaching aimed at doctoral and postdoctoral level and reflect on the sudden pivot in delivery moving from a physical version to online delivery.

The current research might make an important contribution to the theory of planned behavior (TPB) (Ajzen, 2020) in the entrepreneurship education domain. These results provide empirical support that in emerging environments, there is a direct relationship between entrepreneurship program and entrepreneurship outcomes (entrepreneurship self-efficacy and entrepreneurship intention). Interestingly, the findings suggest that even a short sharp intervention such as an online *i2i* entrepreneurship program can have an influence on participants’ entrepreneurship self-efficacy and entrepreneurial intentions. Finally, the understanding of traditional entrepreneurship education on entrepreneurship intentions remains limited, especially regarding issues such as the effect of education on participants’ intentions and the effectiveness of various forms of education programs. Nevertheless, to our best knowledge, the current research is an exploratory and among the first attempts that alter our understanding of the effect of an online entrepreneurial education program on entrepreneurial outcomes (entrepreneurial self-efficacy and entrepreneurial intentions) during the COVID-19 period.

2 Literature Review

2.1 *The Origins of Ideas to Innovation*

Ideas to Innovation (*i2i*) was originally developed in 2002 as a bold experiment under the auspices of the Cambridge MIT Institute (CMI) to explore how the entrepreneurial spirit and innovative methods that had driven the success of MIT could be translated to UK universities. This original residential program aimed to develop entrepreneurial self-efficacy drawing on the psychological theories of Bandura (1977a, b, 1982, 1994). He put forward the theory that when people believe in themselves and their abilities, they are more likely to act. In colloquial terms this is

simply stated as “if you think you can do it—you are more likely to try.” The ability of a previous i2i program (title—Enterprisers) to raise the level of self-efficacy has been researched and published by Barakat et al. (2014).

Originally called CMI Connections, the program aimed to bring graduates together to explore new opportunities. It had already been modified from an MIT course called LeaderShape—which was aimed at building leadership qualities among engineering students. It became apparent quite early on in the life of Connections that the real aim was to foster and nurture an entrepreneurial mindset and provide the skills to enable action. Hence, the founding team evolved the course and called it Enterprisers. And from a general course on mindsets and skill sets, the course has become much more focused to stimulate postgraduates to explore the practicalities of entrepreneurship. This evolution is now run as Ideas to Innovation (i2i) from the Bettany Centre for Entrepreneurship at Cranfield University. Through the support of the EU and Kaunas University of Technology (KTU), KEEN, the program, has now spread to Lithuania and the Baltic region with the leadership and support of Kaunas Technical University.

Ideas to Innovation (i2i) is aimed at doctoral and postdoctoral students to unlock entrepreneurial and creative potential on an individual level. The program also encourages researchers to consider the social and economic relevance of their research and to develop skills and knowledge to commercialize research outcomes.

The structure of the physical face-to-face residential program is based on the following four sets of learning outcomes. Each day has a strap like so that it is easy for participants to understand the overall objectives of the day and to create a “user-friendly” atmosphere.

The program covers 4 days, and each day represents one key element: *Moi* (Day 1), *Ideation* (Day 2), *Nuts and Bolts* (Day 3), and *Crystal Ball* (Day 4). The *Moi* represents participants’ motivations, values, and context. The second “*Ideation*” covers working with people to generate ideas. The third “*Nuts and Bolts*” indicates the essentials of making things happen. The fourth element “*Crystal Ball*” denotes making a statement and looking forward. There is a flow to the way the program is run as indicated in Fig. 1.

Day 1 *Moi* places the emphasis on understanding one’s self and personal motivation, goals, values, and purpose. Putting it in the context of entrepreneurship if one is going to do something entrepreneurial, one needs to think big and beyond self. To support this development, the day ends with a cultural simulation.

Day 2 *Ideation* supports participants with the understanding of what an entrepreneur is and the creative process in which an idea emerges from. The aim is to introduce creative tools for participants and provide them with enjoyable experience and confidence in spotting and developing ideas for entrepreneurship.

Day 3 *Nuts and Bolts* explores the different ways to success including challenges along the entrepreneurial journey such as leadership, building teams, and acquisition of resources. The program also invites entrepreneurs to share their stories, emphasizing both successes and failures. Through this activity we provide a vicarious learning from role models. This is followed by informal networking

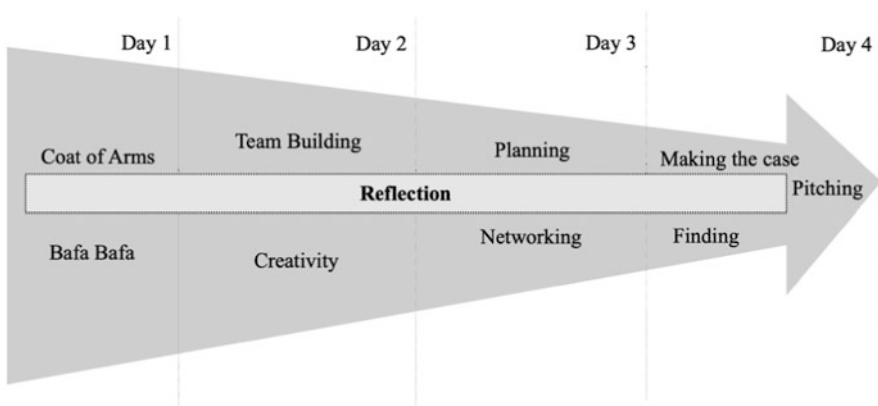


Fig. 1 Schematic of the 4-day residential model of i2i

where participants get to meet experienced entrepreneurs, professional service advisors, and industrialists and practice networking and presenting their ideas. Day 4 *Crystal Ball* equips participants with the art of pitching and looks at how participants can maintain motivation and sustain their ideas and celebrate the experience. Creating a safe environment enables participants to become more open about their work and idea leading to meaningful conversations. The program adopts a light touch to activities and creates a fun atmosphere and nurtures a creative mindset.

In addition to introducing the delegates to the set of hard technical skills required for business venturing (e.g., budgeting, marketing, accounting), the program also promotes development of adequate entrepreneurial self-belief through experiential learning, opportunities to engage in entrepreneurial practice, information acquired from tutors and mentors, and the opportunities for participants to gauge their own entrepreneurial capabilities in a risk-free environment.

Reflection plays a crucial role in the training. Consistent with Cattaneo and Motta (2021), the experience of diverse activities during the entrepreneurship program is not enough; participants should need to reflect on their experiences. As Cattaneo and Motta (2021) argued, “reflection leads such transformation” (p. 186). Hence, every day of the training covers a specific time dedicated to reflection, either in small or large groups.

Within the overall flow, the physical residential program includes diverse activities (see Table 1) that keep the participants fully engaged. The 4 days are supported by periods of quiet time to enable the participants to reflect on their learning, about themselves, their ideas, and their own interactions with the other participants. A recent timetable of the residential model is provided in Table 1.

These learning elements that help to make this program impactful at an individual level are highly diverse and interactive. There are no pre-reading requirements as this

Table 1 A detailed program of the i2i

	Day 1	Day 2	Day 3	Day 4
8:45		Daily briefing	Daily briefing	Daily briefing
9:00	Registrations	Team roles activity	Market need and customer value proposition	Pitching
9:30				
10:00				
10:30		Break	Break	Break
11:00	Welcome and introductions	Debrief Belbin team roles	Big picture of your idea	Pitching to panel
11:30		Setting up creativity process	Funding your first year	
12:00				
12:30	Lunch	Lunch	Lunch	Lunch
13:00			Lunch	
13:30	Getting to know you	Creativity—where are the opportunities?	Networking and pitching skills	Keeping the dream alive
14:00				
14:30				
15:00	Break	Pit stop	Pit stop	Pit stop and departures
15:30	Selecting the i2i journey	Creativity – towards an opportunity	Entrepreneurs' panel	
16:00	Your research impact			
16:30				
17:00	Pitch your opportunity	Break and get ready		
17:30	Reflections	Reflections		
18:00	Break	Break	Meeting with entrepreneurs and industry	
18:30	Dinner	Dinner		
19:00				
19:30	BaFa BaFa	Refine your ideas	Networking – building connections	
21:00	Selecting your projects			

is about being in the moment and taking action. The process switches between a plenary session when the large group may get some insights, talks, and instructions on what is required next and the small group-facilitated sessions, often with two facilitators co-hosting the discussions.

Physical Delivery The benefits of having face-to-face interactions and being “in the moment” are major benefits of a physical program. The informal breakouts, eating together, and joining in personal conversations are all side benefits that add value to the program.

The downside is that the program organizers ask delegates to give up **four** intensive days; travel and perhaps live away from family. And of course, the cost of hosting anywhere between 50 and 80 people is nontrivial. Therefore, achieving similar outcomes with shifting the program to an online mode could have been considered as a matter for a theoretical discussion just a while ago. However, it

became an empirical question with the introduction of social distancing and travel restrictions related to the COVID-19 challenge globally.

Online Delivery With all the changes around travel restrictions and social distancing being introduced, the educators were unsure how the loss of the tactile nature of learning method would impact on individuals and how to keep participants engaged and how to animate creativity sessions that were designed for face-to-face interaction. All the various technologies for remote working exist (e.g., Zoom, Microsoft Teams), but no one in the organization team had any prior experience of this method, so there was a steep learning curve for all. Liguori et al. (2021) have highlighted that the complex nature of learning objectives in entrepreneurial curricula becomes ever more complicated and challenging when delivered online. For instance, the main challenge might be to create an “experiential” classroom because many entrepreneurial programs are experiential in nature. Thus, the elements of entrepreneurship programs such as coworking environments, incubators, or other supporting physical infrastructure are not easily transferable to an online environment. Indeed, the results from tutors in the USA have indicated that the majority of tutors cannot maintain the same level of experiential learning in an online environment (Liguori et al., 2021). Hence, the main challenges appeared to be decreased direct interactions with students, network opportunities, logistical issues, etc. (Liguori et al., 2021). Meanwhile, Liguori and Winkler (2020) have suggested that while teaching entrepreneurship basics may be suited to teaching online, encouraging an entrepreneurial mindset might require nontraditional and even new approaches to online education. Specifically, the online format challenges entrepreneurship educators to remain agile and innovative throughout program delivery (Liguori & Winkler, 2020).

Bearing in mind the issues raised by scholars such as Liguori et al. and realizing that there were elements of the timetable that simply could not be delivered online, the design was changed to a 3-day model, down from 4 days.

2.2 Online Version

The **3-day program** offered activities for participants through rich discussions within large group sessions and small group activities with facilitators. Facilitators were recruited on the basis that each group needed an experienced facilitator and was accompanied by a new facilitator, thus growing the number of facilitators over time.

A key element to the change that had to be made was to move from the very tactile creativity sessions run in the residential model to using a collaboration online platform called Mural to enable brainstorming and creative activity and provide a shared space for participants (e.g., the business model framework development activity).

Day 1 is designed to reflect on delegates’ personal values and motivation using the coat of arms activity applying creativity through the art of reflection. The main aim is to create a safe environment for participants by allowing time for personal

interaction and self-expression. Participants also had the opportunity to revisit their individual research and discuss the potential impact of their individual work on society and the environment. By delivering short focused sessions, the participants retained their attention to focus on the task and to express their ideas in a creative way.

Day 2 continued with the quick pace of activities to focus on the attributes and advantages of the ideas and to equip participants with the skills to carry out rapid evaluation of the market. We applied an interactive creativity session using blended visual and communication tools. Participants were introduced to the basics of business and how to apply it to their academic research. Through continuous short pitching activities, and changing the pace and focus of the activities, participants' attention was maintained throughout the day.

Day 3 The program supports the development of both soft skills for articulating an idea and business skills to increase participants' level of confidence in approaching an idea or research outcome by identifying key resources that are required to build a business case. To ensure that each participant received feedback, the program seeks to ensure that everyone has the opportunity to practice the art of pitching both on a one-to-one basis and to a big group.

2.3 The Impact of Entrepreneurial Education Programs

Countries wishing to grow and develop particularly recognize entrepreneurship as an imperative (Dias & McDermott, 2006). Across the free market economy, entrepreneurship is a significant source of innovation and a vital means to increase efficiency in resource allocation (Acs et al., 2014; Wong et al., 2005). In many societies, the desire to encourage university students into entrepreneurs is shared among policymakers and participants in higher education, including students themselves (Bécharde & Grégoire, 2005; Dickson et al., 2008; Sanchez, 2013). However, business and entrepreneurship education has been shown to have little (Bae et al., 2014; Rideout & Gray, 2013) or in some cases even an adverse effect (Fayolle & Gailly, 2015) on an individual's entrepreneurial intentions. However, with the application of multidimensional tools for measuring entrepreneurial self-efficacy (McGee et al., 2009), it is established that entrepreneurial programs which address particular points in their curricula might have a different impact on students' perceived aptitude for entrepreneurship (Barakat et al., 2014).

Contemporary understanding of individuals' entrepreneurial intentions and predispositions to engage in entrepreneurship focuses on two broad sets of antecedents—personality traits (Carland et al., 1988; Nicolaou et al., 2008) and behaviors (Davidsson, 2006; Gartner, 1988). With rare exceptions (Lerner et al., 2018), scholars agree that entrepreneurial behaviors are neither spontaneous nor impulsive but represent an example of intentional (planned) behaviors that are influenced by situation and context. Extant research in the entrepreneurship field demonstrates that cognition- and intent-based models reflect the multifaceted antecedents for

perception-driven entrepreneurial behaviors (Van Gelderen et al., 2015; Kautonen et al., 2015; Krueger, 1993). The seminal conceptualization of the intentional entrepreneurial event model (EEM) from Shapero and Sokol (1982) claims that decisions for entrepreneurial behavior stem from attitudes—perceived desirability and feasibility. Later on Krueger (1993) suggested that these constructs in the EEM correspond to the attitudes, and the perceived behavioral control concepts explained the theory of planned behavior (TPB) (Ajzen, 1991), which is a well-referred intent model in social psychology. With the development of research on this framework, several scholars (Armitage & Conner, 2001) proposed that the control and feasibility elements in intentionality models can be sufficiently explained with the self-efficacy (Bandura, 1994) construct. Self-efficacy is a concept of the social learning theory (Bandura, 1977a, 1977b) that refers to an individual’s self-perception of their own capabilities in performing specific tasks. There are four main ways in which individuals can develop their self-efficacy: first, by judging their own physiological and psychological state; second, by vicarious learning; third, by complying to social persuasion; and, fourth, by assessing their own performance in previous experience (Bandura, 1982).

Despite long-standing critique on business education in general (Datar et al., 2011; Rubin & Dierdorff, 2013) and its implications for entrepreneurship (Greer, 2010), substantial body of evidence (Bécharde & Grégoire, 2005; Sanchez, 2013) indicates that entrepreneurial training delivered in business schools promotes students attitudes toward business venturing (Fayolle & Gailly, 2015) and enhances their general fitness for the entrepreneurial tasks (Åstebro & Thompson, 2011; Lazear, 2004). Also, individuals attending university programs outside of business schools are exposed to and can benefit from universities’ close links to entrepreneurial ecosystems when they are engaged in making sense of possible future career developments and career changes (Rasmussen & Borch, 2010; Shane, 2004). Particularly the economic benefits of business venturing in universities can be expected in the case when researchers and doctorate students engage in entrepreneurial projects that involve commercialization of academic knowledge (Agarwal & Shah, 2014; Mosey et al., 2007; Ward & Ward, 2009). Those academic entrepreneurship projects can result in the patenting or licensing of research outcomes. To address the gap in the entrepreneurial skills among researchers and doctorate students outside business schools (Karlsson & Wigren, 2012), universities designed initiatives and projects that include short-term trainings in business-related disciplines offered to PhD students and academics whose research projects can be considered for commercialization (Atkinson & Pelfrey, 2010; Huyghe & Knockaert, 2015). Particularly popular proved to be programs designed with the application of Kolb’s principles of experiential learning in teaching entrepreneurship skills (Kim & Fish, 2010; Taylor & Thorpe, 2004). These programs include lecture-like sessions interchanged with various practical activities followed by mentorship support from tutors and facilitators.

2.4 *Measuring the Impact of Entrepreneurial Education Programs*

A literature review on types of impact of entrepreneurial education reveals that the majority of studies have focused on a positive link between entrepreneurship education programs and subjective (e.g., personal change) and objective (e.g., business start-up activity) impact indicators (Nabi et al., 2017). Thus, the list of indicators can involve five levels: (1) current and going measures of the entrepreneurship program (e.g., interest and awareness), (2) pre-and post-program measures (i.e., knowledge, entrepreneurial intentions), (3) measures between 0 and 5 years post-program (e.g., number and type of start-ups), (4) 3–10 years post-program (e.g., survival of start-ups), and (5) 10 years plus post-program (e.g., contribution to society and economy) (Nabi et al., 2017).

Regarding the experiential nature of “i2i,” the most common impact on participants might be entrepreneurial intentions based on Nabi et al. (2017), although the literature presents various ways to **measure entrepreneurial self-efficacy** (see more Newman et al., 2019). Meanwhile, the most widely used measurement contains four dimensions: searching, planning, marshaling, and implementing (McGee et al., 2009; Murugesan & Jayavelu, 2017; Newman et al., 2019). Those items measure individuals’ perceived competencies in various entrepreneurial tasks (Murugesan & Jayavelu, 2017). For instance, the most recent study by Wei et al. (2020) has adopted only four items to measure entrepreneurial self-efficacy.

Meanwhile, a study by Santos and Liguori (2019) used ten items from McGee et al. (2009) scale that involves three entrepreneurial tasks: searching, planning, and marshaling. The most recent study by Wei et al. (2020) uses the entrepreneurial self-efficacy scale accompanied with 19 items, which are composed of 4 dimensions such as opportunity recognition efficacy, relationship efficacy, management efficacy, and risk tolerance efficacy. The opportunity recognition dimension contains four items, while the latter dimensions are accompanied with five items. The full scale is presented in Appendix 1 (see the second page).

2.5 *Conceptual Framework Development*

As shown in Fig. 2, the proposed conceptual framework is organized in the following manner. First, the original entrepreneurship i2i program (content and delivery format) was created and developed. Second, the entrepreneurship outcomes of the impact of entrepreneurship education program are adopted from Newman et al. (2019) and cover entrepreneurship self-efficacy and entrepreneurship intention. Third, the relationship between entrepreneurship outcomes on participants and the entrepreneurship i2i program is explained based on the TPB theory and self-efficacy by Bandura (1977a, b, 1982, 1994).

The TPB has been used intensively in research to explain and predict behavior in a multitude of behavioral domains (Ajzen, 1991, 2005, 2020), from physical activity

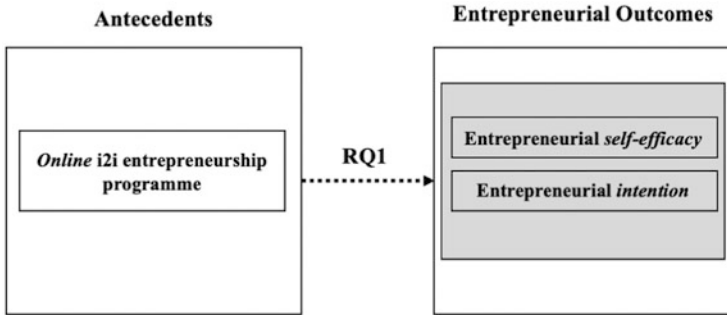


Fig. 2 The conceptual framework

to entrepreneurship. Meanwhile, the intention is determined by three factors: (1) attitude toward the behavior; (2) subjective norm; and (3) perceived control or self-efficacy (Tornikoski & Maalaoui, 2019). Specifically, the TPB has become influential in the entrepreneurship research domain during the past decade. It suggests that the entrepreneurial behavior is “determined by the entrepreneurial intentions, which are themselves determined by three antecedents: (1) attitude towards starting-up; (2) subjective norm; and (3) perceived behavioral control” (p. 508). Thus, recently, Ajzen (2020) has highlighted that TPB “starts with an explicit definition of the behavior of interest in terms of its target, the action involved, the context in which it occurs, and the time frame” (p. 314).

Based on this discussion, the relationship between online i2i entrepreneurship education and outcomes is grounded/framed by TPB theory and self-efficacy by Bandura (1977a, 1977b, 1982, 1994). Therefore, the online i2i program’ (content and delivery format) is considered as an antecedent for entrepreneurial outcomes (entrepreneurial self-efficacy and entrepreneurial intention). Regarding the experiential nature of the *online* entrepreneurship program i2i, it covers more than 20 activities. The proposed model is presented in Fig. 2.

Consistent with results on a previous entrepreneurship i2i program (title—Enterprises) in face-to-face setting, the level of self-efficacy can be raised through the program (Barakat et al., 2014). In a similar vein, another research with secondary school students has shown that entrepreneurial training programs can enhance overall entrepreneurial outcomes (i.e., entrepreneurial self-efficacy and entrepreneurial alertness¹).

Based on the discussion above, the impact of the experiential online i2i entrepreneurship program on participants includes two entrepreneurial outcomes: entrepreneurial self-efficacy and entrepreneurship intention. Taking together, the i2i online

¹Alertness indicates an “opportunity” in entrepreneurship (Tang et al., 2012). The literature provides several approaches on entrepreneurship alertness either opportunities are discovered or they are created or even can cover three areas such as opportunity recognition, opportunity discovery, and opportunity creation (ibid.). Consistent with Tang et al. (2012), entrepreneurship alertness covers two areas such as opportunity discovery and creation.

program can alter entrepreneurial self-efficacy and lead to entrepreneurship intention. Hence, the research question is formulated:

RQ1 *What kind of outcomes (i.e., entrepreneurial self-efficacy, entrepreneurial intention) do impact the online entrepreneurship program i2i on participants?*

3 Methods

3.1 Research Approach

Based on research question, a qualitative research approach was applied. A single-case method was used. The case study enables us to a research answer “What” question and make an in-depth analysis of the phenomenon. Consistent with Chu and Ke (2017), the methodology is developed and shown in Table 2.

3.2 Data Collection

The data are collected through two types of interviews—structured written interviews with participants who attended the online program and semi-structured interviews with facilitators/tutors. Thus, written interviews for i2i delegates were collected via email. Some clarifications were organized through emails, social media (Facebook, WhatsApp), and telephone calls.

The interview guide for i2i program’s participants was prepared based on the literature review (Table 8, Questionnaire; Appendix 1). Meanwhile, a protocol of semi-structured interviews for facilitators is available (Table 9; Appendix 2). The full picture of facilitators is provided in Table 10 (Appendix 3).

Participants consisted of doctoral students and postdocs from Lithuania. Consistent with Melyoki and Gielnik (2020), this research has applied a random approach to select research participants after i2i online training. All interviews were conducted in English. Consistent with Gadeikienė et al. (2021), the main criterion to finishing

Table 2 Research strategy and data collection methods

Research strategy	Data collection method	Data type/context	Sample size sample	Date of data collection/period
Qualitative	Structured written interviews	Primary data	i2i participants ^a	May to June 2021
	Semi-structured interview	Primary data	i2i facilitators ^b	23–24 June on Zoom

^aThe number of delegates was nine. Two respondents did not answer all questions

^bTwo facilitators were involved. The analyzed period did not cover the full activity of group, but only the activity of 3 days

data collection was down to the researchers’ decision whether new interviewees provide any new information toward the investigated phenomenon. The collected data represented the appropriate level of qualitative data that is sufficient for this case.

3.3 Data Analysis

To analyze the data of both interviews, a qualitative content analysis (thematic analysis) was applied. The coding process was carried out manually by assigning keywords, grouping codes, highlighting quotes, and then establishing themes from the codes. The coding process responses were carried out manually by assigning keywords, grouping codes, and highlighting quotes.

Tables 11, 12, 13, 14, and 15 present codes and the descriptions for Q4, Q5, Q6 (Appendix 4–6), and Q9–Q10 (Appendix 8) questions. Table 15 includes codes of the Q8 (see the first column). For the quantitative data (Q7), descriptive analysis was performed with SPSS.

The average duration of both facilitator’s interviews was around 60 minutes (60 min 6 s) (FAS_01 = 54.03 min., FAS_02 = 67.17 min). Notably, the audio recordings were transcribed using the automatic transcription software “Happy Scribe” which has been widely used in previous research (Gadeikienė et al., 2021). In total, both files covered 19,529 words and 47 pages (FAS_01 = 7405 words; 17 pages, FAS_02 = 12,124 words; 30 pages).

4 Results

4.1 Main Results of Facilitator Interviews

Regarding facilitation experience with i2i programs, facilitator (FAS_01) has highlighted that she had “two times on-site and sometimes I think it was now online, I was like this. So altogether <...> four times.” In a similar vein, another facilitator (FAS_02) has mentioned that she started to facilitate entrepreneurial programs in 2012, and the number of times is over ten times. Specifically, the i2i program was facilitated together with program co-founders entailed “<...> anywhere between five and seven” (FAS_02). Moreover, both facilitators have mentioned that they facilitate different formats of i2i (e.g., online, on-site). Table 3 summarizes the results of the data analysis of question related to facilitation experience in i2i program.

Table 3 Sample structure

Interviewee code	Demographic characteristics (i.e., gender)	Facilitator experience in i2i programs	Format of i2i programs
FAS_01	Female	4 times	Online, on-site
FAS_02	Female	~5–7 times	Online, on-site

4.1.1 i2i Online Program Content and Delivery

Regarding the length of the i2i program, both facilitators have argued that it was very intensive program. Nevertheless, both on-site and online i2i programs always are structured in a very intensive way. Indeed, the online program was “*designed* [for three days] <...> *we had to think about this* <...> *And four days is good, but four days in a row already with online was difficult*” (FAS_02) to implement it. As facilitator has described the part of an agenda: “*the first day is very much about like introduction* <...> [and] *all about the team.* <...> *the second day* <...> [entails] *deep conversations and deep topics*” (FAS_01). Specifically, the second day covered various sessions such as a session about participants’ research ideas, creativity, and opportunities to pitch and an interactive session with entrepreneurs. The final day was dedicated to the business model canvas, cash flow, and final preparation and pitching to the panel.

It is important to note that one of the facilitators has explained how the i2i online program was tailored to the potential needs of participants. As facilitator has explained that “<...> *everyone was a bit exhausted from quite intense first lockdown. Everything was on Zoom*” (FAS_02). Therefore, according to both facilitators’ answers, some activities of i2i were removed (or shortened) from the i2i program because it was difficult to run online and, thus, required more time. For instance, the facilitator has mentioned the coat of arms activity (it entails personal values, strengths, life’s motto, etc.) that it “*is absolutely a wonderful experience and I absolutely love it* <...> [but] *we might have needed a little bit more time*” (FAS_01) for that.

The program was designed to satisfy various participants’ needs and, thus, took into account the **context very carefully** (i.e., online format). As facilitator noted that “<...> *we know that we need to cater for people who are introverted as well as extroverts* <...> *there’s some time to have your personal space*” (FAS_02). Regarding the structure of a program, facilitator has highlighted that it was “<...> *very structured and very kind of precise*” (FAS_01). Additionally, **new activities** were added to the program, such as the cultural quiz which was adapted for the online version. A facilitator has mentioned that they “*decided to do a cultural quiz race. But during the full workshop [on-site i2i program], this is sort of a three-hour game* <...>. *We replace it with one-hour elements,* <...> *that was missing a little bit in the overall contents of the online [versus] eye to eye. But* <...> *I don’t think we missed the impacts that we still thought we still gave*” (FAS_02).

The online i2i program involved a limited number of breaks (e.g., coffee break, lunch). The main reason was to gain participants’ attention to the content and boost

their motivation level. As facilitator noted, “<...> *forty-five minutes and then you need a break. It’s kind of like normally what the brain is capable to do. <...>You cannot do it differently, you cannot have too many breaks because then the people are kind of like drift off and losing the kind of, like, motivation <...>*” (FAS_01). In a similar vein, another facilitator has highlighted the importance of activities during the break that enables participants to relax mentally. For instance, activities can cover “<...> *passive or yoga, music or whatever <...>*” (FAS_02). Notably, based on data, additional breaks were organized in small rooms (i.e., break rooms) based on the situation.

Both facilitators have agreed on the importance of digital collaboration platforms such as a Mural.co where it was used to support i2i activities. The Mural platform provides a digital space where all participants can collaborate visually. As an example of facilitator’s expression “<...>we had this big mural <...> where everybody was writing things and what they [participants] expected. <...> [it] worked quite well, actually. I was surprised you could see all these <...>like zooming around and typing things” (FAS_02). Additionally, a cash flow activity was organized on Mural.co platform.

In summary, facilitators have highlighted that the program was applied to an online context very carefully, and some new activities were offered for participants. Meanwhile, the time frame for some tasks was scheduled too short for participants, and it might be explained that the online environment requires some extra time from participants to understand a task and then work on it. Finally, the right amount of breaks should be designed in the program because participants should relax mentally from diverse digital platforms and return to activities with a fresh mind.

4.2 Main Results of i2i Participant Interviews

4.2.1 Demographic Profile Characteristics

In total, nine participants (42.85% from the full training) have finished a questionnaire. The sample contained a larger number of female participants (7; 77.77%). The average age was below 33 ($M = 32.77$) years old. The majority of participants (5; 55.55%) hold a PhD in various domains (e.g., chemical engineering, psychological and behavioral science, material science, psychiatry, pharmacy, mechanical engineering). Meanwhile, other participants had a master’s degree, and one participant was involved in PhD studies.

Only three participants had a business background within the family (3; 33.33%), such as a self-employed mother or entrepreneur father and brothers. Specifically, one participant’s family members were researchers and have recently started to run their business based on research. Interestingly, the majority of participants had no formal business education (6; 66.66%), while the other 3 participants had MBA and/or master’s degree in management, informational technologies, and service management and practical experience in business over 10 years.

Table 4 Entrepreneurial experience of participants (Q4)

Types of experience	Explanation
Entrepreneurial experience/knowledge	Participant 1: “[...] I’ve recently co-founded a tech company, we’re at the stage of validating the technology at a commercially relevant scale”
Working experience	Participant 2: “[...] <i>public and social sector initiatives and consulting</i> ” Participant 4: “[...] I have experience with social initiatives” Participant 6: “[...] directly related with brands and business development. Also, from 2015, I am marketing consultant and [provide] consultations for startups and SMEs <...> it covers business strategies, marketing and communication strategies, green business development topics” Participant 8: “[...] I worked in the private sector briefly. After that, I entered PhD studies. I am currently involved in various projects which are not only scientific <...>”
Education	Participant 1: “[...] I’ve taken several short university courses on innovation and entrepreneurship <...> several courses on social entrepreneurship <...>” Participant 4: “[...] I participated in few seminars and workshops about entrepreneurship <...>”
Other	Participant 9: “[...] I did have an idea on how and where to start because my family member has a small company”

As for the entrepreneurial experience, there were identified diverse types of experience such as prior (or even current) entrepreneurial experience, entrepreneurial knowledge as a result of prior experience and education, and work experience in business or/and in the public sector. Therefore, it seems reasonable to distinguish entrepreneurial experience into entrepreneurial experience/knowledge, working experience, education, and others (Table 4). The latter represents participants’ observations of their family member in their family circle. The results indicated that the majority of participants have working experience in the private sector, followed by some participants who had entrepreneurial knowledge from various education courses. Notably, only one participant has revealed entrepreneurial experience.

4.2.2 Confidence in Own Abilities to Solve Problems Related to a Business Idea

In this case, confidence explains how individuals feel about their abilities to solve problems related to a business idea. The results indicated that almost all i2i participants demonstrate high self-confidence (see Table 5). Additionally, some participants highlighted that their team plays an important role in solving various problems. Only a few participants expressed their doubts about specific knowledge of an area (i.e., marketing) or low personal efforts for idea development.

Table 5 Confidence in Own Abilities to Solve Problems Related to a Business Idea (Q5)

Confidence types	Explanation
High self-confidence	Participant 1: “[. . .] I am very conscious of the uncertainties surrounding tech R&D and the overall high risk of failure, I do not permit myself to get caught up in analysis paralysis. < . . . >” Participant 2: “[. . .] I believe I can solve problems related to my business idea, especially those that are more technical and on the implementation side < . . . >” Participant 5: “[. . .] I have scientific background needed for developing new products. Also, as a PhD student I have developed many professional competences that would help in business” Participant 6: “[. . .] I feel confident as I had variety of business issues situation during my work experience” Participant 7: “[. . .] The confidence level is [related to] the idea and the content of the idea < . . . >” Participant 8: “[. . .] I have competencies in selecting active compounds for products < . . . >. After doing a lot of research, I have experience in developing production technology and conducting research. My knowledge and skills are related to product development < . . . >” Participant 9: “[. . .] I strongly believe I am capable to find scientific solutions to problems related to my business idea and I am fairly certain that I would be able to “sell” the solution < . . . >”
Low confidence or self-doubt	Participant 3: “[. . .] I am not sure that for my idea I will have support from society and business. My doubts are the reason why I am not working hard with my ideas” Participant 7: “[. . .] I don’t have much [knowledge] in development business idea, marketing areas”
Confidence in team	Participant 1: “[. . .] I am happy to have a team of diverse experts by my side < . . . > . . .”
Other	Participant 4: “[. . .] I need to have a team, who will believe in my idea and then all problems will be solved” Participant 9: “[. . .] I do feel some uncertainties related to team—I might prove to be difficult to persuade certain specialists to join”

4.3 Effect of Online i2i Program on Entrepreneurial Outcomes: Self-Efficacy and Intention

Self-Efficacy Scale (Q7) The data shows in Fig. 3 that the average values of four dimensions rated by participants (opportunity recognition, relationship, management, risk tolerance) are pretty similar and vary from 5.08 to 5.53. Interestingly, the relationship dimension received the highest value – 5.53 – followed by the risk tolerance dimension (5.44). Meanwhile, the average values of opportunity recognition (5.19) and management dimensions (5.08) are almost equal and smaller than previous ones.

Regarding individual values (see Fig. 3), the data indicates that almost all participants recognize opportunities equally (the average values are above 4.5). Notably, the relation dimension values among participants are higher and are above 5, but



Fig. 3 The average values of four entrepreneurial self-efficacy dimensions (opportunity recognition, relationship, management, risk tolerance) based on Wei et al. (2020) ($N = 9$)

only one participant had the lowest average value (4.2). The management dimension also received relatively high average values (above 4.6). Interestingly, the majority of participants have indicated that they do manage risks (the average values are above 5.2), except for two participants (see Fig. 3). In sum, the results suggest that the online **i2i program has raised the participants' entrepreneurial self-efficacy.**

Entrepreneurial intention The majority of participants have mentioned that they were saving money (see Table 15; Appendix 9). Only one participant mentioned that he/she was trying to seek funding for a new venture. Four participants (4; 44.44%) did not save money. Moreover, two of them mentioned that they were investing.

4.3.1 Intention to Start a New Venture

Interestingly, almost all participants (7;77.77%) have argued that they would expect to start their own business in the near future (Table 6). More specifically, few participants have already started it. Only one participant was not thinking about his own venture, and one participant was not sure about it all. As the participant wrote “not very likely,” but if the conditions would change, then the participant has argued that “<I would definitely consider it and try to create new projects <.. >” (Participant 2). In sum, the results showed that the majority of respondents were interested in their own ventures. Specifically, these results were aligned with self-efficacy values (see discussion above).

Table 6 Participant intention to start a new venture (Q8)

Intention to start a new venture	Explanation
Positive intention	Participant 1: “[. . .] I believe that I will be co-founding at least one more entrepreneurial venture < . . . >. Today, I’d place the probability at 75%” Participant 4: “[. . .] I have a plan to start my own business” Participant 5: “[. . .] I have established a start-up company and I hope to make a successful business in the next 5 years” Participant 6: “[. . .] 100% < . . . > I see myself as developing individual/custom projects and business ideas (as external consultant) related to my product I am creating at the moment” Participant 7: “[. . .] Very likely, I have started my venture < . . . > I am working already” Participant 8: “[. . .] I have thoughts on starting spin-off business” Participant 9: “[. . .] Most likely the work will be continued in the current family company, however there is a possibility that I will start my own venture. That would happen in case if the current plans will not be successful. The probability < . . . > ~40%.”
Not clear intention	Participant 3: “[. . .] Maybe, I am not sure < . . . > I will look for a new one”

Table 7 Learning practices about a new venture (Q10)

Learning practices about a new venture	Explanation
Learning about a new venture <i>intensively</i>	Participant 1: “[. . .] I am constantly learning about new ventures and try to keep up to date with the field of entrepreneurship” Participant 5: “[. . .] after finishing i2i program I have participated in a longer and more specific course [life science] < . . . >” Participant 6: “[. . .] That why I am [doing] PhD” Participant 7: “[. . .] 1/7 of my time mostly on my weekends” Participant 8: “[. . .] In recent years, my home library has been replenished with businessmen biographies and business books. I listen to podcasts and tutorials on this topic”
Learning about a new venture <i>scarcely</i>	Participant 2: “[. . .] Not so much < . . . >” Participant 4: “[. . .] At this moment not so much”
Other	Participant 9: “[. . .] Currently review of existing technologies and scientific research is being done. Also the prototype is being created and tested”

Note. Participant 3 expressed “Yes” for learning about a new venture but did not specify

Regarding learning about new ventures, most participants highlighted what they were doing, but their practices were different (Table 7). For instance, one participant was doing a PhD that helps to develop a business idea further. Meanwhile, one participant joined a specific course that was directly related to a business idea (e.g., life science domain) after the i2i entrepreneurship program. Furthermore, diverse types of sources were mentioned by participants, including books, podcasts,

and tutorials/courses. All these participants' answers showed that they were motivated to keep moving forward after the program and their intentions were manifested in a variety of ways.

Regarding the question that the i2i online program affects their **awareness to start a new venture**, most participants have noted that the online i2i program did impact their attitude toward new venture or enhanced their confidence level to think about it. For instance, one has noted that the live session with entrepreneurs has made an impact on decisions: “<...> other [entrepreneurs] motivated me, and I started to think about my own business” (Participant 04), while others have mentioned the positive impact of the online i2i program on new venture ideas “i2i course certainly encouraged me to start a new venture <...>” (Participant 09). Regarding the level of confidence, one participant has mentioned that “<...>the positive feedback of other participants, lecturers and organizers encouraged and made me more confident” (Participant 05). Additionally, one participant had self-doubts and has a business idea but still lacks the courage to take actions due to the lack of experience. Meanwhile, three participants were already made a decision about a new venture or wanted before the i2i course was organized.

Actions/Resources The next question was about what steps are needed to start a new venture. The delegates have highlighted diverse types of resources such as **specific knowledge, human resources, physical resources** (e.g., specific equipment), and **financial resources** (e.g., financial grants, personal finance). Several quotes support this: “<...>I figured out what kind of people and things I need and I started to search for the right people” (Participant 4); “There is a lack of lab equipment in local market <...>” (Participant 06) and “I just need more money for the start <...>” (Participant 09). The importance of knowledge has also been acknowledged “<...> I have been learning about lean non-profits and social enterprises <...> I've been selected to <...> program <...>.”

5 Conclusions

The i2i program is designed to employ an experiential approach to entrepreneurship education. The program covers a variety of activities that include both large group (e.g., the spirit of an enterprise) and small group activities (e.g., understanding team role). The relationships between antecedents of entrepreneurial self-efficacy and entrepreneurial self-efficacy and entrepreneurial self-efficacy and entrepreneurial intentions were explored. The data about the online i2i was collected through two types of interviews – semi-structured interviews with facilitators/tutors and structured written interviews with online i2i participants.

The results of facilitators' interviews have highlighted the importance of tailored content to the online environment and its variety (activities). It was also highlighted

that the i2i content was tailored to the online format carefully and might satisfy various participant types and their needs, including introverts and extroverts. Importantly, the program’s structure for online version i2i involved new activities that helped to maintain participants’ attention and interest in the content. The analyzed program involved a virtual cultural quiz which was run for social interactions. Also, digital collaboration platforms such as Mural.co played a key role for participants’ engagement within a specific activity, but the duration of activities (i.e., a cash flow) on the platform should be considered. The results show that not all participants can make a task for a shorter time.

Our findings reveal that the online i2i program equally enhances participants’ entrepreneurship knowledge and boost their motivation to start their ventures. Also, the main results support those various activities of online i2i entrepreneurial program (e.g., successful entrepreneurs and mentors) supported with digital collaboration, and communication platforms can be a precursor or even a catalyst to enhance entrepreneurial intentions (i.e., to start their venture). Nevertheless, the results indicate that almost all i2i participants raised their level of self-confidence. Online pitching training has been identified as a key practical skill that is transferable to future experiences of presenting to a larger audience.

From a learning perspective, it would appear that the same overall content can be delivered online as in face to face as long as there are supporting tools and not just giving talks online. The supporting tools in this case included collaboration platforms, quizzes, ongoing events beyond the short 3-day program, and a final deliverable task set for the participants. It also relied heavily on the facilitators’ role being transferable from the face to face to the online version, and it appears that the main element that held it altogether was the shared set of values and a common purpose of raising self-efficacy alongside entrepreneurial intent.

From a practical perspective, the main lessons are that the delivery team has to do a lot more preparation because the participants are either on or off—not just round the corner at a coffee break or lunch. To maintain the social interactions to build trust and empathy and not turn the whole enterprise into a task delivery remains the main challenge to this type of training and general intervention. We have a long way to go yet to better understand how this can be developed.

6 Theoretical Implications

This research has several theoretical implications. Its novelty is that the current research investigates the relationship between entrepreneurship program i2i on participants’ entrepreneurship self-efficacy and entrepreneurial intentions. Meanwhile, the previous literature stresses the effect of entrepreneurship programs on participants’ self-efficacy and entrepreneurship intention in a face-to-face or physical setting. In other words, entrepreneurship programs based on experiential learning

were organized in a face-to-face setting where many variables can be controlled. For instance, the interpersonal interaction between participants and even between participants and mentors can be detected and managed more easily in the face-to-face setting in comparison with the online version of the training when many participants do not use the function of a camera on.

Our proposed model provides a better understanding of the online entrepreneurship program, and how it impacts participants' entrepreneurship self-efficacy and entrepreneurial intentions, although the analyzed entrepreneurship program i2i is short and intensive and might not be sufficient to foster entrepreneurship intention equally for all participants. Therefore, follow-up events such as a pitch competition or even coaching sessions might be helpful to sustain entrepreneurship self-efficacy over the time that leads to entrepreneurship intention.

7 Limitations

The current study analyzes a simple cause-effect relationship model and avoids the general mediation model where entrepreneurial self-efficacy can be a mediator variable between an independent variable (i2i program) and a dependent variable (entrepreneurship intention). For this effect, a quantitative study with a more significant sample of entrepreneurship programs is recommended for future research. Meanwhile, this research has involved only two experienced facilitators of the i2i program. Future research studies might include the full list of an entrepreneurship program's facilitators.

The current research analyzes the relationship of the entrepreneurship program (experiential learning) on participants' self-efficacy and entrepreneurial intention. Indeed, program's participants can vary based on their abilities to start and run their business. Partially consistent with Krueger and Welpel's (2014) suggestions for social entrepreneurs, future research might investigate the relationship between online experiential learning of entrepreneurship programs, participants' abilities and the impact on entrepreneurial intention.

Finally, another future research avenue could cover a longer time frame of evaluation of the impact of entrepreneurship program on participants' entrepreneurship intention. Thus, based on the previous successful experience by the Enterprises program created by MIT and Cambridge universities, the current program was adapted for the online environment, and it can act as a catalyst for long-term impact on the economy (Kelly, 2005). Therefore, future research might include a long-term view on evaluating the impact of online entrepreneurship programs.

Appendix 1

Table 8 The development of questions for an interview protocol (*structured*)

Question types	Explanation/definition	Questions	Sources
<i>Demographic profile characteristics</i>			
Age, gender ^a	NA	Please indicate your age	Brändle et al. (2018)
Education background	Technical nontechnical	Please describe your education/family business background	Jena (2020)
Family background	Business background and nonbusiness background		
Availability of entrepreneurship experience	NA	Have you ever had entrepreneurial experience?	Developed based on Markowska and Wiklund (2020)
<i>Entrepreneurial self-efficacy</i>			
Self-efficacy	“< . . . > assess beliefs that one can personally execute a given behavior” (Krueger, Reilly, Carsrud, 2000; p. 419)	Describe about your motivation to start your own company	Adopted from Barakat et al. (2014)
		Describe about your confidence in your ability to solve problems related to your business idea	
		Could you provide an example where you have applied a fresh approach to problems?	
		What kind of resources are essential for you to star your own company?	
		Describe your abilities to choose suitable team members for your business	
<i>Entrepreneurial self-efficacy^a</i>		Four dimensions (opportunity recognition efficacy, relationship efficacy, management efficacy, risk tolerance efficacy)	Wei et al. (2020)
<i>Entrepreneurial intentions (outcome)</i>			
Entrepreneurial intentions (outcome)	Entrepreneurial ^a intentions It defined as “the intention of an individual to start a new business”	Thinking of yourself, how true is it that you: <ul style="list-style-type: none"> • You are saving money to start a new venture? 	Adopted from Newman et al., 2019; Thompson, 2009; Krueger Jr et al., 2000;

(continued)

Table 8 (continued)

Question types	Explanation/definition	Questions	Sources
	(Newman et al., 2019; p.410)	<ul style="list-style-type: none"> • Intend to set up a new venture in the future? Or estimate the probability you'll start your own business in the next 5 years? • Spend more time learning about new venture? 	Santos & Liguori, 2019

^a Gender data was included into a database

Questionnaire

Interviewer/researcher: [removed]

Date and time:

Respondent:

Introduction

This questionnaire is conducted within the scope of research on *online i2i events in Lithuania*. This research focuses on experiences of *i2i participants* during and after *i2i events* in Lithuania.

The findings of the research will be presented at the international **IEEE ICTE 2021** conference and prepared a book chapter.

Getting Acquainted [1–3 Qs]

The Main Questions [4–7 Qs]

Entrepreneurial Intentions (Outcome) [8Q–10Qs]

Additional questions:

- Do you have any questions and/or remarks or are there any relevant points that we have not yet covered in this interview about *i2i online* event?

Important! If you do agree, please provide your responses in written form. *Anonymity will be guaranteed and all information possibly revealing your identity will be removed before publishing.*

Thank you very much for all your time© .

Name/surname.

Demographic Profile Characteristic

1. Your age:
2. Education background:
3. Family background (business background; nonbusiness background). Please describe your education/family business background.

The Main Questions

4. Have you ever had entrepreneurial experience?
5. Describe your confidence in your ability to solve problems related to your business idea.
6. What kind of resources are essential for you to start your own company?
7. Entrepreneurial self-efficacy (scale was adopted by Wei et al., 2020).

Using a seven-point rating scale (see below), please indicate how much do you agree or not agree with the following statements related to entrepreneurial self-efficacy.

1 = strongly disagree; 2 = disagree; 3 = somewhat disagree; 4 = neither agree nor disagree; 5 = somewhat agree; 6 = agree; 7 = strongly agree. Please indicate “+”

Note. A table of 19 original statements was used from the previous work by Wei et al. (2020)

Entrepreneurial Intentions (Outcome)

8. You are saving money to start a new venture?
9. Intend to set up a new venture in the future? Or estimate the probability you’ll start your own business in the next 5 years?
10. Spend more time learning about new venture?

Additional Questions

- Do you have any questions and/or remarks or are there any relevant points that we have not yet covered in this questionnaire about i2i *online* event?

Appendix 2

Table 9 Guide for the *semi-structured* interviews

Interview part	Questions	Specific remarks of questions
1. Introduction	1.1 How many i2i programs did you facilitate?	– Facilitation experience of years
2. Main questions	<p>2.1 Usually, the i2i program covers four intensive days. Could you reveal the main logic behind the 3 days program content for an online format?^a</p> <p>2.2 What are the benefits of the online i2i program vs. the physical (or offline) i2i program?</p> <p>2.3 What do you think about breaks in this online?</p> <p>2.4 What kind of differences could you identify in compared with the online i2i program vs. the physical (or offline) i2i program?</p> <p>2.5 Based on data from the WhatsApp group “KEEN i2i facilitators” some tasks required more time than it was expected. Could you elaborate on these issues more from your own experience?</p> <p>2.6 What kind of digital tools did you use for the online i2i and for what, and how did you select them?</p> <p>2.7 What kind of dark challenges during the first i2i online in Lithuania could you recall?</p>	<p>Program structure:</p> <ul style="list-style-type: none"> – Diverse activities (added or removed/tailored for online i2i) – Tactile sensation <p>Concentration level (i.e., high, low)</p> <p>Break types^b:</p> <ul style="list-style-type: none"> – Lunch break – Coffee breaks <p>i2i program:</p> <ul style="list-style-type: none"> – Types (online, offline) – Different digital communication and collaboration tools <p>Specific tasks of i2i program:</p> <ul style="list-style-type: none"> – Cash flow – Business model canvas <p>Digital tools:</p> <ul style="list-style-type: none"> – Communication/interaction – Collaboration <p>Challenges related to the online i2i:</p> <ul style="list-style-type: none"> – Time management – Commitment level of participants—energy level of participants
3. Conclusion part	3.1 Would you like to add something important that we have missed during our discussion?	

^aThe program of 3 days was shown during the discussion with interviewees on the Zoom platform

^bThe breaks can range from 10 mins to 1 h

Appendix 3

Table 10 The online i2i program facilitator’s description

Facilitator code ^a	Facilitator experience (e.g., experienced/non-experience)	Role during i2i
FAS_01	Experienced	Facilitator/tutor
FAS_02	Experienced	Facilitator/tutor
FAS_03	Experienced	Facilitator/tutor
FAS_04	Experienced	Facilitator
FAS_05	Experienced	Pop-in facilitator
FAS_06	Experienced	Facilitator
FAS_07	<i>Non-experience</i>	Facilitator
FAS_08	<i>Non-experience</i>	Facilitator
FAS_09	<i>Non-experience</i>	Facilitator
FAS_10	<i>Non-experience</i>	Pop-in facilitator
FAS_11	<i>Non-experience</i>	Pop-in facilitator

^aAll names/surnames were coded

Appendix 4

Table 11 The codes and the descriptions for the Q4

Code	Subcode	Description
Entrepreneurial experience	Entrepreneurial experience/knowledge	Such as prior entrepreneurial experience
	Working experience	Such as a number of years; a type of company (e.g., private); entrepreneurial initiatives, etc.
	Education	Such as special entrepreneurial studies; courses (e.g., innovation and entrepreneurship; i2i program); etc.

Appendix 5

Table 12 The codes and the descriptions for the Q5

Code	Subcode	Description
Confidence in own abilities to solve problems related to a business idea	High self-confidence	Such as a positive (personal) attitude about skills and abilities, trust in themselves, etc.
	Low self-confidence	Such as scared feelings, “negative” <i>feelings</i> , low confidence; feel incapable of doing things, etc.
	Confidence in team	Such as a positive attitude about skills and abilities towards a team, etc.

Appendix 6

Table 13 The codes and the descriptions for the Q6

Code	Subcode	Description
Resources to start a company	Human resources	Such as a team; networks; etc.
	Intellectual resources	Such as a specific knowledge, license, etc.
	Physical resources	Such as a company building/physical place; an equipment for lab; (etc.
	Financial resources	Such as financial resources, money, capital, etc.

Appendix 8

Table 14 The codes and the descriptions for Q9–Q10 questions

Code	Subcode	Description
Intention to set up a new venture or the probability to start it in the next 5 years	Positive intention	Such as I believe, I hope to make, I have thoughts, very likely, etc.
	Not clear intention	Such as I am not sure; maybe; etc.
Learning about a new venture Spend more time learning about new venture	Learning intensively	Such as constantly learning, books, podcasts, etc.
	Learning little	Such as not so much

Appendix 9

Table 15 Participant responses about saving money for a new venture (Q8)

Sources of money for a new venture	Explanation
Saving money	Participant 1: “[...] [saving money] indirectly. I want to make sure that I have a fair amount of runway to cover my personal costs when engaging with a new venture <...>” Participant 3: “[saving money] yes” Participant 8: “[...] I save on another bill so I can implement the idea. But money doesn’t have the biggest impact, the most important thing is to find the right people to complement my abilities <...>” Participant 9: “[...] there are plans to start another product/solution in current family company <...>I am unable to disclose any details”
Alternative to saving money (funding)	Participant 5: “[...]’ applying for grants to have money for developing prototypes”

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Applying Eye-Tracking Technology in the Field of Entrepreneurship Education



Lina Kaminskiene, Kateryna Horlenko, and Ling Yi Chu

Abstract Eye-tracking application in social sciences including entrepreneurship education has increased significantly in the recent years. This technology has been used to investigate the learning process and how to foster it through instructions delivered, material used and the learning environment created. Traditional research with eye-tracking application mainly concentrates on visual aspects in the learning process including but not limited to text comprehension. A growing area of eye-tracking technologies is focused on entrepreneurship education including teacher education because schools are considered as an important stage for developing entrepreneurial competences.

In general, the area of the application of eye tracking has become extremely wide in different sciences which also positively contributes to research in education. Transdisciplinary and multidisciplinary approaches are helpful to ensure multiple perspective as well as to ensure the validity of research data and results.

This chapter is an attempt to critically reflect on how eye-tracking methodology is applied for research on entrepreneurship education and what are growing methodological challenges in it. At the end some implications for further studies in the field of entrepreneurship education are discussed as well as limitations of eye-tracking-based studies are highlighted.

Keywords Eye tracking · Entrepreneurship · Entrepreneurship education

1 Methodology

The search and selection of the relevant literature was conducted among peer-reviewed journals in the field of education and social sciences. The search of literature was done through ERIC (EBSCO) database and was not limited to journals indexed in Web of Science or Scopus since entrepreneurship education study using

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Table 1 The inclusion and exclusion criteria for literature review

Criteria	Inclusion criteria	Exclusion criteria
Sources of information	Include articles based on empirical findings or theoretical analysis. Articles published in the peer-reviewed, open access journals, full-text articles	Exclude sources published without peer review, with no full text available
Content	Include studies where eye tracking is regarded as a core subject. Include papers related to K12 education, higher education in general, learning concepts in isolation	Exclude studies where eye tracking is not a core subject, studies related to specialised higher education (medicine, geology, etc.), studies not in the field of education (e.g. in neuroscience)
Type of study	English, quantitative and qualitative studies, reviews, full conference papers	Conference abstracts, reports and editorials, commentaries
Availability	Full text accessible to the authors	Full text non-accessible to the authors

eye-tracking methodology is a relatively new area of investigation. The process consisted of several steps. The search was done using the keywords ‘eye tracking’ and ‘education’. This produced a vast number of sources. Seeking to narrow down the search, we included the keywords such as ‘entrepreneurship’ and ‘education’; however, these keywords did not help in identifying the most relevant publications. After screening the available abstracts of articles generated from the initial search, we came up with 505 papers relevant for further analysis.

The second step involved a careful analysis of the abstracts and applying inclusion/exclusion criteria (Table 1) to select the most relevant publications. Papers which did not directly deal with eye tracking in the field of education and in entrepreneurship education were excluded from further analysis. Some EU-level policy documents were included in the study to present the political context of entrepreneurship education in Europe. To ensure the saturation of the data, additional papers specifically focusing only to entrepreneurship education were added. The final sample of the analysed data sources consisted of 105 articles, studies, conference papers and EU policy documents.

2 Entrepreneurship Education

In its fundamental sense, the term entrepreneurship refers to starting and developing new ventures, connecting resources with opportunities and creating value (Gartner, 1990). Within a more holistic approach, it can reflect a worldview that accepts change as a natural part of life (Johannisson, 2018), implying an active, creative, self-reliant individual. Both types of definitions have implications when adapting the term to the context of education, that is, equipping students with knowledge about and skills for entrepreneurial activity.

One of the debates in the field of entrepreneurship education is related to the twofold view on entrepreneurship: should its focus lie on the process of business creation or on the development of entrepreneurial individual? The current view on entrepreneurship education seems to aim combine both approaches, with the latter being relevant for all levels of education, and the former more suitable for the secondary and higher education levels (Lackeus, 2015). While entrepreneurship education is grounded in the entrepreneurial activity as such, approaching it from education science perspective shifts the focus to the learner as a human being and her skills, beliefs and intentions (Kyrö, 2018). A major goal of entrepreneurship education is to help students embrace the entrepreneurial worldview and self-reliant attitudes (Gibb, 1993). Entrepreneurship education implies the development of attitudes, behaviour and capacities on the individual level because entrepreneurship may be manifested through skills and attitudes which are revealed and implemented through personal career. This in a long-term perspective creates value to the society and economy. Entrepreneurship education can contribute to the enhancement of entrepreneurial and innovation culture, by changing mindset and equipping individuals with relevant skills.

Entrepreneurship education shares similarities with the principles of progressive education and constructivist learning paradigms. It promotes collaboration, cooperation and search of new perspectives. It prepares students to recognise opportunities and take action in the environment characterised by complexity, thus emphasising creativity and personal agency and ability to face risks and assume responsibility (Kyrö, 2018). The classroom activity is learner-centred and even learner-led when learners are supported to follow own interests and find ways to apply them in reality. The goal of the process is value creation, that is, bringing change to the environment by interacting with it and producing utilities for other people as stakeholders (Lackeus, 2015). Another distinctive characteristic of entrepreneurship learning is decision-making. In this regard, students can be made acquainted with different models of reasoning that are applicable for entrepreneurship. An example of such models is the effectuation process proposed by Sarasvathy (2001). According to effectuation thinking, the entrepreneur makes decisions exploring different outcomes based on the means she already has at hand, as opposed to causation thinking where it is needed to reach a certain predefined outcome and find means to do so.

The above-mentioned attributes of entrepreneurship education imply a greater focus on collaborative learning and personal initiative of students in the classroom. At the same time, student individual differences in terms of gender, cultural and social background as well as student personality and intentionality have influence on student involvement with entrepreneurship-oriented activities (Pittaway & Cope, 2007). Generally, the quality of entrepreneurship education largely depends on the concrete schools and resource availability. Also, teacher professional background has been identified as an important factor influencing implementation of entrepreneurship education (Ruskovaara & Pihkala, 2015). There is a noticeable variability in institutional implementation of entrepreneurship education and the underlying pedagogies, reflected in the case study reports as prevailing research evidence in the field (Pittaway & Cope, 2007). Reviews reported use of action learning, venture

creation simulation, venture development, role plays, experiential learning, project work, enterprise visits and mentoring as teaching methods (Solomon, 2007; Pittaway & Cope, 2007). Nowadays, the digital environment has become the new space for both learning and entrepreneurial activity, where the learning methods can be utilised and developed.

Entrepreneurship education can become a trigger to societal changes and a very important factor in the development of all sectors. The role of public and private sectors is equally significant while creating and developing efficient ecosystems which stimulate and support the creation of innovative enterprises. Even though contexts from countries may differ, entrepreneurship education in its various forms may provide possibilities to actively engage in their exploitation taking into consideration the existing environments and cultures.

Developing the entrepreneurship competence in learners is one of the core aims of entrepreneurship education (Komarkova et al., 2015; Tittel & Terzidis, 2020). Lackeus (2015) described it as a combination of skills, knowledge and attitudes that facilitate the entrepreneurial value creation. Students need to *'learn to see entrepreneurship as a journey rather than a destination [...] this must happen while the students themselves are in personal flux in both cognition and emotion'* (Welsh et al., 2016, p. 127). Lans et al. (2018) discussed entrepreneurship education and entrepreneurship competence in terms of 'what' and 'how'. The 'what' stands for the types of competences that build the entrepreneurship competence. The authors distinguished between the cognitive, social and moral competences. The 'how' elaborates the way students learn, namely, the pedagogies applied, types of assignments, learning goals and outcomes. The specifics of entrepreneurship education signify that the interplay between the cognitive and emotional aspects of learning is crucial for understanding it on the individual and group levels. This line of research has developed significantly in educational sciences in the past decades in the field of student engagement and self-regulated learning (Christenson et al., 2012) and is expected to develop in the context of entrepreneurship education as well (Kyrö, 2018). Moreover, expertise development (Ericsson et al., 2006) is present in entrepreneurship just like in other fields, allowing studying entrepreneurial competence in expert/novice paradigm, especially from the perspective of entrepreneurial cognition drawing on findings from cognitive psychology (Dew et al., 2009; Mitchell et al., 2004). The cognitive processes and heuristics typical for entrepreneurial perception and decision-making can be identified through expertise research and developed into teaching techniques for entrepreneurship education.

In Europe, relevance of entrepreneurship education has been linked to supporting the economies and employment on the one hand and promoting active citizenship and democratic values on the other (Kyrö, 2018). Entrepreneurship education in a higher education sector is traditionally focused on the development of entrepreneurial skills and mindset and to the support and recognition of entrepreneurial initiatives. Entrepreneurship education is a process which aims to develop individual mindset, behaviour and capacities which are employed in creating value in different contexts and environments. Active graduates should be prepared to use and exploit their potential and create their future as indicated by the European Entrepreneurship

Competence framework (EntreComp; Bacigalupo et al., 2016) and related studies (McCallum et al., 2018; McCallum et al., 2020).

In general, entrepreneurship is not only focused on the creation and development of one's own business. It is very much linked to creativity, innovation and growth, a way of thinking and acting which is significant for different contexts, environments and ecosystems. In this context the entrepreneurial ecosystem could be characterised as an interdependent and interactive system of entrepreneurial activity. This interdependence involves institutional regulations, environmental conditions which predetermine socially and economically perspective opportunities and how entrepreneurial individuals form and develop these institutional and environmental conditions.

3 Eye-Tracking Technology

Attempts to design eye-tracking equipment began as early as the nineteenth century and developed from various obtrusive methods with physical eye attachments to the contactless, non-obtrusive and often portable eye trackers used nowadays (Holmqvist et al., 2011; Wade & Tatler, 2005).

The core of the technology is recording the position of the eye and calculating its movement in relation to a screen or a scene. The eye tracker consists of an infrared light source pointed to the eye and a camera that records the pupil and the reflection from the light on the cornea (Holmqvist et al., 2011). Eye trackers can be remote, as a part of a computer, or mobile, designed as glasses. The former allows tracking-eye movements when looking at the computer screen, while the latter allows examining the gaze pointed to any object within the field of view. The mobile eye tracker has also a front-looking camera for first-person scene recording.

Elements of eye movement that present interest for eye-tracking research in education are fixations and saccades. Fixations are time intervals when the eye is comparatively still and acquires new information, that is, fixating on an object or a certain area. They can last from 150 ms to 600 ms and build the basis of visual perception (Duchowski, 2007). Saccades are quick movements from fixation to fixation when the eye does not acquire new information (Rayner, 2009). Understanding of how a person distributes attention can be gained from examining where, in what order and for how long fixations occur, with saccades as transitions in between. Fixations and saccades are analysed in relation to task-specific regions – areas of interest (AOI). The lengths of both measures depend on the task and complexity of the stimulus (Rayner, 2009). Measures of eye movement can be counted, or reported temporally and spatially (Lai et al., 2013). The count scale stands for the characteristics of fixations and saccades that can be counted (e.g. fixation number). The temporal category describes the time spent on a certain area (e.g. total fixation duration, average fixation duration, first fixation duration). The spatial category implies that fixations and saccades are analysed in the space dimension, that is, their locations and overall arrangement (e.g. scanpath pattern).

One more measure that the modern eye trackers can detect is the pupil size. Quick pupil dilation can indicate emotional arousal or mental effort (Martin, 2019). However, pupil size is sensitive to lightning conditions, so this measure needs to be treated with caution.

Educational research can make use of modern eye trackers in the laboratory or in the field. Laboratory settings make it possible to control conditions of the study. Holmqvist et al. (2011) mentioned several important points for laboratory settings. Controlling lighting is important for optimal eye tracker recording, and especially when measuring the pupil size. When using remote eye tracker, participants' head movement can cause noise in the eye-tracking data or lead to loss of calibration, so a chin rest is needed to stabilise the head of the participant. Eye trackers with multiple cameras and infrared sources are less sensitive to head movements. In addition, soundproof laboratories allow minimising external noises that could distract participants. Laboratory settings are suitable for examining separate elements of learning as a process and provide high internal validity but lack ecological validity (Duchowski, 2007). Studies in the field or 'on-site', on the other hand, need to respect the less controlled environment comparing to the laboratory. At the same time, the availability of state-of-the-art mobile and remote eye trackers allows such work and ensures ecologically valid authentic conditions for the research (Jarodzka et al., 2021). For the field of education, this is especially important, as learning and teaching are context-dependent, social and interactive processes that take place in connection with the environment (Jarodzka et al., 2017). Thus, eye tracking allows obtaining unique insights about human perception and cognition across several dimensions.

4 Theories Applied in Eye-Tracking Research

Eye-tracking technology allows focusing on instructional design issues and helps to explore how learning material is visually presented to eliminate distraction and optimise its function to support learning. Focusing on the flow of information processing to and within the working memory, the two most influential theories are the cognitive load theory (Chandler & Sweller, 1991) and the cognitive theory of multimedia learning (Mayer, 2009). Both theories work according to the assumption that working memory capacity is limited; learning only takes place where there is available capacity not consumed by inadequate instructional design; learning solely occurs where there is active engagement with the learning material.

Cognitive load theory (Chandler & Sweller, 1991) shines light on the scientific approach to the design of learning materials so that the pace and complexity are best comprehended by the learner. The goal is to make the best use of the limited working memory load by avoiding presenting tasks that are too difficult (monitor the 'intrinsic load'), improve the layout of the instructional material (reduce the 'extraneous load') and increase active engagement with the instructional materials (optimise the 'germane load'). Expanding on this, cognitive theory of multimedia learning

(Mayer, 2009) urges the importance to rethink multimedia instructional messages so that they guide effective cognitive processing during learning but not causing extra burden on the learner's cognitive system. The three assumptions on how humans process information are:

1. Channels for processing visual-pictorial and auditory-verbal information are independent of each other (the human mind is 'dual channel').
2. Most people can only maintain maybe five to seven "chunks" of information in working memory at a given time (human mind is 'limited capacity').
3. Learning happens when learners identify relevant information and work to synthesise words and pictures into meaningful information that is stored in long-term memory (human mind is an 'active-processing' system).

A related theoretical framework, cognitive-affective theory of learning with media (CATLM; Moreno & Mayer, 2007), also integrates the emotional aspects of multimedia learning with the cognitive ones. It postulates that both emotional and motivational factors have an impact on learning, that learners can regulate their emotions and motivation to support learning and that learners' individual differences influence the effect of multimedia instruction. Adopting a constructivist view of learning, multimedia is far beyond information delivery systems, but cognitive aids for knowledge construction. The theories offer similar guidelines on how to design instrumental material, focusing on its visual presentation—in order to optimise learning efficiency.

Jarodzka et al. (2017) proposed the second research line of eye-tracking research on visual expertise as the expertise developmental topics which explores learning beyond the initial stages. This is when the organisation of knowledge accumulates past the initial stages and into the long-term working memory (Ericsson & Kintsch, 1995). Information starts to scaffold into categorised chunks, or schema (van Lehn, 1996), which expands the working memory as more spaces are being made for other entities. These formed 'frameworks' that learners have created for themselves help to organise and interpret information, and these cognitive cues assists in learning new information by making connections to this prior knowledge. When a schema follows a temporal order, it is referred to as a script (Schank & Abelson, 2013). The schema is also organised and labelled with shortcuts where long chains of reasoning are folded away into one entity and only unfolds its chains when required (Boshuizen & Schmidt, 1992). The more efficiently organised their prior knowledge or schema a learner must work with, the more referencing material he/she has when trying to execute a task with speed and accuracy. A learner eventually proceeds into becoming an expert of their domain of expertise (Ericsson et al., 2006) where they can consistently and superiorly perform on specific sets of representative tasks from a domain (Ericsson & Lehmann, 1996). Experts demonstrate tacit knowledge when they encode domain-related patterns using their encapsulated knowledge as a reflection of chunking in perceptual processes (Reingold & Sheridan, 2011).

Difficulties to execute eye-tracking application to visually information-rich areas are where visual expertise is most relevant, as relevant information is difficult to be selected due to the presence of numerous irrelevant information, visual dynamic

environments lead to possibilities of visual saliency, and transient information and element of information may appear and disappear simultaneously—leading to split-attention effect. Jarodzka et al. (2017) also pointed out that stimuli used in visual expertise research are domain-specific and cannot claim to be representative, where findings cannot be generalised to other information-rich and dynamic domains.

The third line of eye tracking in educational research is the eye movement modelling examples (EMMEs), which bridges the novice learners to the experts. EMMEs are computer-based videos that display the gaze behaviour of a domain expert while they execute a problem-solving task. This is a training model, where (relative) novices learn from the experts using EMME as an instructional document (Xie et al., 2021). EMME video examples are professional vision (or the layover of the experts' visual focuses) simultaneously supplemented by the verbal explanations of the expert for complex real-life problems to be dissected and explained following the cognitive processes of the expert. The novice/learner is given the opportunity to look through the expert's eyes to guide the visualisation of the expert's cognitive processes by following how the experts' visual focus flows and hearing how the expert explains their own thought processes.

Some recent applications of eye tracking can help to follow the process of novices learning from experts. For novices, the idea builds on the principles of the social learning theory that learners observe and imitate authentic task completion from more skilled others (Bandura, 1977). For experts, eye movement illustrates the superior approach to tasks explained by the information reduction hypothesis (Haider & Frensch, 1999) and selective processing – engaging longer and more frequently with elements of task-relevant information (Crundall et al., 2012). Research on teaching and training applying this concept shows that learning by seeing an example of a task being successfully executed is more efficient than learning by trial and error (Kirschner et al., 2006). EMME provides an opportunity to show novices where to look and, more importantly, why (Kok et al., 2015), as there is no print trying to make novices act like experts. This is especially true when the critical processes are not observable from the outside and verbalisation of the experts' thoughts must be supplemented. Jarodzka et al. (2017) pointed out the importance of EMME models would be experts who are highly experienced in teaching their expert domain, to better associate their verbal explanation in accordance with difficulties that students typically face. EMMEs do not need to record the instinctive reaction of how experts solve tasks and can be repeated. It allows space for the experts to prepare and familiarise with the task, and to be reflectively aware of their audience (the novices) by thoroughly considering factors such as prior knowledge (Kalyuga, 2007), and evaluating whether gaze-voice coupling is tight enough during the recordings (Richardson & Dale, 2005).

5 Eye-Tracking Data and Analysis

As a scientific data collection method, eye tracking is credited for its objectivity, temporality, and for the field of education—the variety of study designs that can incorporate it. Eye movement is automatic; a person may not always be consciously aware of own gaze as it reflects both voluntary and involuntary attention (Duchowski, 2007). Besides, eye tracking provides an opportunity to observe and measure a cognitive process throughout a certain time period or in real time (Alemdag & Cagiltay, 2018; Kaakinen, 2021). To analyse the eye-tracking data beyond attention distribution or mental effort, and to make a clear connection between the eye movement measurements and cognitive processes, it is important to combine them with other sources of data (Lai et al., 2013; Orquin & Holmqvist, 2018). To name a few, these could be verbal reports (Jarodzka et al., 2013), cued retrospective reports (van Leeuwen et al., 2017), knowledge tests (Clinton et al., 2017) or video recordings (Pouta et al., 2021). Thus, data triangulation became essential in current eye-tracking research in education.

Eye tracking allows collecting rich and continuous data for each participant. It can be analysed quantitatively or qualitatively, depending on its type: count and temporal measures can be analysed quantitatively, while spatial measures require qualitative analysis. The choice of the analysis approach depends also on the research question and affects the study outcome (Kaakinen, 2021). Quantitative measures are analysed in relation to AOIs; the analysis may be based on several measures, such as number of fixations, fixation duration, number of repeated fixations and total fixation time (Holmqvist et al., 2011).

Qualitative analysis is based on examining gaze images and video recordings and is especially time-consuming. From data gathered from mobile eye trackers, researchers may need to review and code tens of hours of video recordings. Two common visual representations of eye movement for qualitative analysis are scanpaths and heatmaps (Drusch et al., 2014). Scanpaths show the sequence of fixations and saccades in the stimuli space or visual view. This helps researchers to follow participants' attention and cognitive processing, with a possibility to track memory patterns or arising difficulties (Duchowski, 2007). Scanpath analysis can lay ground for distinguishing groups of participants, such as experts and novices (Kaakinen, 2021), and developing EMME (Jarodzka et al., 2013). The other visualisation type, heatmaps, colour code areas are based on aggregated data from duration and/or number of fixations from one or several individuals (Drusch et al., 2014). Examples of heatmap usage in education studies include illustrating teacher's gaze over classroom (Coskun & Cagiltay, 2021) or identifying learners' approaches to tasks, such as when counting with the help of mathematical representations (Bolden et al., 2015). Presentation of the findings can be structured according to the research questions, themes or data sources, often including results of data triangulation.

6 Opportunities of Eye-Tracking Research in Entrepreneurship Education

Research on entrepreneurship education can be oriented in two main directions: the learning process and the assessment of its effects. Lackeus (2015) summarised the methods used to collect and analyse data about entrepreneurship education as thought-based, action-based and emotion-based, utilising such tools as experience sampling methods with mobile phone surveys, surveys based on theory of planned behaviour (Ajzen, 1991) and case studies, all of which reflect the traditional qualitative and quantitative methods. Drawing on eye-tracking studies in education, we focus on how eye tracking can be an additional objective method for enquiring into the learning process within entrepreneurship education.

It should be noted that the literature on entrepreneurship education heavily emphasises the learner and leaves out the teacher. As entrepreneurship education can take place on any educational level – from primary school to higher education – the teacher is the central figure in the educational process who enables the whole process (Ruskovaara & Pihkala, 2015). Therefore, we aim to add the teaching perspective by illustrating how eye-tracking research helps to define teacher expertise and to make connections to the domain of entrepreneurship education.

6.1 Research on Learning: Enhancing the Current Research Instruments

6.1.1 Components of Entrepreneurial Competence

As mentioned, scholars emphasise the combination of cognitive, social and emotional components in the learning process within entrepreneurship education. We provide examples of eye-tracking research in education that focus on each of these components, starting with the least explored one.

6.1.2 Emotional Component

The emotional aspects of learning belong to the least studied ones at the present time. A major number of studies concern emotional design in multimedia learning (as part of cognitive-affective theory of learning with media; Moreno & Mayer, 2007). For example, Park et al. (2015) reported that positive emotions associated with the learning material improved learning outcome in terms of comprehension and transfer. Similarly, Stark et al. (2018) used eye-tracking data to investigate learners' engagement with the instructional materials as well as their emotional states with self-reporting to draw conclusions about the influence of emotional text design on learning and learner's emotional state. It was found that both emotional designs

(positive and negative) led to better learning outcomes, as well as that emotional design assisted the elaboration process, but suppressed metacognition. The positive emotional design had no effect on learners' emotional state, whereas negative design led to a worse emotional state in learners. A related line of research focused on how imposed mood influenced students' learning: students with imposed positive mood showed longer and more effective processing of scientific texts that led to higher learning outcomes (Scrimin & Mason, 2015).

Another potential possibility is to explore the emotional response of students in different situations by means of eye tracking and pupillometry. A recent work (Liu, Tao, & Gui, 2019) looked into the ways to use eye tracking to identify participants' emotional states during task completion, when the pupil size signalled the difficulty of the task and the blink rate—the level of concentration on it.

6.1.3 Social/Collaborative Component

The modern mobile eye tracker technology records data through several channels – the gaze tracking itself, the scene camera video recording and the audio recording of speech. Several recent studies show how these data can be used for analysing the classroom interaction in detail. Salminen-Saari et al. (2021) studied phases of student collaborative learning during a mathematical problem-solving task. Analysing data from mobile eye trackers, classroom video recordings and smart pen devices helped researchers to map the collaborative interaction where the phases of verifying, watching and listening were prevalent. The ways to differentiate successful collaborations on the basis of joint attention were also identified. Rosengrant et al. (2021) studied undergraduates' sustained attention during interactive enquiry-based classes. It was a longitudinal study where 17 students wore a mobile eye tracker over several semesters. The results showed that students stayed on-task the majority of the recorded time, and authors linked this high rate to the inquiry-based type of instruction. Haataja et al. (2021) investigated the role of the eye contact between teachers and students in the classroom interaction during problem-solving group work in the mathematics lesson. Both teachers and students wore mobile eye trackers; also video recording was present in the classroom. The data analysis was guided by interpersonal theory and revealed that eye contact was highly situational: students-initiated eye contact when teachers demonstrated communion, while teachers engaged in eye contact more when showing authority. In entrepreneurship education, students often collaborate with peers and the teacher, and the eye-tracking technology could help to map this interaction.

6.1.4 Cognitive Component

Focusing on the process of learning allows gaining insight on the fine-grained, incremental level, which can be informative for researchers and teachers. This can be approached through understanding learning and monitoring learning.

From the perspective of understanding learning, being able to see the incremental process of how students approach tasks when working on their project allows teachers to know how students learn, but also whether they learn what teachers expect them to. In the study of da Silva Soares et al. (2021), where teachers were presented with heatmaps that reflected students' strategies in approaching mathematical tasks, teachers pointed out that they had a different idea of students' strategies than the ones demonstrated. Schindler and Lilienthal (2020) reported a case study of a student solving a mathematical task while his gaze was tracked. The gaze pattern recording was used in a retrospective session where the student provided explanations for his actions. This allowed to develop a tentative model for the mathematical creative process that was distinct from existing models. The unique side of this study was using the mobile eye tracking that allowed the student to solve the task with pen and paper to preserve the authentic settings for the process (Schindler & Lilienthal, 2020). In entrepreneurship education, students often learn by doing (McCallum et al., 2018) and are offered techniques and models for analysis and reasoning, such as SWOT analysis, design thinking, business model canvas, etc. (Lackeus, 2015). Following the learners' reasoning when applying such tools could be a possibility to see their approach and line of thought when designing business models.

From the perspective of monitoring learning, on a more general level questions regarding student attention focus and experienced difficulty during tasks could be answered with the help of learning analytics. The term learning analytics defines extraction of meaning from learning-related data (Jaakonmäki et al., 2020). It can be used for optimising learning and teaching based on data-driven measurements and predictions and making the educational process more transparent (Jaakonmäki et al., 2020). Stracke and Skuballa (2021) proposed to apply eye tracking on different levels of education as a data collection and diagnostic tool within an emerging evaluation framework: for insights about teacher work and instructional materials at the micro- and meso-levels, and for making decisions about those on the macro-level policy level.

6.1.5 Multimodal Data Collection

Especially informative and inherently more complex information can be collected when eye tracking is part of multimodal data collection, that is, objective and subjective data from a number of channels from learners (Järvelä et al., 2021). The sources of data may include self-reporting, such as questionnaires; behavioural data, such as performance measures; computer logs, such as mouse clicks; psychophysiological and physiological indicators, such as eye tracking, skin conductance, heart rate and accelerometry; and first- and third-person video recordings (Wiedbusch et al., 2021; van Leeuwen et al., 2017; Prieto et al., 2016). For research purposes, indices of arousal, cognitive load and experienced difficulties can be extracted from these data. They can largely inform research on self-regulated learning of students. The multimodal data help record cyclical and temporal processes, as well as

activation of regulation, important for capturing self-regulated learning phases, and indicate critical moments in collaborative learning (Järvelä et al., 2021). Besides, these data can be collected as part of multimodal learning analytics (MMLA) and visualised on a dashboard to inform teachers and enable intervention.

6.2 *Research on Teaching: Contributing to Development of Teacher Expertise*

6.2.1 Teachers' Professional Vision

The application of eye tracking has founded a new model for teaching research that can greatly inform teacher education, in the teaching of entrepreneurship and beyond. Studies within the expert-novice paradigm utilised video-based and real-life teaching conditions in the laboratory and authentic settings. These studies underlined the aspects of teacher visual expertise for classroom management (van den Bogert et al., 2014), teacher priorities, the impact of the cultural context (McIntyre, 2016), as well as teachers' focus of attention (Muhonen et al., 2020), and interpersonal behaviour (Haataja et al., 2021) in general. These aspects are hard to investigate with the help of self-reporting methods but are becoming more relevant as entrepreneurship education started moving from higher education downwards to general K12 education—echoing European Union's targeted renaissances of entrepreneurship (Lindner, 2018).

Teachers' professional vision is regarded as teachers' ability to notice and interpret classroom events that are relevant to various aspects in the process of learning (Goodwin, 1994; van Es & Sherin, 2002). Borko and Putnam (1996) suggested that teacher knowledge underlying effective teaching includes content knowledge (understanding the concepts and disciplines of subject matter to be taught), general pedagogical knowledge (knowledge on the nature of learning) and pedagogical content knowledge (how to best explain content knowledge to students and awareness of students' potential misconceptions). Effective teachers, or expert teachers, however, show superior performance in skill sets (Forzani, 2014) of teaching such as classroom management, instructional explanations and formative assessment—represented in their more elaborated and coherently organised knowledge structures with accumulated teaching experiences (Krauss et al., 2008). When teacher knowledge overlaps with the superior performance skill set of expert teachers, these 'curriculum scripts' allow teachers to make instant, meaningful, informed and flexible teaching decisions in classrooms (Putnam, 1987). The ultimate goal, once again, is for practitioners and researchers to effectively design, evaluate and improve teaching and learning.

In addition to the possibility to advance the understanding of teachers' visual expertise in general, eye tracking can help be a part of teacher education via:

- Training pre-service teachers for classroom work through EMME and discussion of the model's gaze
- Recording pre-service teachers' classroom video and eye-tracking data for assessment and reflection-guiding purposes (Coskun & Cagiltay, 2021)
- Developing country-specific resources based on the findings from classroom eye-tracking research in relation to a certain teacher competence (Faiella et al., 2019)

However, for eye-tracking application to have direct and solid implications on teacher training, it is important to be reminded by McMahan et al. (2019) on the perpetual tension between research on teaching and teaching practices in real life, where teacher training needs to construct life-long professional learning skills that would sustain effective practices within the ever-changing classroom. Teacher training cannot be simplified into a set of skills with routines to be re-enacted inside the classroom. For teaching to be theoretically informed on bases of needs of individuals and groups of learners, how contexts where learners can flourish is to be created is an art form that can be transferred from the experts to the (relatively) novice teacher. This is true when the intensions of entrepreneurship education is either on *learning for entrepreneurship* (obtaining relevant knowledge and skills) or *learning about entrepreneurship* (obtaining general theoretical understanding), right before learners enter the stage of *learning through entrepreneurship* (experiential, entrepreneurial learning process) (Kyrö, 2005). Here, EMME is a valuable tool to be embedded into established methods of teaching as an expertise training. EMME episodes can be filled in when the tasks include visual aspects where studying the eye movement of an expert can offer insights as an elaborated model to design a curriculum for multifaceted issues, as suggested by Jarodzka et al. (2017).

7 Challenges in Eye-Tracking-Based Research

As innovative as it is, application of eye-tracking technology in education settings may still be challenging for researchers. Especially when starting with the method, researchers need time to get acquainted with the hardware and software principles, various eye-tracking measures and running pilot studies. This may often require a team of researchers, so the method may not be always feasible for individual researchers.

7.1 Hardware and Data Collection

Despite the recent advancement in the eye-tracking technology, limitations and specificities of the hardware remain in place and affect the research. Many studies reviewed in this chapter reported loss of data at some point of data collection caused

by de-calibration, malfunction, eye tracker and screen ratio incompatibility, participants looking beyond the eye tracker viewing angle or individual participant characteristics. Utilising eye-tracking technology always implies accounting for possible data loss.

7.2 *Data Analysis*

A common limitation in reported studies is a limited sample. This may be due to the case study design (van Leeuwen et al., 2017), eye tracker cost (Rosengrant et al., 2021) and difficulty of data processing (Stahnke & Blömeke, 2021). Due to intensive eye-tracking data analysis, researchers may lack possibilities to analyse all the data collected (McIntyre, 2016) or include more points for analysis in the study (Clinton et al., 2017). The time for publishing may increase as well. On the other hand, one study may yield enough data for several analyses and possibilities for data re-examination (Goldberg et al., 2021).

7.3 *Chosen Measures of Analysis and Research Conditions Influence the Outcome*

The choice of the measures applied to analysing the data directly affects the analysis outcome. For example, McIntyre and Foulsham (2018) provided event-based scanpath analysis and noted that a duration-based analysis could have led to different results. Also, study settings may affect the research results. Studies that examined novice teachers gaze behaviour by demonstration of classroom video recording, and those carried out during a real-life lesson (Goldberg et al., 2021) showed different results in respect to novice teachers' attention to student misbehaviour: video-based studies showed that novice teachers paid attention to students' disruptive behaviour, while in real classroom conditions, novice teachers tended to avoid looking at misbehaving or uninterested students and concentrated on those who followed the instruction. Goldberg et al. (2021) noted that these differences were due to how likely the participants assessed the chance to directly take action regarding student misbehaviour.

7.4 *Interpreting Cognitive Processes*

Defining and interpreting the cognitive process behind the gaze is not simple. What participants look at does not always coincide with what they process (Rayner, 2009), and there can be different reasons for participants to fixate on an area: it can be

difficult, relevant to the task or attractive (Orquin & Holmqvist, 2018). Thus, if think aloud recording is not available, what researchers see and interpret in the data can differ from where participants allocated their covert attention. This is a major limitation in eye-tracking research and some studies indicate it as such. Literature reviews on eye tracking in education (Alemdag & Cagiltay, 2018; Lai et al., 2013) also pointed out a need for examining the connection between eye movement measures and behaviour measures in addition to the general recommendation to clearly state the gaze-cognition assumption for every study (Fiedler et al., 2019).

7.5 Limitations of Additional Methods

When several data collection methods are employed and data triangulation can be made, a sound procedure applies to non-eye tracking data collection as well, with notice that each of the complementing methods has limitations on its own. For example, the cued retrospective reporting approach should elicit information about participants' cognitive processes by guiding and not interrupting participants' remembering (Pouta et al., 2021). At the same time, cued retrospective reporting can focus only on some of the complex elements of teaching and teachers' vision (Pouta et al., 2021). An example of how verbal data collection can influence the study outcome is the usage of post hoc think-aloud verbalisation in the study of Wyss et al. (2021). The teacher participants were asked to view a clip from a classroom that contained a 'critical incident' and report what they saw. Only 6 out of 56 participants noticed the incident and did not try to interpret it. The researchers noted that this could be caused by researchers encouraging participants to say what was *seen* without giving a direct prompt for interpretation.

7.6 Newness of the Method and Ethical Issues

Although eye tracking has a detailed history in different domains, it is a rather new method in educational research. If other domains concentrate on participants' involvement with media, such as user interface design, or even reading, educational science has moved the eye trackers to real-life classroom, with the complex interactions, dynamic environment and unpredictability of variables. This led to the emergence of new research designs that require a new methodological and theoretical consensus respectively (Jarodzka et al., 2021). Other facets of moving research into the classroom include recruitment of participants, novelty effect and ethical issues. First of all, teachers and students may be reluctant to take part in the data collection sessions that involve video recording and eye tracking. Rosengrant et al. (2021) provided an illustration to this – in their study, only one instructor agreed to have their lessons recorded by mobile eye tracker worn by students. At the same time, when relying only on participants who volunteered to take part in the study

themselves, self-selection bias may appear (Stahnke & Blömeke, 2021). Along with that, introducing new data collecting equipment in the classroom directly may create a novelty effect and change the behaviour of the participants (Faiella et al., 2019). Additionally, privacy-related ethical issues arise. Classroom recordings concern all students and teachers present in the classroom. This implies recording and storing a large amount of data from a high number of participants, including minors, and difficulties for initiating the research due to the numerous consents that need to be collected by researchers (Jarodzka et al., 2021). Besides, depending on the study purposes, eye-tracking data may include sensitive information, such as data on learning difficulties, which should not be accessed by third parties (Liu, Xia, et al., 2019). Thus, researchers need to be extra careful when collecting, storing and analysing the eye-tracking data.

8 Implications of Eye-Tracking Application on Entrepreneurship Education

In the specific case of entrepreneurship education, the direct application of eye-tracking technology can have implications on the increasing usage of multimedia in the teaching and learning of entrepreneurship. Ratten and Rashid (2021) suggested that integration of technological skills in the entrepreneurship curriculum can best prepare students for the international market as entrepreneurship relates directly to the rapidly changing business, market and products—entrepreneurship education needs to reflect on these constant changes to grow students into adoptive individuals with entrepreneur mindsets. The learning environments require modification to incorporate new era technologies and address up-to-date changes, while well-structured reflection on the digital nature of economics must be addressed in entrepreneurship education frameworks. While multimedia enriches teaching and learning of entrepreneurial concepts by providing more direct connections to real-life scenarios and maintaining students' motivation in class (Sudarwati et al., 2019), it is important to be reminded about the quality aspects of multimedia materials created and delivered through e-learning or on-line learning not taking into consideration the human cognition processes (Mudrick et al., 2019). Wu et al. (2021), too, explored the integration strategy of artificial intelligence and multimedia teaching in innovation and entrepreneurship education (IEE) in higher education, hindering the importance of ensuring appropriate access and engagement of multimedia content. Similarly, An and Xu (2021) identify on the connection between entrepreneurial education and vocational training as *entrepreneurship-oriented personnel training* in the form of maker education. The inevitable effects of the Internet of Things (IoT) and artificial intelligence (AI) technology on the construction of virtual Maker spaces in both K12 and higher education institutions both imply new platforms and methods of teaching and learning. This ensures that entrepreneurial education is highly practical and up-to-date. On this note, the design of virtual Maker spaces can

borrow from eye-tracking technology evaluations to ensure that instructional design issues are eliminated and both theoretical and practical learning materials are visually presented without distraction and optimise their function to support learning. Well-designed virtual learning materials and spaces will also allow a broader range of field experts with rich entrepreneurial backgrounds to be directly included in the assessment and evaluation process of entrepreneurial talent cultivation education (Zhong et al., 2020).

An interesting aspect of eye-tracking technology application to entrepreneurship education relates to perhaps the more practical side of entrepreneurship, relating to digital entrepreneurship and digital marketing. Ratten and Rashid (2021) suggest that effective entrepreneurship education needs to incorporate tasks designed for students to mimic and understand the experiences of entrepreneurs to incorporate emotional and intellectual intelligence leading to greater forms of creativity. This idea of *mimicking* is worthy of further expansion in relation to EMME designs. Concepts of digital marketing can be borrowed to help users reach out to the maximum audience, creating awareness among users, and communicate with customers intelligently. The use of eye-tracking technology to improve marketing allows one to see things from the perspectives of the consumers to gain insight into what grabs attention, what influences purchasing behaviour and how consumers engage with products. Examples include shopper research, packaging research, advertising research and user experience (UX) research. While educational scholars explore new ways of delivering education, concepts can borrow from an almost identical foundation as the goals are, similarly, to attract student attention, trigger motivation and maintain engagement. This kind of cross-disciplinary mindset too echoes the core of entrepreneurship education by inviting students to find creative ways to reapply tools in response to modern-day problems or societal needs while exploring new opportunities.

Furthermore, the idea of *learning from the expert* in maker education is worth further exploring where it overlaps with the concept of eye-tracking application and professional vision. Early reviews on entrepreneurship education such as Solomon (2007) have long hindered the importance of teaching by involving experts. Learning in classrooms in this case can happen from both students and the teachers while engaging with entrepreneurs/entrepreneurship experts. Modern eye-tracking technology shines new light on this reminder as roles of teacher and students in learning environments may be reconsidered. However, limitations of eye-tracking technology applications on entrepreneurship education may also be due to contradictions on the fundamental difference in how to learn from the experts. The need to understand visual expertise relates to how professionals or experts perceive events and scenes from the expert domain difference from non-experts, in order to gain insights to how the experts notice and gain situational awareness (Endsley, 2015), leading to their cognitive process patterns. In entrepreneurship education, entrepreneurship is seen as competences that can be obtained, such as the attitude and ability to solve new problem with unknown answers (Núñez & Núñez, 2016). Seeing how previous problems have been solved by experts through the expert's eyes may offer case study-based insights but does not offer a model for learning the competencies to

become more entrepreneurial. This is particularly true when the entrepreneurial spirit refers ‘a competence that is developed by each person who perseveres in fulfilling their motives, relinquishing stability to further develop themselves, others and their environment with passion, risk and sacrifice... (with) the desire to understand their (own) motivations... (and) seek and generate new opportunities to fulfil their motives, relying on their strong drive for achievement’ (Arruti & Castro, 2021, p. 4). As eye tracking is based on the eye-mind hypothesis, or what is attended to by the eye is processed by the mind (Duchowski, 2007) which must be accompanied with stimulate recall to offer a fuller perspective on what we understand as professional vision, it is therefore important to cross-reference the selective attention—based on eye-tracking evident professional vision – and knowledge-based reasoning, based on verbal data or questionnaires (Minarikova et al., 2021). This allows students to both see and hear from the expert’s processing in encountered problems, where both ‘attention based on their reasoning, and reason about things they give attention to’ (Sherin et al., 2011, p. 5) can both be observed either by the students or teachers looking to teach it. Eye-tracking technology can be complimentary in enriching entrepreneurship education.

9 Conclusions

The study on the application of eye tracking in educational research reveals that new technologies allow to expand our approaches to investigate learning and teaching process through different perspectives. Currently eye-tracking technology is used in numerous thematic areas, which were identified through this research: information processing, effects of instructional strategies, different individuals’ learning styles, effects of learning strategies and patterns of decision-making.

Entrepreneurship education is a new field where eye tracking can be applied. Existing research in educational sciences can inform this new direction with the proposed focus on learning and teaching. It can be recommended to concentrate on features of learning and teaching that are of higher significance specifically for entrepreneurship education, such as collaborative activities, decision-making and reasoning when working with specialised entrepreneurial tools.

For learning, eye tracking offers a micro-level objective observation of cognitive processes, interpersonal interactions and emotional responses. Regarding teaching, eye tracking is a way to connect the psychological and professional aspects, revealing the cognition and perception behind the teaching process. Still, there are limitations associated with the technology and a need for defining a new methodology for eye-tracking studies in real-life classrooms.

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Part IV
Setting New Imperatives to Related
with the Customers and Stakeholders
in the Ecosystems

Solutions of Brand Posts on Facebook to Increase Customer Engagement Using the Random Forest Prediction Model



Egle Vaiciukynaite, Ineta Zickute, and Justas Salkevicius

Abstract This paper aims to predict customer engagement behaviour (CEB), i.e. likes, shares, comments, and emoji reactions, on company posts on Facebook. A sample of 1109 brand posts from Facebook pages in Lithuania was used. The Random Forest method was used to train models to predict customer engagement behaviour based on features including time frame, content, and media types of brand posts. The data was used for training nine binary classification models using the Random Forest method, which can predict the popularity of a company's posts. In terms of social score, accuracy of likes, comments, and shares varied from 68.4% (likes on a post) to 84.0% (comments on a post). For emotional responses, accuracy varied from 65.6% ('wow' on a post) to 82.5% ('ha ha' on a post). The data was collected from one single media platform and country, and encompassed emotional expressions at an early stage on Facebook. The findings of Random Forest prediction models can help organisations to make more efficient solutions for brand posts on Facebook to increase customer engagement. This paper outlines the first steps in creating a predictive engagement score towards diverse types of brand posts on Facebook. The same approach to features of brand posts might be applied to other social media platforms such as Instagram and LinkedIn.

Keywords Customer engagement behaviour · Emoji · Social media · Machine learning · Posts · Random Forest

1 Introduction

The increase of social media platforms has led to continuous changes in how entrepreneurs carry out their day-to-day activities (Fan et al., 2021; Olanrewaju et al., 2020). Meanwhile, entrepreneurs use social media for diverse purposes and may expect different outcomes (Olanrewaju et al., 2020). Indeed, on social media,

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191

entrepreneurs can collect various types of information data about customers' needs and market potential, communicate with their existing and potential customers in new ways through messages, and build relationships with relevant stakeholders.

The most recent study by Olanrewaju et al. (2020) has done a systematic literature review in the domain of social media and entrepreneurship. The results suggest that research studies in this domain are remarkably new and fragmented. Moreover, the literature review of social media usage in entrepreneurship research covers four areas: marketing, information search, business networking, and crowdfunding. Specifically, the marketing field is the one most developed regarding artificial intelligence (AI) issues and discussions (e.g. AI personalised recommendations) (Loureiro et al. 2021). Despite that, less attention has been devoted to social media marketing in combination with machine learning and/or AI, with only several empirical studies in existence. For instance, the study by Capatina et al. (2020) has explored the perceptions of 150 marketing experts from three countries (Italy, France, Romania) on three single antecedents (i.e. audience, image, and sentiment analysis) regarding AI-based software for social media marketing, but the empirical research can unlock the full potential of social media and digital records for entrepreneurship research (Obschonka and Audretsch, 2020; Kosinski et al. 2013). Nevertheless, the causal relationship of company/brand content and customer engagement on social media was not explored, particularly from a machine learning perspective.

As social media usage is increasing among both businesses and customers, successful social media implementation initiatives are a priority for businesses. Previous studies offered frameworks that explain the adoption and use of social media by entrepreneurs, covering two perspectives: customer-oriented adoption and entrepreneur-oriented adoption (Olanrewaju et al., 2020). The customer-oriented adoption framework pays attention to customer engagement as the foci of social media use (ibid.). The centre of the entrepreneur-oriented adoption framework denotes how to implement social media within the business (Olanrewaju et al., 2020). The current research seeks to contribute the theory and practice in the social media implementation by brands/companies' domain within a *customer-centric* perspective.

The concept of customer engagement behaviour (CEB) has been widely analysed in academic literature (Beckers et al. 2017; Hollebeek and Andreassen 2018; Yang et al. 2016). Following the most recent suggestions by Harmeling et al. (2017) and Obilo et al. (2020), this research uses the behavioural manifestation of CEB, which is defined as *'the customer's behavioural manifestations toward a brand or firm, beyond purchase, resulting from motivational drivers'* (van Doorn et al. 2010, p. 253).

CEBs on social media can be encouraged with various features of company/brand posts. Hence, previous studies of CEBs on Facebook have investigated several features of company messages, namely, content, emotional characteristics, and media types (e.g. video, image, and links). For instance, Leung et al. (2017) investigated four media types in hotel brands' posts (e.g. video, image, link, word) and six types of post content (i.e. promotion, product, reward, brand, information, and involvement). Recently, social media provides 3-D and carousel images, live

videos, and interactive polls. Therefore, a more granulated level of analysis, including content analysis of text and images, is needed.

Regarding CEB, the latest developments of Facebook support five consumer emoji reactions: love, ha ha, wow, sad, and angry. Meanwhile, previous studies have analysed the impact of different features of posts on only three customer responses (i.e. likes, comments, and shares) on Facebook (Labrecque and Swani 2017; Leung et al. 2017). The full spectrum of emotional reactions was not included. Moreover, all these customer emoji reactions might act as a catalyst for other customers' behaviours as well.

Companies' messages and CEBs can be tracked and analysed through text-based sentiment analysis and offer a more granular level analysis. Indeed, recent academic studies have combined lexicon-based (an automatic) and machine learning-based approaches to sentiment analysis research in customer comments from 83 Facebook brand pages (Dhaoui et al. 2017). Despite several attempts to analyse text-based sentiment analysis and use a machine learning approach, the focus of the prediction of post popularity on Facebook has attracted limited attention in academic literature. Meanwhile, this machine learning approach provides a more nuanced and robust understanding of the practices of a company's/brand's messages on social media platforms and might enhance the field's methodological development. Therefore, the fundamental question remains regarding how to predict CEBs on Facebook, based on the features of a company's posts (e.g. content types, media types, emotional cues). To address a research question, this research seeks to predict CEBs (likes, shares, comments, and emoji reactions) on Facebook based on the features of company/brand posts. Hence, a Random Forest (RF) method was applied.

This chapter includes a review of the relevant literature on CEBs on social media platforms and, thus, integrates a behavioural approach to CEBs. Notably, this chapter seeks to alter the academic discussion about the power of machine learning on CEBs on Facebook. Machine learning advances social media research (Khan and Chang, 2019) and enables entrepreneurs to build personal or a company's/brand's brand on social media. Therefore, this research contributes to the growing body of literature on the features of a company's posts and CEBs on social media. Regarding various features of brand posts, this research is based on widely used theories of uses and gratifications and media richness. Furthermore, from a theoretical perspective, the current research expands existing views of content types by distinguishing them into single content and blended content types and providing empirical evidence for the effect on CEBs. Hence, the research contributes to the uses and gratifications theory by proposing a list of various content types of brand posts that satisfy users'/customers' specific needs based on their behavioural responses regarding the number of likes, shares, comments, and emotional reactions on Facebook.

Using a machine learning perspective, the chapter offers a novel research approach to the social media marketing literature, and offers several contributions to both academics and practitioners. Firstly, this research investigates the relationship between various features of company messages and CEBs, and, thus, provides a prediction model of customer responses (e.g. likes, comments, emoji reactions) towards various features of company messages on Facebook. Hence, it offers a

deeper understanding of what kind of post features are the most effective for successful CEBs on Facebook. Secondly, the enhanced list of company post features enables social media practitioners to rethink their current social media marketing strategies and excel at them. Finally, the proposed prediction model can act/serve as a foundation and can be developed further within additional components and is suitable for AI-enabled business applications on social media.

The remainder of this study is organised as follows: firstly, this study provides the theoretical background encompassing the features of brand posts, conceptualisation of CEB on Facebook, and a conceptual framework development; secondly, this paper presents the methodology; and thirdly, it provides results. Finally, the conclusions and discussion are provided.

2 Theoretical Background

Traditionally, companies seek to capture customers' attention and stimulate them to react to their content on social media platforms. These customer actions might encourage other customers to respond, and the message can reach a huge audience organically without any additional costs (e.g. paid post nature). Thus, company/brand sales posts may provide the best deals and immediately attract customers to buy their products/services from their websites or order products through private messages. Moreover, after the post-purchase phase, a happy customer can express his or her opinion about the product/service (e.g. rate products/services with stars on the Facebook page), write a positive message to a company/brand privately, or even create content and tag the company's/brand's page on social media platforms. As a result, both sides – either company/brand or customer – can initiate this communication.

But how to implement social media within the business is covered by the centre of the entrepreneur-oriented adoption framework (Olanrewaju et al. 2020). Moreover, the implementation of social media can involve several actions such as setting up a company/brand page on social media, creating and constantly developing strategies for social media activities (e.g. product/service brand awareness, sales), and publishing relevant content. Indeed, the latter action requires consistent and persistent support on social media platforms and efforts to discover a real value for customers.

The effective social media implementation can lead to tangible and intangible benefits for the business. For instance, Aulet (2013) has highlighted that if the company can focus primarily on creating demand, then various web-based techniques such as e-mail, inbound marketing, telemarketing, and social media marketing help lessen the need for direct salespeople. Moreover, companies enhance their own performance if they have an active presence on social media (Kumar et al. 2016; Tafesse and Wien 2018; Yoon et al. 2018). Another great benefit for companies is the extensive analytics about customers, which are not possible through the human channel (ibid.). Meanwhile, the company's/brand's social media implementation

starts within a clear social media strategy, platform, and selected features of business/brands posts that keep the customer engaged.

2.1 Features of Brand Posts: Content Types, Media Types, and Time Frame

CEB might be influenced by various features of brand posts on Facebook. Accordingly, a huge variety of research has investigated the relationship between users' usage of media content and motivation on social media, and there are several dominant perspectives. The uses and gratifications approach by Katz (1959) explains customers' social media use motivations (Li et al. 2021). Meanwhile, the 'use' follows the assumption that the message cannot influence users (media) who have no 'use' for it (Katz, 1959). Indeed, the 'use' approach aligns with the user's values, interests, and associations, and the social roles that have a greater influence on them than without it (ibid.). At the same time, 'gratification' holds that media users need to achieve gratification.

Social media as a medium should satisfy user gratifications similar to those that traditional mass media does (Pujadas-Hostench et al. 2019). Thus, social media empowers users to consume different content and, thus, socialise with each other which, in turn, influences their behaviour. Therefore, social media users can have diverse gratifications (i.e. entertainment, information). Within the context of social media, previous studies classified brand content into two groups such as informative and entertainment. These two groups cover two consumer motivations respectively: entertainment and information. While information motivation has four sub-motivations that contain expertise, surveillance, pre-buying information, and inspiration motivation (Muntinga et al. 2011), the sub-motivation of information content might include a remuneration type of content (i.e. special rewards). Additionally, the supportive literature that applied theory includes empirical studies by Muntinga et al. (2011), Dolan et al. (2016), Annamalai et al. (2021), and Mishra (2021).

Meanwhile, a brand post can be accompanied with a diverse media type and encompass information with various degrees of media richness (e.g. photo). For instance, video and photo posts are considered richer than text posts. Thus, media might differ in its capacity to possess rich information which can be explained by the theory of media richness (Daft and Lengel, 1986). Ishii et al. (2019) believe that the media richness theory will remain as '*the landmark foundation of studies on continuously evolving communication technology and media use behaviour*' (p.129). Indeed, the theory is widely used by social media researchers describing the media type of brand posts, which are commonly defined as the vividness of posts (see Cvijikj and Michahelles 2013; Luarn et al. 2015; Annamalai et al. 2021). Meanwhile, brand posts with videos are engaging and immersive and present a high level of vividness compared to images with a low level of vividness.

The academic literature provides the classification of features of brand posts that involves mainly three major categories such as time frame, content, and media types. The last two broad categories of post features can be divided into subcategories. For instance, content types of brand posts can cover eight content types such as informational, entertainment, social, promotions, social responsibility initiatives, user-generated content and reposts (e.g. influencer), educational, and job offer(s). User-generated content cannot be classified as a post created by the company itself, but the company/brand can post and/or repost it on social media platforms. Additionally, all these content types can be blended and constitute a single post with mixed content types. In a similar vein, media types of brand posts may involve images, video, and links. Thus, the text of a brand post can be accompanied by various emotional cues (e.g. emoji, emoticons). The discussion about single content and mixed content types is provided below.

2.1.1 Time Frame of Brand Posts

Theoretically, the time frame (i.e. publishing time) represents the day of the week and the time of day (Cvijikj and Michahelles 2013; Sabate et al. 2014). The exact time can be currently done either ‘manually’ or ‘automatically’ by using special platforms (e.g. Later). Indeed, the appropriate time for publishing is expected to create better possibilities for organic reach. For instance, late evening is a good choice for companies/brands to attract the attention of young parents when the children are sleeping.

2.1.2 Content Types of Brand Posts

Informational content posts involve information about the company, brand, products/services, or other information related to marketing activities (De Vries et al. 2012; Luarn et al. 2015). For instance, a clothing brand can post an informational post about new collections and provide detailed information about the colours, materials, etc.

On the other hand, *entertainment content* contains fun content or entertains viewers. Indeed, the content is not related to the brand or a particular product or service but enables users to enjoy themselves, have fun, and escape from routine (Gutiérrez-Cillán et al. 2017; Luarn et al. 2015).

Remuneration posts involve various benefits, including economic incentives and rewards (Aydın, 2020). These brand posts can encourage customers to take action towards a buying decision (Tafesse and Wien 2017). For instance, a sales promotion post can involve special promotional offers (e.g. price discounts, 70% off), promotion codes, and competitions/quizzes ‘share and win’.

Social brand posts contain various questions or statements to encourage interactions with users, provide them with the opportunity to react to a post, and facilitate the interaction further (Luarn et al. 2015). For instance, a brand can publish a post

about their employee of the month, and fans of the brand page can express their surprise emotion or even write a greeting message in the comments section.

Social responsibility initiatives. A Corporate Social Responsibility (CSR) brand post is assumed as a ‘communication that is designed and distributed by the company itself about its CSR programs’ (Khan et al. 2016, p. 699) based on Morsing (2006). Programmes of social responsibility involve energy consumption, carbon footprints, sustainable consumption, and others. An example of this type of post is as follows, e.g. ‘[...] Thank you Ronald McDonald House Charities of Southwest Florida for keeping her family together!’ (Khan et al. 2016, p. 701).

User-generated content and reposts. Voorveld (2019) notes that brand communication with customers on social media can blur the lines between brand content and other content. The other content that companies can repost can be named ‘user-generated content’, which is regarded as a post created by social media platform users.

Nevertheless, the user-generated posts can cover diverse types of content, including informational, social, and entertainment, which might be related to a company/brand or not related to a company/brand. The only distinction here is that the content is not created by the company/brand. Moreover, the content can be sponsored by a company/brand, but social media influencers can create a post (Vaiciukynaite 2019). Specifically, social media influencers can generate posts with original and authentic content (ibid.), while brands/companies can repost these posts on social media platforms.

Importantly, user-generated content can be created not only by social media users but also by social media influencers (a company/brand-sponsored post), and companies/brands might reshare their content. Importantly, social media influencers can be either micro (i.e. smaller reach) or macro (i.e. bigger reach) and might impact user responses differently (Voorveld 2019). This reshared content should credit the original content within ‘@username’.

Educational posts describe posts that educate and inform customers (Tafesse and Wien 2018). For instance, food-brand posts can involve posts on how to prepare a particular dish or how to cook properly (e.g. how to prevent vitamin and mineral loss when cooking vegetables). These posts can entail information that enables customers to gain new information and skills. It is important to note that these brand-generated posts are related to a company’s/brand’s products or services.

Job offers – a job advertisement is generated by a company or brand to inform potential job seekers about job possibilities. Facebook (2020) for business suggests that brand pages can reach their fans and get more information about their candidates quickly for free. Moreover, job offers can be designed creatively and may stimulate potential candidates to answer some questions or stimulate their curiosity to open a company/brand link.

The mixed content types. Typically, previous research has provided classifications of post content that entails only a single content type. Importantly, according to Tafesse and Wien’s (2017) findings, brand posts can contain multiple messages in a single post. However, according to this study’s findings, brand posts can have multiple types of post content (ibid.). Indeed, a brand can design longer posts that

entail two distinct parts of the text. For instance, the first part of a post text can contain information about new products/services, while the second part of the text might involve remuneration content. Therefore, the company/brand can expect a more significant reach among users as the company/brand informs them about its product/service and stimulates them to act accordingly (e.g. ‘share and win’).

2.1.3 Emotional Cues of Brand Posts

All these types of text content can be altered with *emotional cues*, i.e. *emoji*. More specifically, company textual messages can be associated with emotional (non-verbal) (i.e. emoji) and verbal (i.e. words) cues. An emoticon is typographical (textual symbols), such as an emoticon with the tongue sticking out (‘:P’). On the other hand, emojis are graphic symbols that can include representation of facial emotional expressions, abstract concepts, and also plants, animals, gestures or body parts, and other objects (Rodrigues et al. 2018; Troiano and Nante 2018).

Luangrath et al. (2017) have classified non-verbal cues into four categories: (1) words are accompanied by special characters or text styles with caps, (2) non-standard language words, (3) words that do not fit grammatically within a sentence, and (4) posts that include visual emoji. Hence, a verbal message can be accompanied by diverse non-verbal cues. Moreover, the most recent study by Das et al. (2019) has investigated advertisements accompanied by emoji and indicated that the presence of emoji can encourage a higher positive effect for customers that leads to higher purchase intention.

2.1.4 Media Types of Brand Posts

The types of brand content posts can be accompanied by various types of media, including videos, images, and links. All these media types can contribute to different levels of vividness in the posts. For instance, an image/photo represents a low level of vividness because it contains pictorial content (Luarn et al. 2015). In contrast, video is considered to have a higher level of vividness (Antoniadis et al. 2019), for instance, YouTube videos. A medium level of vividness is for links to websites/news sites or blogs (Luarn et al. 2015). In many cases, links include company links or other sources on the Internet. For instance, a company may provide a brand post with expert views from external sources or use a link with more detailed information about a product/service. Interestingly, posts with hyperlinks are the most common on institutions’ Facebook pages (Chauhan and Pillai 2013).

Concerning images, there are many different types such as an image accompanied by product images, humans with products images, consumption contexts, nature backgrounds, etc. For instance, Berg et al. (2015) noted that images with human models have facial expressions and can be found in advertisements, on packages, etc. Notably, the previous study revealed the importance of facial expressions for an

effective brand post in terms of CEB on Instagram (Rietveld et al. 2020). Indeed, photos of human models can be published on social media platforms as well.

2.2 Customer Engagement Behaviour on Facebook: Definition and Conceptualisation

A company can have their business page on Facebook and initiate interactions with its existing or new customers through their posts. Customers might be motivated to express their engagement behaviours towards diverse types of company's posts. As a result, the company can develop and build relationships with their customers, and in turn, customer engagement can have a positive effect on a company's performance (Kumar and Pansari 2016; Yoon et al. 2018). Indeed, company posts can act as a trigger for customers' attention and, thus, motivate them to express responses to posts.

Active customer participation on social media can be defined as 'customer engagement' or 'customer engagement behaviour'. These terms have been widely analysed by academics and practitioners, but there is still no general agreement about their definition and conceptualisation. Consequently, academics use diverse terms for 'customer engagement'. For instance, some authors use terms such as 'social media engagement' (Tafesse and Wien 2017), 'customer engagement' (Harmeling et al. 2017), 'social media behaviour' (Dimitriu and Guesalaga 2017), '(customer) engagement' (Chaffey 2007; Marsden 2017), 'customer engagement behaviour' (van Doorn et al. 2010), 'customer brand engagement behaviour' (Leckie et al. 2018), and 'firm-initiated customer engagement behaviour' (Beckers et al. 2017). Moreover, previous studies have conceptualised customer engagement (or customer engagement behaviour) differently as either a psychological state or behavioural manifestation beyond purchase, resulting from customer motivational drivers (Beckers et al. 2017; Harmeling et al. 2017; Hollebeek and Andreassen 2018; Hollebeek et al. 2014; van Doorn et al. 2010).

Recently, there is an increasing trend towards using a behavioural approach (Rietveld et al. 2020; Beckers et al. 2017; Barger et al. 2016; Carlson et al. 2018a, b; Yoon et al. 2018). Consistent with Rietveld et al. (2020), this research assumes a behavioural approach for understanding customer engagement on social media. Therefore, customer engagement behaviour is defined as '*the customer's behavioural manifestations toward a brand or firm, beyond purchase, resulting from motivational drivers*' (van Doorn et al. 2010, p. 253). Similarly, customer engagement is '*a customer's voluntary resource contribution to a firm's marketing function, going beyond financial patronage*' (Harmeling et al. 2017, p. 316). Consistent with Obilo et al. (2020), customer engagement is made up solely of behaviours, and this research applies a behavioural approach, which is widely used in previous academic and practical studies (Ferrer-Rosell et al. 2020; Luarn et al. 2015).

On Facebook, CEB might involve a list of reactions' functionalities such as likes, shares, emoji, or emotional reactions. Importantly, these reactions' features can be enhanced due to platform updates. For instance, Facebook enables users to express animated and diverse emoji reactions to posts; for example, the user can press a 'love' button. Recently, due to COVID-19, Facebook has launched a new emoji 'care reaction' – a heart being hugged (Hayes 2020). On Facebook, emotional reactions include love (beating heart), ha ha (laughing face), wow (surprised face), sad (crying face), and angry (red/angry/pouting face) (Emojipedia 2020).

In summary, and consistent with Yoon et al. (2018), our research is focused on active customer actions because their engagement behaviour (i.e. liking) exposure could also influence other customers' behaviour. Hence, this current research denotes active customer actions on Facebook, including eight behavioural responses: likes, comments, shares, love, ha ha, wow, sad, and angry expressions.

3 Conceptual Framework Development

The proposed model of CEB on Facebook is based on various features of brand posts and organised based on stimulus-organism-response paradigm (S-O-R) (Mehrabian and Russell, 1974). The paradigm provides that the environmental stimuli (S) lead to an emotional reaction (O) and, in turn, influences customers' behavioural responses (R) (Carlson et al. 2018a, b). Importantly, the framework was widely applied in studies of online consumer behaviour (Eroglu et al. 2003; Manganari et al. 2009). Meanwhile, the most recent studies have applied the full S-O-R paradigm (Carlson et al. 2018a, b; Triantafillidou and Siomkos, 2018; Schreiner et al. 2021) or a part of the S-O-R framework to CEB on social media platforms' context (see Mishra, 2021).

Based on the S-O-R paradigm, the stimulus (S) denotes various features of a brand's/company's posts, while response (R) means CEBs on Facebook and the developed model is shown in Fig. 1. The features of the brand posts are explained based on the theories uses and gratifications and media richness.

Based on the literature review, the features of brand posts entail three broad categories: content types, media types, and time frame. All these features of brand

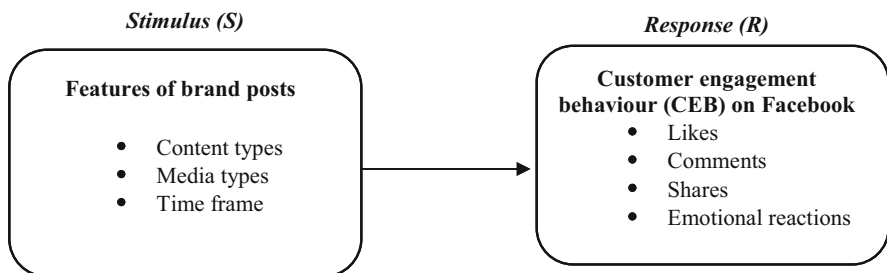


Fig. 1 Conceptual framework of CEB on Facebook based on features of brand posts

posts can act as a catalyst for customer engagement behaviour (CEB) on Facebook. The CEB covers likes, comments, shares, and emotional reactions. Specifically, within the latest developments of Facebook, the platform supports five distinct consumer emoji reactions: love, ha ha, wow, sad, and angry. Therefore, the current research integrates the full spectrum of emotional responses. Conceptual framework explains that the stimulus (features of brand posts) can act as input features for a mathematical model for predicting CEB response – output variables (likes, comments, shares, emotional reactions).

4 Methodology

The analysis of methodological approaches in CEB research has revealed that qualitative and conceptual approaches are the most used. Meanwhile, using a mathematical modelling approach might achieve a more nuanced and robust understanding of the company/brand communication practices on social media platforms. Therefore, the current research has chosen an empirical approach to model CEB on Facebook on features of brand posts based on stimulus (S) and response (R) framework (see conceptual framework development in Fig. 1). For this purpose, various types of companies/brands, which cover diverse market contexts, including business to business (B2B) and business to customer (B2C) on Facebook, were used. Consistent with Tien and Aynsley (2019), both markets were involved. The posts were gathered manually from official companies' Facebook pages. Companies'/brands' pages were selected if they published posts regularly and/or at least once a week on average (Abitbol et al. 2019). Following Tafesse and Wien (2017), posts covered a four-week period (1–31 June 2018) and were analysed further by using a hand-coded content analysis. Two coders who were not related to this research were involved in the coding process.

Following previous studies (see Table 1) and conceptual framework development of stimulus and response (see Fig. 1), this research considered the main categories of post features, such as content type, media type, and time frame. All these categories have subcategories under the specific features, for instance, content types. Features of posts were divided into media type (e.g. video, image) and content type (e.g. informational, social), which are explained below. The selected list of companies included a diverse range of industries based on Tafesse and Wien (2017) and was later refined. In sum, all variables were coded at the single post level (Abitbol et al. 2019).

Additionally, adapted by Rietveld et al. (2020), the brand's pages involved a minimum of 100 posts on the Facebook platform, which ensures us to enable a fair comparison between brand accounts. As a result, three brands were removed from the list.

Table 1 The coding categories of features of brand posts on Facebook

Features of brand posts	Subtypes	Key sources
Time frame	<ul style="list-style-type: none"> – Day (e.g. Monday) – Time of the day (e.g. morning, day, evening) 	Cvijikj and Michahelles (2013), Sabate et al. (2014), Antoniadis et al. (2019)
Content type ^a	<ul style="list-style-type: none"> – Informational (e.g. products/services) – Entertainment – Social (e.g. company employee, current event) – Promotions (e.g. discounts) – Social responsibility initiatives – User-generated content (i.e. brand created, and influencer created) – Educational – Job offer/–s 	De Vries et al. (2012), Tafesse and Wien (2017), Luarn et al. (2015), Facebook (2020), Annamalai et al. (2021)
	– Blended content types ^b	Adapted from Tafesse and Wien (2017)
Media type	<ul style="list-style-type: none"> – Images^c – Video – Links – Other 	Leung et al. (2017), Luarn et al. (2015), Sabate et al. (2014)

^aThe text of a brand post can be accompanied with emoji. Following the list of emoji from Luangrath et al. (2017), the emoji was coded as one that means a post contains emoji (e.g. happy face with sunglasses) and ‘0’ – a post with no emoji

^bThe research has not predefined blended or mixed content types. This approach was explorative

^cImages can cover both graphical images and non-graphical images (i.e. photos). The graphics image is drawn, i.e. pictorial. This research was focused only on the non-graphical image format

4.1 Coding Variables

4.1.1 Independent Variables

Based on the coding categories of the features of brand post on Facebook (see Table 1), content types, media type, and time were captured.

4.1.2 Dependent Variable: Customer Engagement Behaviour

Consistent with previous studies (Barger et al. 2016), this research operationalises CEB as a set of measurable customer actions on a company’s Facebook page, such as customer response to a company/brand message: likes, comments, shares, and emotional reactions (i.e., love, ha ha, wow, angry, sad) (see Table 2).

Once all posts were analysed, the collected dataset had to be labelled to perform the classification task. The current research seeks to measure CEB by predicting how

Table 2 The coding categories of CEB on Facebook

Indicators of CEB	Sources
Likes	De Vries et al. (2012), Cvijikj and Michahelles (2013), Labrecque and Swani (2017), Luarn et al. (2015), Antoniadis et al. (2019)
Comments	De Vries et al. (2012), Cvijikj and Michahelles (2013), Labrecque and Swani (2017), Luarn et al. (2015), Antoniadis et al. (2019)
Shares	Cvijikj and Michahelles (2013), Labrecque and Swani (2017), Luarn et al. (2015), Antoniadis et al. (2019) ^a
Emotional reactions (love, ha ha, wow, angry, sad)	Michael (2016) ^b

^a Authors have measured several computed values

^b Adapted from practical insights; All CEB indicators/metrics may vary based on the organic reach or paid reach

popular a post is in metrics from the raw data: number of likes, comments, shares, and emotional responses.

These different types of customer social actions can be categorised into a diverse level of engagements. For instance, a liking behaviour indicates less value compared with a commenting behaviour or sharing behaviour, and receives a lower score (Peters et al. 2013). Indeed, customer comments require more effort and engagement from consumers (Yoon et al. 2018).

Adopted from the BuzzRank interaction rate formula on social media by Peters et al. (2013), the metric for a social media score was developed. This social media score was calculated using the following formula (1):

$$S_p = \text{likes}_p + \text{comments}_p \times 2 + \text{shares}_p \times 3 \quad (1)$$

where S_p is a social media score of post p , likes_p is the number of likes of post p , comments_p is the number of comments on post p , and shares_p is the number of shares of post p . After target metrics for CEB were calculated, data labelling was started based on these metrics. Two classes were formed. The first class created was unpopular brand posts, and the second one indicated popular brand posts. It is important to note that the popularity of brand posts was computed for each metric separately (e.g. likes).

Concerning customer likes, all brand posts that have a smaller/lower number of likes than the mean of likes in the dataset were marked as ‘unpopular posts’. In contrast, all brand posts that have a larger number of likes than the mean value of likes were assigned to the ‘popular posts’ class. In a similar vein, the same process was performed for all CEB metrics: social score, likes, comments, shares, and emotional reactions (i.e. love). Therefore, nine classification tasks were formulated for each of the CEB metrics.

4.2 Prediction Method and Model

Many machine learning methods are capable of dealing with classification tasks. Moreover, several machine learning models can be built, including naive Bayes, k-nearest neighbour, logistic regression, decision tree, and Random Forest (RF) (Eluri et al. 2021). For this research purpose, the RF method was selected. Specifically, the RF model was successfully used by previous researchers in the social media domain (Hajhmida and Oueslati, 2021; Huang et al. 2018).

Inner workings of the RF algorithm are based on decision trees. The main flow of RF is to build many decision trees, which then vote to assign the specific class to the given input. In this paper, inputs are a post's parameters, and binary classes reflect predicted post popularity (popular and unpopular post). Moreover, some degree of randomisation is used when picking the feature on the node split: not every feature is used on every node on the decision tree. This is done to lower the risk of overfitting the model. When generating the decision trees on specific attributes, we split the tree and an attribute is placed as a root node based on splitting measures like the Gini index or information gain.

The Gini index is based on the probability of a variable being classified incorrectly when it is picked randomly. This index ranges from 0 to 1, where zero means that all data points belong to the same class and 1 means that data points are distributed evenly. The Gini index can be calculated using the following formula (Bramer, 2007) (2):

$$G = 1 - \sum_{i=1}^n (p_i)^2 \quad (2)$$

where G is the Gini index and p_i is a probability of being classified as a particular class. Given the Gini index, it is possible to calculate feature importance in the model. For each decision tree in the RF, a node's importance can be calculated using the Formula (3):

$$Ni_k = w_k G_k - w_{left(k)} G_{left(k)} - w_{right(k)} G_{right(k)} \quad (3)$$

where Ni_k is the importance of the node k , w_k is the weighted number of samples reaching node k , G_k is the Gini index of node k , and $left(k)$ and $right(k)$ indicate the split of node k in the decision tree. Finally, the importance value for each feature can be calculated by the Formula (4):

$$Fi_i = \frac{\sum_{k=k \text{ node splits of feature } i} Ni_k}{\sum_{k=1}^N Ni_k} \quad (4)$$

where Fi_i is the feature importance of feature i and Ni_k is the node importance of the node k . This value can then be normalised by dividing it by the sum of all feature importance.

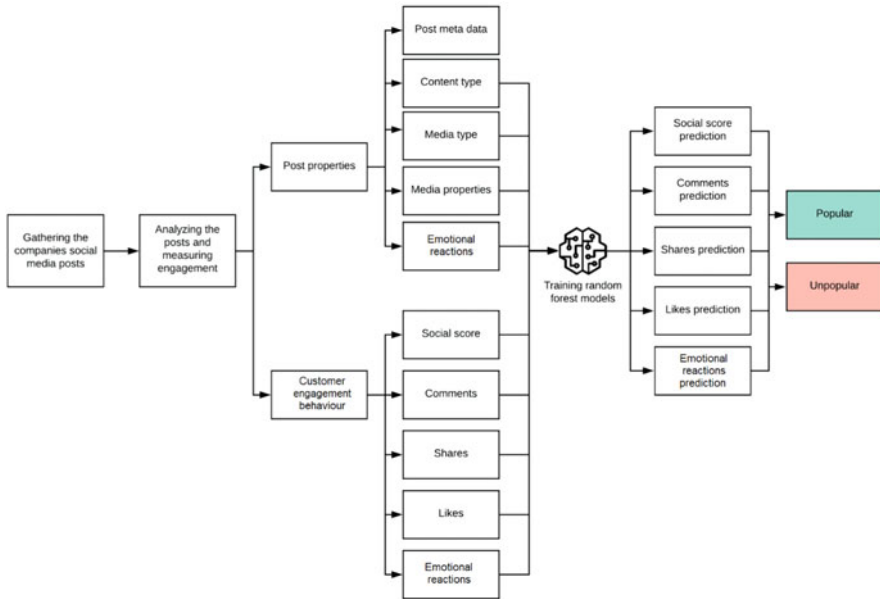


Fig. 2 Prediction model of CEB on Facebook based on various features of brand posts

The prediction model of CEB on Facebook is based on brand posts’ features, such as time frame, content type, and media type. This model is illustrated in Fig. 2.

To sum up, this paper follows the standard process of data analysis for creating machine learning models. In the beginning, the initial database of companies’ posts was gathered; then, each post was analysed in terms of post properties and customer engagement. These extracted properties were used to train nine models, which are capable of predicting post popularity in terms of calculated social score, likes, comments, shares, and each emotional reaction (for five emotional reaction types).

Finally, to ensure model correctness, the validation procedure and evaluation parameter were selected. The widely used tenfold, cross-validation method was chosen to validate the model, thus ensuring that data samples from the training set do not spill over to the testing set and minimising randomness by splitting the dataset into ten separate folds and using nine of them for training, and one of them for testing, and iterating for all of them. For model evaluation and comparison prediction accuracy, the area under the curve (ACU) parameter was selected. The ACU parameter measures how good the model is at predicting the correct class: popular or unpopular brand post.

5 Results

5.1 *Descriptive Results*

The descriptive results are discussed based on three types of the company's post features: time frame, content, and media types. In total, 1109 posts were analysed from the official brand/company's pages on Facebook.

5.1.1 Time Frame

The results show that the largest number of posts was published on Friday (21.3%; 236) and Thursday (19.3%; 214), while the least number of posts was on Sunday (6.5%; 72). Indeed, the companies posted messages during working days (85.6% of all posts; 949). Regarding the time of day, which was classified into three groups: morning [from 06 a.m. to 10 a.m.], day [from 10 a.m. to 2 p.m.], and evening [from 2 p.m. to 12 p.m.], the majority of the posts were published in the evening (45.3%; 502), whereas the lowest number of posts were published in the daytime (23.5%; 261).

5.1.2 Content Types

Almost half of brand posts (45.1%; 500) involved informational content type, followed by promotional content (35.3%; 391). The majority of brand posts contained informational (45.1%; 500) and social (35.3%; 391) content types, followed by social (15.8%; 175), social responsibility (3.1%; 34), and entertainment (0.8%; 9).

5.1.3 Media Types

Four types of media were included: image, video, link, and other. The latter included unlisted types such as a graphical image. Most posts covered an image media format (70.6%; 783), followed by videos (15.4%; 171) and links (12.7%; 141).

5.2 *Random Forest and Accuracy of Trained CEB Prediction Models*

The Random Forest algorithm was used for CEB prediction model training. Importantly, a few insights from the trained models can be observed by analysing the feature importance measured by the Gini index. Based on the results, the content

type and the time frame (e.g. day, time of a day) were the strongest predictors for post popularity calculated by the social score (see Table 3).

The results reported in Table 3 indicate that the features of brand posts such as day show a higher importance value (> 0.25 and $0.20-0.25$) for the social score, likes, comments, shares, and emotional reactions, including love, wow, ha ha, and angry. In a similar vein, a higher importance value (> 0.25 and $0.20-0.25$) was indicated for content types and likes, shares, love, ha ha, and sad expression. Interestingly, the post text with emoji showed the importance of customer commenting and sad expressions on Facebook (see Table 3; the importance value is between 0.10 and 0.15). Notably, video length could be associated with sad expressions ($0.20-0.25$). The least important values for features of brand posts were indicated for different media subtypes such as human emotions, and emoji stickers in a photo, followed by images accompanied with a logo, and human faces/bodies.

These models were evaluated based on prediction accuracy using tenfold cross-validation. According to the results, in terms of social score, likes, comments, and shares, the strongest prediction models were for the company's post comments and shares (see Table 3). Indeed, these models were capable of predicting whether a brand post would be popular in terms of shares (80.3%) and comment accuracy (84.0%). It is important to note that models for customer likes (68.4%) and computed social score (72.3%) have shown slightly lower accuracy values. Results of predictive models for emotional reactions are provided in Table 3 (see accuracy values).

6 Conclusions and Discussion

The descriptive results highlighted that the majority of brand posts were published during working days and less on weekends. Moreover, the largest number of posts was posted in the evening. The findings show that the primary content types of brand posts on Facebook are informational and remuneration. These results are aligned partially with the first studies on brands' posts on Facebook (see Luarn et al. 2015). Importantly, this research also indicates mixed content types such as informational and promotional, followed by social and remuneration. Our findings also support Taffese and Wien's (2017) findings that brands do post blended content types.

Concerning media types of the company's post, the dominant media type of posts was an image. Moreover, this result is following the study by Sabate et al. (2014), indicating that accompanying a brand post with images plays a key role in the post's popularity. Images can contain different features, such as human faces with emotions (e.g. happiness, surprise, neutral), and emoji stickers. Importantly, the least popular media types of posts among companies/brands were links.

Our findings provide evidence to suggest that both the time frame and content types of brand posts matter for CEB on Facebook prediction. Indeed, our research results are aligned partly with global trends, provided by Hootsuite company, a global leader in social media management (see more: Tien and Aynsley 2019; the

Table 3 The calculated Gini index for the features' importance and accuracy of trained CEB prediction models

Features of posts		Models										
		Social score ^a	Likes	Comments	Shares	Emotional responses				Ha Ha	Sad	Angry
Time frame	Subtypes	> 0.25	0.20–0.25	0.20–0.25	> 0.25	Love	Wow	Ha Ha	Sad	Angry		
	Day	> 0.25	0.20–0.25	0.20–0.25	> 0.25	> 0.25	0.20–0.25	0.20–0.25	0.10–0.15	0.10–0.15	> 0.25	> 0.25
Content type	Time of the day	0.05–0.10	0.05–0.10	0.10–0.15	0.10–0.15	0.10–0.15	0.15–0.20	0.15–0.20	0.10–0.15	0.10–0.15	0.10–0.15	0.10–0.15
	Different types ^b	0.15–0.20	> 0.25	0.15–0.20	0.20–0.25	0.20–0.25	0.15–0.20	0.20–0.25	0.20–0.25	0.20–0.25	0.10–0.15	0.10–0.15
	Emoji text	0.05–0.10	0.05–0.10	0.10–0.15	< 0.05	0.05–0.10	< 0.05	< 0.05	< 0.05	0.10–0.15	< 0.05	< 0.05
	Image/video/links	0.05–0.10	0.05–0.10	0.05–0.10	< 0.05	< 0.05	0.05–0.10	0.05–0.10	< 0.05	< 0.05	< 0.05	< 0.05
Media type: image	Logo	0.05–0.10	0.05–0.10	0.05–0.10	0.05–0.10	< 0.05	0.05–0.10	0.05–0.10	< 0.05	0.10–0.15	< 0.05	0.10–0.15
	Human faces	0.05–0.10	0.05–0.10	0.05–0.10	0.05–0.10	0.05–0.10	0.05–0.10	0.05–0.10	0.05–0.10	0.10–0.15	< 0.05	< 0.05
	Human face and emotions	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.10–0.15	< 0.05	< 0.05
	Human face and happy emotion	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Media type: video	Human face and surprise emotion	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Human face and neutral emotion	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
	Emoji sticker	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Length	0.05–0.10	0.05–0.10	0.05–0.10	0.10–0.15	0.05–0.10	0.05–0.10	0.05–0.10	0.10–0.15	0.10–0.15	0.20–0.25	0.10–0.15	
Accuracy value:	0.723	0.684	0.840	0.803	0.684	0.656	0.825	n/a ^c	n/a ^c			

^a Social score is a computed value (see Formula 1), which represents how much a company's posts remain popular on Facebook

^b Different content types of posts (see the list above)

^cNot enough data to train the model and assess the accuracy of the model. Values (i.e. <0.05, 0.00–0.05, 0.10–0.15, 0.15–0.20, 0.20–0.25, >0.25) represents the diverse features of brand posts' importance

second quarter in 2018). For instance, the best time to post on Facebook is between 9 a.m. and 2 p.m. on Tuesday, Wednesday, or Thursday for B2B brands, while for B2C brands the best time is 12 p.m. on Monday, Tuesday, or Wednesday (*ibid.*). Hence, a time to publish posts for brands on weekends is not recommended, although these results are aligned with previous research by Cvijikj and Michahelles (2013).

The content types of brand posts are also associated with customer likes, shares, love, ha ha, and sad expressions. These results suggest that the brand should pay more attention to various content types, such as informational, social, remuneration, social responsibility, etc. Notably, the findings support insights by De Vries et al. (2012) that different drivers of posts influence the number of likes and comments on Facebook. Thus, the current results also support findings by Annamalai et al. (2021) that varying influences of content types of posts are shared by sport clubs on social media. Interestingly, the results show that the text of a brand post accompanied with emoji can act as a catalyst for customer comment responses and for sad expressions on Facebook. It is important to note that brands should avoid posts that encourage customers to express negative emotions.

Analysis of our trained machine learning prediction models is also in line with previous findings. The importance of image on CEB was indicated by Luarn et al. (2015) and Sabate et al. (2014) over the brand posts accompanied by videos (a high level of interactivity). A possible explanation for these results might be biased because the number of images posted by brands was higher than posts accompanied with videos. Thus, the research did not distinguish brands based on company size and their social media budget for media types of posts, or the type of market (e.g. B2C, B2B). In summary, a post's time frame, use of an image, content type, and use of emojis were important features for the prediction model and generated Random Forest decision trees. Thus, it is useful to collect and include these features when dealing with CEB prediction.

To the authors' best knowledge, there is no previous research that explores features of a brand's posts on CEB using a granular level of analysis. The current research results extract new features that can be added to existing classifications of brand posts, especially job offer content, influencer reposts, mixed content types (i.e. informational and promotional), emoji within the text, images with emoji, humans and/or emotional expressions (e.g. happiness, surprise, neutral), and logos and video.

7 Limitations

This research has several limitations. First, the exploratory data analysis using the Random Forest method is used. Thus, the dataset includes emotional expressions at an early stage on Facebook. In general, CEBs (i.e. likes, comments, share, emoji reactions) are increasing over time from January first to March tenth from 2017 until 2019 towards many Top Web publishers (Owen 2019). Therefore, future studies

should replicate the analysis using the most recent data from companies' pages on Facebook.

Second, the data was collected from one single social media platform (i.e. Facebook) and country (i.e. Lithuania). Further studies should replicate the analysis using datasets from different social media platforms and countries, providing a deeper understanding of CEBs towards different features of company messages.

Third, CEBs can be different across diverse types of brands (i.e. B2B, B2C) and their message nature (i.e. organic, paid messages). For example, B2C brand messages perform best at noon on Monday, Tuesday, and Wednesday (Cooper 2020). The paid message can reach a wider audience and might generate diverse types of CEBs on Facebook. Unfortunately, the current research could not collect data about post reach, which indicates the number of users who saw a post (Barnhart 2020). Moreover, the ratio between the number of reach and engagement can reveal more about users' willingness to engage with a brand post. For instance, a high ratio can be an indicator that a post might involve relevant content to the brand's audience. While company and post nature are outside the scope of this research, future research can involve these aspects in analysis.

The following limitation must be highlighted: a conceptualisation of CEB on Facebook. The current research does not apply the view to CEB that entails active and passive participation on Facebook. Hence, future research studies might involve additional metrics such as the total number of people reached through the message that capture passive customer participation as well. The last limitation is due to the constant updates by social media platforms, especially Facebook. For example, Facebook is updating its features and functionality continuously. Therefore, the paper presents an area for future research that has both theoretical and practical value.

In conclusion, this research responds to the call for research on timing and frequency features of brand posts (Rietveld et al. 2020) and seeks to provide a more granular level of analysis of post features on CEB on Facebook. The current research provides a novel approach in this area, and future research can enhance our findings.

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Entrepreneurial University and Social Innovation Ecosystems: Do They Support HEIs' Knowledge-Based Economic Development?



Nibedita Saha, Tomáš Sáha, and Petr Sáha

Abstract This chapter intends to analyze and develop the concept of the entrepreneurial university and social innovation ecosystem from multiple viewpoints, including HEI regional knowledge spillover and social innovation ecosystem theoretical approaches, as well as policy and research views. The emerging perspectives of the entrepreneurial universities in the knowledge economy are considered as an instrument for “innovation and development” that acts as an elixir for the social innovation paradigm. Due to its vital position in the horizon EU strategy, respectively entrepreneurial universities and the social innovation ecosystem are gaining increasing importance in the EU’s regional knowledge-based economic growth policy discourse. Since then, they’ve been used by policymakers around the world as building blocks for executing various innovation policies, including research and innovation, smart inclusive regional knowledge growth, social innovation, industrial development, and regional development policies. The responsiveness of entrepreneurial universities and the social innovation ecosystem is envisioned in this chapter as a “facilitator” for increasing knowledge-based economic development and innovation-driven regional growth.

Keywords Entrepreneurial university · Higher education institution (HEI) knowledge-based growth · Quadruple helix · Social innovation · Triple helix

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1 Introduction

The conception and significance of entrepreneurial universities' emerging perspectives in the knowledge economy especially the transformations or reforms of universities have been inclusive with the impact of social innovation ecosystems and sustainability of entrepreneurial universities (Cai and Ahmad, 2021). Today, local, provincial, and national higher education institutions (HEIs) face an uncertain and complex situation caused by globalization, economic distress, as well as social and environmental challenges. In this regard, the role of entrepreneurial universities in economic development, i.e., *knowledge-based and innovative economic development*, i.e., *social innovation*, has become a key subject in academia, business, management, research and development, and policymaker's debates regarding the cap potential to decorate local know-how spillover and innovativeness to generate prosperity and marketability (Heaton et al., 2019). Similarly, entrepreneurial universities' knowledge development process, especially in convergence regions, faces growing difficulties. Nevertheless, inside the regions, the present know-how spillover has encouraged other regions also in order to create innovative knowledge of cross-disciplinary studies that facilitate SMEs and HEIs to compete with the commercial enterprises and socioeconomic challenges (Morawska-Jancelewicz, 2021). Given such trends, the corona pandemics of our time are offering the most recent examples of how a global market and knowledge society are gaining experience in handling the global emergency. For example, entrepreneurship also can offer a wider range of options, as well as speed and agility, to a world that is adapting to the impacts of COVID-19 (Ratten and Jones, 2021).

Although there are some ambiguities in the activities of entrepreneurial universities that need to be addressed, it implicates the facilitating characteristics of entrepreneurial university's knowledge-driven behavior. This chapter aims to identify gaps and consider the understanding of the *entrepreneurial university's strategy and social innovation ecosystem as an integrated approach: HEIs' regional knowledge spillover and social innovation ecosystems* theoretical approach along with the policy and research perspectives. Both the approaches attain significant eminence in the Horizon Europe strategy, *through the policymakers and researchers* nationally and across the world for enforcing smart inclusive local growth, social innovation business, and local policies. Consequently, the significance of HEIs such as entrepreneurial universities emerges gradually recognizing its importance. As, they can perform an important role by engaging themselves with the broader stakeholder community to overcome the outstanding challenges of the modern era.

Accordingly, researchers Cruz et al. (2021); Pugh (2020); Carayannis and Campbell (2010); and Kamran et al. (2021) stated that a successful academic entrepreneurship ecosystem automatically leads to the emergence of business ecosystems with consequent societal and regional advantages. Additionally, Sperrer et al. (2016) emphasized that the "entrepreneurial university" concept is nowadays speculated a critical function in promoting self-improvement and innovation that facilitates overcoming the challenges of highly turbulent and unpredictable markets. In the

context of entrepreneurial universities' key role, Guerrero and Urbano (2010) mentioned that the entrepreneurial university concept particularly addresses the notion of knowledge-based entrepreneurship that appears as a crucial driving force. According to their understanding, it acts as a knowledge producer as well as a knowledge disseminator – to enhance economic growth, create employment opportunities, and initiate competitiveness as a whole. Consequently, it is necessary to highlight that entrepreneurial universities' interrelations with environmental and internal factors play a crucial role in fulfilling entrepreneurial missions (teaching activities, R & D activities) and knowledge-based economic development (Clark, 1998; Sporn, 2001; Etzkowitz, 2004; Kirby, 2004, 2006; Guerrero & Urbano, 2012).

On the other hand, concerning entrepreneurial universities' impact on regional knowledge-based economic development, Etzkowitz and Klofsten (2005) emphasized that nowadays entrepreneurial universities' role in regional knowledge spill-over is perceived as different technological and social dynamics, in particular, centered on exceptional technological advances which have created some extraordinary opportunities. Simultaneously, from the regional innovation policy perspective point of view, the conception of an entrepreneurial university is a “bottom-up” approach of different actors (such as business, government, and academics) collective initiatives, i.e., the formation of the “triple helix” concept to facilitate regional knowledge-based economic growth. Furthermore, it is necessary to mention that the significance of social innovation along with the HEI's knowledge-based economic development cannot be ignored, since the social innovation ecosystem creates a strong synergy between the economic and natural science innovation process that strengthens the connection to resolve the social problems (Balaton et al., 2016).

While addressing the institutional knowledge development process and social innovation process, Moulaert and Nussbaumer (2005a, 2005b); Moulaert et al. (2007); Carayannis and Campbell (2006); Carayannis and Alexander (2006); Urbano and Guerrero (2013); and Ferreira et al. (2018) underlined that in modern day, the impression of regional social innovation gadget and entrepreneurial university's knowledge development strategy escalates HEIs' innovation-driven regional growth. Respectively, Hannon (2013) stated that an entrepreneurial university's operational approach acts as a promoter of innovation and knowledge-oriented societal growth. Again, Carayannis and von Zedtwitz (2005) also said the entrepreneurial university would connect entrepreneurs from local, regional, and global levels. From the growing importance of the social innovation system point of view, Morawska-Jancelewicz (2021) demonstrated the new significant activities of entrepreneurial universities encouraging social innovations (i.e., the quadruple helix perception) especially emphasizing the regional knowledge-based economic development system. In addition, taking the initiative within the advent of social well-being creates an effect in the best of life and allows the co-advent of understanding within the framework of public-nonpublic partnerships.

As Joanna Morawska-Jancelewicz mentioned (Morawska-Jancelewicz, 2021, p. 3), In this new paradigm, the importance of knowledge is not determined exclusively by competitiveness and productivity, but by taking into account the creation of social well-being, the impact on the quality of life and co-creation of knowledge as part of public-private

partnerships. The existence of a well-developed network in a given territory makes it possible to combine and strengthen the actions of all entities (actors), which influences, as a result, the acquisition of a collective skill conducive to innovation processes.

This indicates an additional distinctive trait of entrepreneurial universities that enable social innovation ecosystems to improve the existing knowledge of higher education institutions and contribute to the knowledge economy. Enduring with this debated topic, the authors intended to exemplify a unique purposeful framework that considers entrepreneurial universities' knowledge-based economic growth as well as socially valued network relations and regional developments. Correspondingly as a way to fill the space of noticeably few research on entrepreneurial universities and social innovation ecosystems help on HEIs' knowledge-primarily based totally economic development, this chapter intends to show the accessibility and benefits of entrepreneurial universities' (EU) significant activities initiating innovation-pushed regional development. In consequence, the work of Daniel et al. (2020) shows in what way the entrepreneurial universities taking initiatives in regional economic development that fostering the entrepreneurial mindset among higher educational institutions within the local communities and companies. Furthermore, Saha et al. (2020a, 2020b) also highlighted that entrepreneurial universities act as a great facilitator for provincial socioeconomic growth, because of the spin-off of new, progressive tasks that enhances value through know-how advent and entrepreneurial discovery process (EDP). From the HEIs' supportive *mechanism factor of view, entrepreneurial universities play an important function in sustainable local and financial development: figuring out the considerable advantages in affiliation with the social innovation process; permitting the important elements that encourage social innovation and social entrepreneurship development process; and supporting the positive flows of information to create unique tacit knowledge that supports regional knowledge spillovers to enhance sustainable entrepreneurial ecosystems.*

Following these abovementioned benefits of entrepreneurial universities, it is essential to mention that in recent times, entrepreneurial university acts as an important facilitator in changing the perception for supporting HEIs that has put more emphasis on "entrepreneurial university" as a "third mission" conception (Saha et al., 2020a, 2020b; Saha and Saha 2020c). This impression enables to develop a conceptual framework for combining both the insights of entrepreneurial universities operational approach and social innovation ecosystems that fascinate one of the prominent activities of the HEIs that empower to explore the future prospect and integrate the global society effectively. Hence, the comprehensive aim of this observation is to decide whether or not there are institutions among the stages of improvement of entrepreneurial university and social innovation ecosystems that are connected with the supportive facility of HEIs' knowledge-based economic development and enhancement of further regional economic development. In addition, *the theoretical contribution* of this chapter's subject matter is primarily based on evolutionary areas and the strategic role of entrepreneurial university and social innovation ecosystems which encompasses significant areas of regional knowledge-based economic development. On the other hand, the *practical contribution* of this

chapter brings about elevating cognizance approximately the present-day possibility of entrepreneurial universities withinside the context of triple helix, quadruple helix, and inclusive knowledge-based economic growth and transformation of HEIs' right into a regional, revolutionary, and entrepreneurial university. The findings of this study may be used as suggestions for local organizations who are in search of boom universities' contributions to understanding primarily based totally financial system with the emergence of social progressive procedure that foster social entrepreneurship.

To illustrate the content of this study, this chapter consists of six additional sections. The first section focused on identifying the theoretical framework of the premeditated role of entrepreneurial universities, by facilitating the knowledge-based economic development strategy of higher education institutions. Section two summarizes entrepreneurial university's contributions and influence in social innovation along with the subsection of social innovation ecosystems and knowledge-based economic development. Subsection three discusses the role of entrepreneurial universities as agents of the knowledge economy, as well as the strategic impacts of entrepreneurial universities on knowledge development and competitiveness. Consequently, this section four expands the discussion by addressing challenges related to the strategic role of the entrepreneurial university and the combined social innovation strategies that support the dissemination of HEIs' knowledge and enhance socioeconomic development. Later, section five presented solutions and recommendations with respect to issues, influences, and challenges. Finally, section six the last part deals with the recommendation and conclusion. Furthermore, as a result of the entrepreneurial university and social innovation ecosystems' combined effort to support HEIs' knowledge-based economic development that continues to move forward for regional economic development, this section highlights the need for more detailed studies on the said topic, which is carried onward by the chapter.

2 Theoretical Background of the Entrepreneurial University and Social Innovation Ecosystem

The theoretical context of the "entrepreneurial university" notion and rising attitude of the social innovation ecosystem determines that in the era of modernization and industrialization, both entrepreneurial university and social innovation ecosystem are viewed as sources of regional knowledge-based economic development. Thus, entrepreneurial university conception has increasingly been recognized as a leading perception of knowledge spillover, socioeconomic development, and regional competence development. On the other hand, entrepreneurial universities can perform a crucial educational role to facilitate the discussion on the way of entrepreneurship development. Relating to this conception, Jami and Gökdeniz (2020) also mentioned that entrepreneurial universities can act as a well-defined and implicit process where universities can also help new businesses (start-up) to build innovative business

models, put systems in place, and train human capital, i.e., human resources to professionally meet their business needs.

In order to examine the impact of entrepreneurial universities on HEIs, some major aspects that support entrepreneurial universities' top-down leadership strategies and policies on HEIs' knowledge-based economic development have been proposed by Bezanilla et al. (2020); Audretsch et al. (2012); Lehmann et al. (2020); and Pinheiro et al. (2015), for example, empowering and encouraging academic entrepreneurship; developing an entrepreneurial culture, attitudes, and aptitudes within institutions that will play a key role in creating and promoting regional economic growth and competitiveness; and generating their own funding capability and establishing their own technology transfer offices and incubators.

Conferring this Kirby (2004, 2006) indicated that entrepreneurial universities' role as a knowledge development process acts like a driving force that reflects individuals' skills and creativity and generates willpower to achieve it. Cosequently, it is necessary to underline that the entrepreneurial university concept or approach is not a groundbreaking concept, since it does have various meanings, strategies, and identities based on the notions of commercialization, enterprise, good governance, innovation, new venture creation, employability, and others.

Conversely, Kamran et al. (2021) emphasized that entrepreneurial ecosystems are considered as a backbone of any country in socioeconomic development due to their enabling capability to develop business incubators. Due to their obligations for supporting the European Union's Science With and For Society (SWAFS) development plan, business incubators first appeared in public consciousness through entrepreneurial university activities, particularly in public sector universities (EU). The strategy's ultimate purpose is to provide the required scientific and technological support to meet the demands of modern industry. According to Delaney et al. (2020), all policy instruments, including Horizon 2020, should foster the recognition that codesign with people, stakeholders, and end users. Similarly, Bouncken and Kraus (2021); Acs et al. (2017); Roundy et al. (2017); Audretsch et al. (2019); Hannon (2013); and Hannon et al. (2006) also emphasized the concept of entrepreneurial universities' perception that demonstrated the underlying idea of the entrepreneurial ecosystem. It indicated that through entrepreneurial mindset, firms or higher education institutions (HEIs) will have the potential to achieve their advantages over their rivals, uniquely based on their existing resources, knowledge, skills and abilities (KSAs).

Respectively, from the social development perspective point of view, Biggeri et al. (2018) demonstrated that social innovation systems can be illustrated as a phenomenon of the society where multidisciplinary (business people, accounting persons, economists, and sociologists) approaches as well as multistakeholder (policymakers, technocrats, researchers, investors) contributors jointly put their effort to face the challenges and accomplish social needs smoothly, for example, by *providing better working conditions, better education facilities, community development, or healthcare services* than the existing solutions, as well as extending and strengthening the civil society.

Concerning the inclusive perceptions of entrepreneurial universities and the synergetic effect of social innovation ecosystems, Saha and Sáha (2020c) stated that both approaches are interconnected and interrelated for enhancing social entrepreneurship that is embedded in the entrepreneurial discovery process. Related to this issue, Sinclair et al. (2018) mentioned that essentially social innovation can be considered as a “distinctive and effective” approach that emerged in response to meet the unwanted effects, i.e., social problems and needs that prompted and motivated by a social purpose.

Borzaga and Bodini (2012), on the other hand, stated that the goal of social innovation is to not only deal with radical technological change, which is an emergent phenomenon of social entrepreneurship, but also to create an environment for finding alternative solutions and closing social gaps in the market and public sector. It also allows for the identification of the best possible approaches to empower existing human resources, particularly from underserved groups, by activating their core skills and incorporating them in the innovation process (2018, Sinclair et al.).

Subsequently, researchers Benneworth and Cunha (2015) also addressed that *entrepreneurial university contributes to social innovation processes which can be recognized by encouraging knowledge development process which helps to move the process forward by facilitating progression between stages, whether through existing knowledge or something co-created with the affected community; making its resources available, whether through direct financial support or access to university infrastructure and assets in the innovation process; and supporting the social innovation process, either by advising social innovators on how to access external knowledge resources or persuading them to do so.*

Furthermore, to indicate entrepreneurial universities’ premeditated role on HEIs’ knowledge-based economic development and social innovation system, Saha et al. (2020b), Saha and Sáha (2020c) too described that entrepreneurial university’s challenging perspectives might be viewed as a crucial way for successful implementation of HEI’s good impact on societal development and technological disruption.

2.1 Entrepreneurial Universities’ Key Enabling Perspectives in the Framework of the HEIs’ Knowledge-Based Economy

Regarding entrepreneurial universities’ empowering perspectives, Agarwal et al. (2007) and Audretsch and Berlitski (2013) demonstrated that the key enabling role of entrepreneurial universities can be considered as essential support *in society, which is based on its unique tacit knowledge. Furthermore, they also indicated the changing perception of HEIs that has put more emphasis on “entrepreneurial university” as a “third mission” conception.* The OECD’s “A Guiding Framework for Entrepreneurial Universities” (2019) identifies seven specific areas of action and

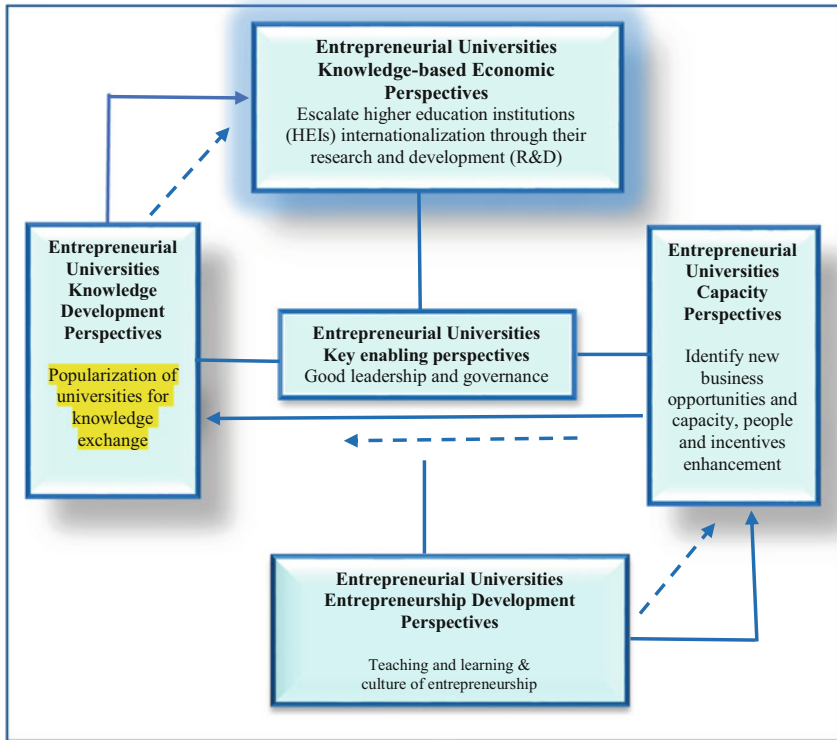


Fig. 1 Entrepreneurial universities' key enabling perspectives support HEIs' knowledge-based economy (own interpretation)

initiatives, including leadership and governance, organizational capacity, people and incentives, entrepreneurship development in teaching and learning, pathways for entrepreneurs, and university-business/external knowledge exchange relationships to measure and transform institution's entrepreneurial role through multidimensional digital self-assessment and management tool (www.heinnovate.eu/en).

In addition, *entrepreneurial universities' key attributes (including powerful management and governance, potential incentives, entrepreneurial learning, and sustaining entrepreneurial spirit) mainly facilitate region's knowledge-driven growth, i.e., regional economic development.* Correspondingly, this study took the initiative to examine how to make the best possible use of the available effective support system, which takes into account all aspects, institutional settings, and resources that may aid future entrepreneur success (Fichter et al., 2016). To identify the entrepreneurial university's key enabling perspectives and their impact on developing the knowledge development process, it is critical to comprehend how entrepreneurial ecosystems and knowledge-enhancing innovation systems function. Figure 1 depicted entrepreneurial universities' major enabling views, demonstrating how they support the knowledge-based economy of HEIs. Simultaneously, Shepherd

and Patzelt (2011); Kuckertz and Wagner (2010); Parrish (2010); and Abdelkafi and Hansen (2018) also stated that the development of entrepreneurial knowledge spillovers starts within the university context. Correspondingly, they also revealed that universities are also able to support external economic factors that inspires good leadership and governance, enhances organizational capability, induces entrepreneurial learning spirit, develops an interpersonal relationship for university or external relationship for knowledge exchange, and finally escalates higher education institution (HEI) internationalization through research and development (R & D) resources and the establishment of a sustainable development strategy.

However, to investigate the relationships between entrepreneurial universities' key enabling elements and HEIs' knowledge spillover as well as to measure the entrepreneurial dimensions, it is required to know each university and its strategic activities the way they encourage and empower an entrepreneurial spirit within the institutional environment and culture. Mainly it depends on four important dimensions, i.e., human capital, resources, and activities; strategic management and networking and business development environment; popularization and communication activities; and performance indicators as well as a good-practice example. Such as the case of the LISTO project (2020) can be taken into consideration, the way they recommended a three-step approach for analyzing the entrepreneurial dimension of universities as a joint collaborative approach that accelerates the social innovation process and integrates explicit knowledge to achieve social value.

2.2 Entrepreneurial Universities in the Framework of HEIs' Regional Knowledge Spillover and Social Innovation

Several scholars, such as Agarwal et al. (2007) and Audretsch and Berlitski (2013), stressed that knowledge spillover theory of entrepreneurship primarily benefits to understand how this activity of entrepreneurial ecosystems and knowledge enhancing innovation systems. Similarly, Fichter et al. (2016); Shepherd and Patzelt (2011); Kuckertz and Wagner (2010); Parrish (2010); and Abdelkafi and Hansen (2018) also stated that the development of entrepreneurial knowledge spillovers starts within the university context. The above mentioned scholars also observed that universities can support external economic factors such as SMEs and start-ups develop technology-driven products. As it inspires good leadership and governance, enhances organizational capability, induces entrepreneurial learning spirit, develops an interpersonal relationship for university or external relationship for knowledge exchange, and finally escalate higher education institutions' (HEIs) internationalization through their R & D resources and the implementation of a long-term development strategy.

To indicate entrepreneurial universities' distinctive role in the context of HEIs' regional knowledge spillover as shown below in Fig. 2 (graphical representation showing the last 5 years (2015–2020) citation report from Web of Science database

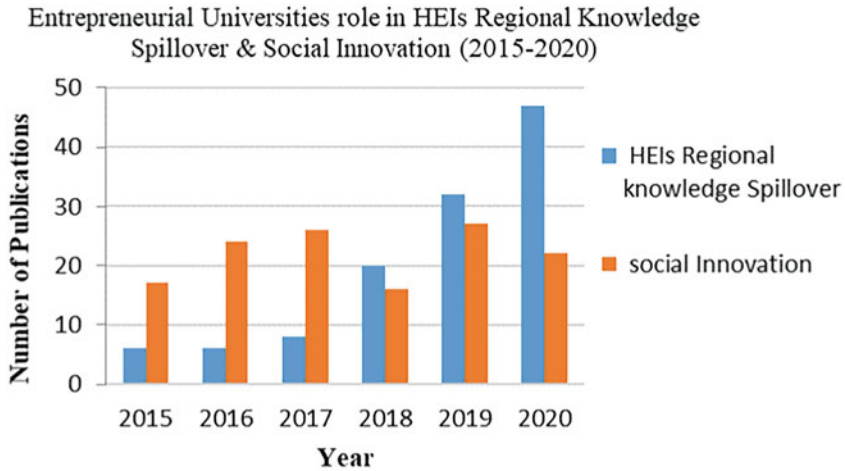


Fig. 2 Graphical representation of entrepreneurial universities' position in HEIs' regional knowledge development and social innovation during the last 5 years (2015–2020), citation report from WOS

of entrepreneurial universities' role in HEIs and social innovation). It is necessary to highlight and examine the relative ways of entrepreneurial universities' innovation-led knowledge spillover that influence social innovation ecosystems in the context of HEIs' regional knowledge spillover. As a result, it provides regional and organizational significance, as well as competence and knowledge-based economic growth. Furthermore, building unique entrepreneurship- and knowledge-driven innovation hubs requires the dynamic perspective of entrepreneurial universities. Whereas, entrepreneurial universities explored attempts to increase the use of tacit knowledge in regions or countries, knowledge retention in SMEs, and knowledge dynamics (Fuster et al., 2019; Baporikar, 2019).

According to researcher Pugh et al. (2018), entrepreneurial universities' strategic role as a regional knowledge and innovation component has risen to prominence in recent years. Consequently, Fayolle and Redford (2014) and Mian (2011) also assumed that entrepreneurial universities' most important additives play a vital function in enhancing regional HEI's competitiveness that influences regional economic growth and wealth creation.

Correspondingly, to demonstrate entrepreneurial universities' contributions and influence in social innovation ecosystems, Medvedeva (2015) identified that the social dynamics of entrepreneurial universities are concerned with determining the circumstances of their transformation from knowledge-generating entities to full-fledged civil society elements. More specifically, to comprehend the notion of "entrepreneurial universities" significant role that empowers social innovation, it is necessary to describe its collective approach (AID), i.e., adopting new knowledge, improving existing knowledge, and developing new knowledge to gather information-based social development framework. Consistently, it also explains

that social ventures are dynamic in a wide range of fields, including individual social administrations, metropolitan retrieval, ecological administrations, and the arrangement of other public administrations. As a result, researchers chose to concentrate their efforts on work integration social enterprises (WISEs) in order to facilitate international collaboration (Defourny & Nyssens, 2010; Ahmad et al., 2018).

2.3 Entrepreneurial Universities in the Framework of Social Innovation Ecosystems and Knowledge-Based Economic Development

In relation to this contentious issue, there is universal agreement that the gap between economic progress and well-being is widening faster than ever before. At the same time, the appearance of entrepreneurial universities' comprehensive perspectives has become one of the main mechanisms of enhancing social as well knowledge-based economic growth nationally and internationally. In addition, it is required to indicate that to meet the societal challenges, the role of an entrepreneurial university's contribution is remarkable. Through academic spin-offs for scaling up innovation, resources, and action to deliver the sustainable development goals, entrepreneurial universities' strategic efforts strengthen the role of social and institutional environments in the social innovation process (SDGs) (Franco-Leal et al., 2020; Saha and Saha 2020c).

Moreover, this chapter put more emphasis on how social innovation ecosystems and knowledge-based economic development imply the significance of entrepreneurial universities, broad perspectives that have been recognized as an effective approach of fostering social innovation system, and knowledge-based economic development through provincial knowledge spillover. Consequently, this study intends to highlight the new challenges and diversity of the socioeconomic contexts. For example:

- Inclusiveness in higher education
- Inclusiveness in innovation
- Inclusiveness in social innovation
- Inclusiveness in the university's developmental process
- Inclusiveness in social development and social entrepreneurship
- Inclusiveness in knowledge-based economic development

Confirming this researcher Johannes Carl (2020) expressed that entrepreneurial university's wide-ranging outlooks have great inspiration on the enduring paradigm shift from technological upbringing to the social development process. His study emphasizes the connectivity of the two emerging research fields of social innovation ecosystems and knowledge-based economic development (i.e., entrepreneurial ecosystems and social innovation ecosystems) that instinctively create social entrepreneurship development. Consequently, it is important to mention the social reform

work of Professor Dr. Muhammad Yunus (2007) in Bangladesh. To alleviate poverty through social innovation and social entrepreneurship development, in 2007, he first took the initiative to spark this concept of a social “innovation” awareness program among academics and researchers (Yunus, 2007; Yunus et al., 2010, 2012).

3 Research Method

This study aims to respond to the framework method of the entrepreneurial university and social innovation ecosystem perspectives with a qualitative approach and a review of the literature. It focuses on stimulating and encouraging HEIs to create an entrepreneurial environment for regional knowledge spillover and knowledge-based economic development. Investigates by way of discovery. This qualitative literature review approach includes some forms of constructivist review to have coherent foundations that may support and justify entrepreneurial universities’ different perspectives (Greene, 2006). The purpose of this academic research on entrepreneurial universities is to address the theoretical considerations (*won from diverse researchers’ perceptions of different thematic ideas and perspectives*) that review the entrepreneurial university transformation, entrepreneurial university’s contributions that influence regional knowledge spillover through entrepreneurial capacity enhancement and creation of new business opportunities to facilitate social innovation (Table 1). Based on a logical approach, some important research assumptions have been developed and coined by the conceptual understanding of the entrepreneurial university and social innovation ecosystem. Inductive reasoning, in general, refers to the degree of support for a specific type of knowledge representation that indicates a certain degree of knowledge, which is derived from scientific theories (such as the entrepreneurial discovery process, regional innovation strategy, and knowledge for regional growth) and drew on modern approaches to both strategic and dynamic activities of entrepreneurial universities, the role of higher education institutions (HEIs), and social innovation ecosystems.

In this chapter our research mainly highlighted the following areas:

- Conceptualization of entrepreneurial universities’ role on higher education institutions (HEIs).
- Entrepreneurial universities’ key enabling perspectives and elements that influence regional knowledge spillover related to social innovation.
- Exploratory study on entrepreneurial university and social innovation ecosystems relations.
- Both approaches (entrepreneurial university and social innovation) impact factors that strengthen and enhance regional social innovation potential, and regional knowledge-based economic development.

Concerning this challenging topic, it is crucial to state that the primary goal of this research is not to investigate the operational activities of “entrepreneurial

Table 1 Research methodology of entrepreneurial university and social innovation ecosystems’ combined effort on HEIs’ knowledge-based economic development (own interpretation)

Main stream of the study	No. of article used from different databases (WOS, SCOPUS & others)	Research subjects	Research question
Entrepreneurial universities and social innovation ecosystems’ different perspectives (Benneworth & Cunha, 2015;. Biggeri et al., 2018)	27 (approx.)	Entrepreneurial university and social innovation processes and elements	Entrepreneurial universities’ contribution in social innovation (how it influences?)
Entrepreneurial university and social innovation ecosystems’ support regional knowledge-based economic development (Fuster et al., 2019; Baporikar, 2019; Carayannis & Campbell, 2012)	30 (approx.)	Entrepreneurial university and social innovation ecosystems’ combined effort on regional knowledge-based economic development	Entrepreneurial university and social innovation ecosystems’ positive effect strengthen and enhance regional social innovation potential, and regional knowledge-based economic development (why it is important for regional knowledge growth?)
Conceptualization of entrepreneurial universities’ role on higher education institutions (HEIs) and knowledge spillover (Audretsch & Link, 2018a, 2018b; Baporikar, 2019)	28 (approx.)	Entrepreneurial universities’ role on higher education institutions (HEIs)	Entrepreneurial universities’ key enabling perspectives and elements influencing regional knowledge spillover (what are the main purposes?)

universities.” Rather, it is necessary to mention that this study mainly focused on highlighting the “entrepreneurial ecosystem that promotes social innovation,” which was done on purpose (that enhances regional knowledge as well as entrepreneurial universities’ innovative capabilities). The purpose of narrowing the definition of entrepreneurial activity, on the other hand, is recognized in the fact that it encourages entrepreneurial universities to be compatible with the conceptual reinforcements of the innovative knowledge development strategy, which is a phronetic iterative approach (i.e., the study of social phenomena based on a contemporary interpretation) of entrepreneurial universities to guide entrepreneurial ecosystem for regional knowledge development and internationalization of entrepreneurial universities.

As a result, this study enables us to understand entrepreneurial universities’ agile perspectives of regional knowledge development and social innovation strategies that stressed HEI’s entrepreneurial activity and raise regional knowledge-enhancing

programs to promote regional economic growth and potentiality. Although the knowledge production process of a creative higher educational institution has a global charm, its application in the framework of Knowledge for Growth (K4G) must be original. As a result, entrepreneurial university activities and social dimensions' considered policy approaches for sustainable development, as well as to inspire the societal development entrepreneurial spirit of their students, play a critical role. Hence, the significance of this study demonstrates that HEI's innovation-driven regional knowledge development strategies foster societal development challenges that distinctively accelerate HEI's internationalization capacity, and learning capability through their research and development (R & D).

4 Entrepreneurial Universities in the Context of Triple Helix, Quadruple Helix, and Inclusive Knowledge-Based Economic Growth

Responding to this contextual matter of triple helix, quadruple helix, and inclusive knowledge-based economic growth and the relationship between entrepreneurial universities and social aspects, this chapter took the initiative to identify how the social innovation ecosystem can trigger to boost the knowledge-based economic development. Agreeing with this consensus, several scholars also revealed that the inclusive perspectives of entrepreneurial universities have a great impact on the ongoing paradigm shift from technological upbringing to the social development system. Also, it shows that both perceptions have close links with the two emerging research fields of entrepreneurial ecosystems and social innovation ecosystems that automatically initiate social entrepreneurship development.

Similarly, while deliberating the inspiration of entrepreneurial universities' creative and knowledge diffusion activities as well as rational approaches to social innovation, this research investigates how institutional or regional knowledge, innovation, social innovation, and the environment (i.e., natural environment) interact. Relating to this debated issue, it is important to describe the differences between the entrepreneurial and evolutionary triple helix approach and the quadruple helix notion, i.e., distinct modes of knowledge production, in relation to this contentious subject.

Concurring to the issue in the context of "university-industry-government relations," Triple Helix (TH) focuses on knowledge production and application, which discusses the interaction and interrelationship between academics, industry, and government to support economic and social growth, such as knowledge-based economic development and the creation of a knowledge-based society.

On the other hand, quadruple helix (QH) focuses primarily on the need for a university-led community innovation system (CIS), which supplements the lack of and inadequacies of national university institutions in the majority of developing countries. Concerning national universities, it has been observed, that they are

frequently faced with the challenge of demonstrating their knowledge-based economic development (throughout a multi-stage structure of national, international, and trans-national levels) and innovation structures, which are characterized by the aid of using a range of specialized knowledge and social innovation schemes.

Responding to this approach, numerous researchers, for example, Carl (2020); Etzkowitz and Leydesdorff (2000); and Carayannis and Campbell (2012), emphasized that through this quadruple helix model, national as well as international universities get inspiration to develop the community innovation system in their existing national innovation system that improves people's ability to mobilize and use resources, coordinate knowledge and human capital training, and deploy institutions in order to conduct out favorite experiments on activities and functions carried out by citizens at the grassroots level and in local communities (Carayannis & Campbell, 2009).

Moreover, it has been observed that HEIs' knowledge creation and perception and civil society's community development approach significantly influence TH and QH perspectives. Accordingly, it demonstrates a keen interest in the development of the entrepreneurial ecosystem and social innovation ecosystems, which, on the one hand, stimulate dynamic capabilities for improving institutional attractiveness and, on the other hand, provide a suitable platform for the development of innovative capabilities, stimulating regions and nations to create an innovative environment, though it is not a simple process to initiate the social innovation system and knowledge-based economic growth, especially through correspondence between HEIs' advanced knowledge (innovation) systems and advances (high-quality) of civil society. Consequently, we cannot disagree that nowadays there are several social dimensions of reforming higher education institutions (HEIs) that are supporting the social innovation system.

4.1 Entrepreneurial Ecosystems and Social Innovation Ecosystems Influence Knowledge-Based Economic Development

To justify entrepreneurial ecosystems and social innovation ecosystem's influence on knowledge-based economic development, the proposed research direction will be analyzing the significance of entrepreneurial universities' coherent approach. It explains about regional knowledge development process and competitiveness that foster social entrepreneurship, and firms' competitiveness through knowledge-based economic development. The dynamic perspectives of entrepreneurial universities gain considerable attention due to their key enabling inspirations that support HEIs and firms (SMEs) to respond to the challenges of regional knowledge development through expanding business networks to achieve social benefits. Fuster et al. (2019) and Baporikar (2019) also emphasized that entrepreneurial universities support a

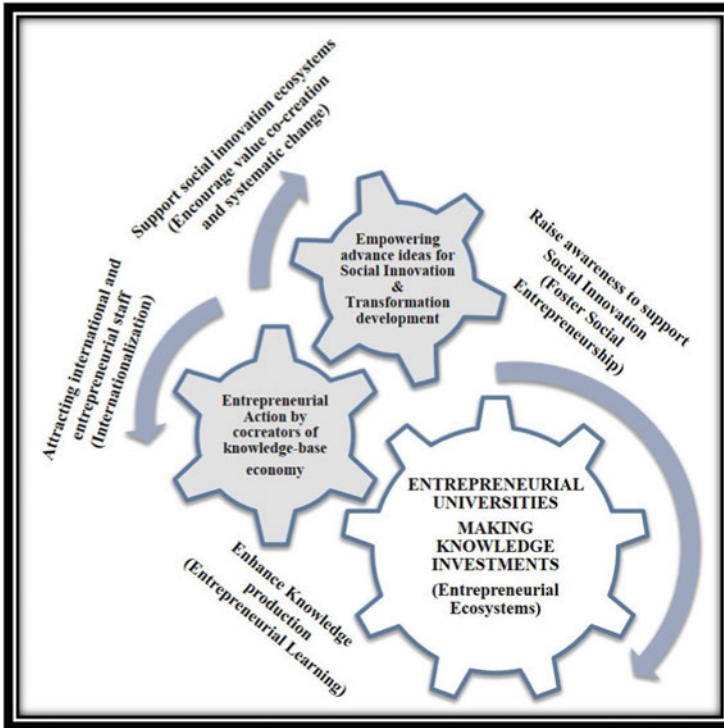


Fig. 3 Thematic model of entrepreneurial ecosystems' and social innovation ecosystems' influence on regional knowledge-based economic development (own interpretation)

regional knowledge-based innovation system and promote the tacit knowledge of regions, businesses, and higher education institutions.

Furthermore, Fig. 3 depicts the significance of entrepreneurial ecosystems and social innovation ecosystems' influence on regional knowledge-based economic development. Figure 3 illustrates mainly *three important elements of entrepreneurial universities*:

- That is, *entrepreneurial universities' entrepreneurial learning and teaching capabilities*
- *Entrepreneurial universities' internationalization capabilities*
- *Entrepreneurial universities' social awareness and regional value creation capabilities through regional knowledge spillover which were all arranged around the question of how entrepreneurial universities' entrepreneurial ecosystems and social innovation ecosystems influence on knowledge-based economic development*

Conversely, the current study also highlighted that social innovation, social entrepreneurship, and entrepreneurial university's inclusive perceptions facilitate encourage and expedite to cope up with the societal challenges, social needs, and

systematic social change. It enhances the capacity to adopt the change and create social entrepreneurship and facilitates the regions to compete successfully in order to promote entrepreneurial network spirit and innovation-driven regional and societal growth (Saha et al., 2020a, 2020b; Saha and Saha 2020c).

However, more precisely the role of entrepreneurial universities' strategic initiatives, i.e., entrepreneurial ecosystems, has been seen to stimulate the following features, such as:

- Empowering advanced ideas for social innovation and transformation development – that raise awareness to support social innovation (*foster social entrepreneurship*)
- Encouraging entrepreneurial action by co-creators of the knowledge-based economy – that enhance knowledge production (*entrepreneurial learning*)
- Stimulating support social innovation ecosystems – that encourage (*social value co-creation and systematic change*)
- Enhancing knowledge development process – that attract international and entrepreneurial staff (*internationalization*)

Mainly it is accentuating more than the traditional commercialization activities, and notably, in developing countries, it is one of the crucial aspects of escalating the social innovation system through systemic change and boosting knowledge-based economic development.

Furthermore, Muktadir-Al-Mukit et al. (2016) identified that entrepreneurial universities place a greater emphasis on good governance and leadership for developing entrepreneurial thinking than on technology transfer (patents, spin-offs, and start-ups), indicating that entrepreneurial and social innovation ecosystems have a positive impact on regional knowledge-based economic development. In addition, the study of Kruja, 2013 also focuses on the strategic role of entrepreneurial universities as a vital provider of support and services to local populations. Conversely, to represent entrepreneurial universities' attitudes toward knowledge-based investment especially highlighted on people, i.e., human resources from an organizational culture perspective, it demonstrates a positive attitude for institutions knowledge development, as well as promoting the attitude of entrepreneurial growth. The example of Global Entrepreneurship Monitor (GEM) is also investigating to boost their knowledge-based economic development (Kruja (2013); Ghouse et al. (2021); Cunha and Benneworth (2013)).

However, Kirby et al. (2011); Păunescu et al. (2013); and Audretsch and Link (2018a) recognized that there is a possible and coherent link that exists between social responsibility and social entrepreneurship in higher education institutions (HEIs) that are required to be addressed while emphasizing entrepreneurial universities' strategic initiatives and ecosystems. Similarly, entrepreneurial universities' active engagement in regional development can also be seen in commercializing their expertise through spin-offs, patents, and licensing, according to Audretsch and Link (2018b) and Olo et al. (2020). Also, in this way regions gain profit through job creation, spin-offs, knowledge spillovers, and the attraction of new talents.

Furthermore, to gain a better understanding of how entrepreneurial universities are assisting HEIs in their knowledge-based economic development, it is required to highlight the example of “NESTA” (Kitson et al., 2009) (displaying innovation setup in UK universities). It has been also observed that nowadays universities have been projecting their consideration significantly and more comprehensively, for conventional exchange of protected innovation of their industry to grow worldwide, and uniting thinking process and practice.

To justify the question of how, why, and what are the major aims of entrepreneurial universities and social innovation in supporting HEIs’ knowledge-based economic development, this research induces us to apprehend the subsequent three crucial research propositions (RPs).

RP1: This research proposition states that entrepreneurial universities’ and social innovation ecosystems’ combined effect on HEIs’ knowledge development strategy is considered to be the most important factor and procedure for building HEIs and innovative capabilities. In the context of the regional knowledge development plan, the knowledge acquisition process of creative institutions has a global impact. So, there is a vibrant role aimed at entrepreneurial universities’ ecosystems and HEIs’ knowledge development attitudes for sustainable development to carry out a systematic study about the entrepreneurial universities’ strategies that mainly focuses on HEIs’ knowledge-based economic development (i.e., *the intrinsic role of entrepreneurial universities and the combined efforts of social innovation policies have a symbiotic impact on socioeconomic improvement. Even though the dynamism of regional knowledge development strategies also has a vibrant effect on entrepreneurial ecosystems, the entrepreneurial discovery process (EDP) creates a smart, inclusive, growth-based entrepreneurship attitude throughout the region.*

RP2: In this research proposition, it demonstrates entrepreneurial universities the right path for knowledge-driven growth and societal engagement that will promote social entrepreneurship (SE) and social innovation (SI). On the other hand, this study also determines entrepreneurial universities’ premeditated role that has a vast impact on HEIs’ knowledge-based regional growth. However, it is an important policy approach of developing regional associations and institutions to induce creative activities that encompass the region with knowledge which is Europe’s future prosperity. Mainly it depends on the region’s ability to leverage, and citizens (well-being), i.e., *entrepreneurial universities’ inclusion and social innovation ecosystems are critical for achieving millennium development objectives and sustainable development goals that encourage the growth of social enterprises.*

RP3: This argument emphasized the dual perspective of entrepreneurial universities’ strategic ambitions and regional innovation plans, which encouraged regional knowledge-based economic development. On the other hand, the social innovation system’s dynamic capabilities their priorities, elements, and fundamental aspects also play an important role (which is based on the opinion of the different countries’ academic experts as well as the EU framework), since both notions, namely, the positive impact of entrepreneurial universities and the prospective priorities of social innovation strategies, have provided a comparative overview of higher education institutions’ activities on entrepreneurial ecosystems and growth-oriented

entrepreneurship development. Therefore, it's far assumed *that the high-performing entrepreneurial universities' value-added activities will inspire higher education institutions and creative regions to achieve sustainable development goals (i.e., to achieve a competitive advantage by establishing entrepreneurial universities that improve knowledge production) (entrepreneurial learning).*

This chapter confers about the significant benefits that the entrepreneurial universities will acquire in association with the social innovation process, which influences the entrepreneurial universities' *formal, informal factors, resources, and capabilities* in order to enhance knowledge-based economic development. The following research proposition statements were formulated in the context of numerous researchers (Benneworth and Cunha, 2015; Biggeri et al., 2018; Audretsch and Link, 2018a, 2018b; Baporikar, 2019) as well as other eminent researchers (Benneworth and Cunha, 2015; Biggeri et al., 2018; Audretsch and Link, 2018a, 2018b; Baporikar, 2019) and other eminent researchers:

- RP1: Enable the identification of new business prospects and the enhancement of knowledge development capability, human resource development capability, and overall regional economic development capability
- RP2: Enhance university-business/external knowledge exchange partnerships
- RP3: Increase HEI globalization and value co-creation in society

Therefore, the consequence of this study represents that entrepreneurial universities play a crucial role in spreading and widening the twinning perspective of HEIs' innovative capabilities and societal development that fosters knowledge-based economic development.

5 Recommendations and Conclusion

Based on our previous discussion this study revealed that HEIs' knowledge development approaches include a number of powerful mechanisms that foster an entrepreneurial mindset by providing the right leaders, selecting appropriate members of governing bodies and senior administrators of HEIs to accelerate regional governance (i.e., to encourage and stimulate industrial competitiveness within the region through entrepreneurial learning and enhancing institutional innovation), and attracting an entrepreneurial spirit and ecosystem through internationalization of SMEs. Last but not least, this chapter's main revelations are as follows: entrepreneurial universities' deliberated efforts and higher education institutions' knowledge production approach play a significant influence in enhancing knowledge-driven innovation and community innovation system that enable to sustain knowledge-based economic growth. Additionally, this chapter also confers significant benefits that the entrepreneurial universities will acquire in association with the social innovation process, which influences the entrepreneurial universities' *formal, informal factors, resources, and capabilities* in order to enhance HEI's knowledge-based economic development, though some intervention may occur, which restricts the

entrepreneurial activity that encourages their participation in the modern knowledge economy.

From an implication's point of view, this chapter is a pragmatic literature review, and thus it is partially limited to discuss the relative approaches of entrepreneurial ecosystems and social innovation ecosystems that debate HEIs' innovation and knowledge-driven economic growth. It is not merely enough for academics, policymakers, and social innovators to come together and resolve the socioeconomic impacts that stimulate knowledge-based economic development.

From the practical implications, academic perspectives, and social dimensions' point of view as well as future expectations' point of view, it is essential to mention that, practically, this chapter may provide some interesting insights and suggestions for those seeking to increase universities' contributions to a knowledge-based economy with the emergence of social innovative process that fosters social entrepreneurship.

Academically, this conceptual chapter might also additionally inspire the young generations to move for better research on entrepreneurial and social innovation ecosystems and expand an entrepreneurial thought setup for social change.

Socially, this chapter should empower current HEIs and their universities to make a critical contribution to satisfy the societal demanding via universities' multidisciplinary teaching and study activities. Henceforth, it can be understood that the perception of entrepreneurial universities' HEI's regional knowledge spillover strategy has been observed as an important strategic initiative that relates HEI's knowledge development process through social innovation ecosystems and entrepreneurial ecosystems. Briefly, it may be stated that an entrepreneurial university's formal elements (i.e., capitalization of know-how, interdependence with the enterprise and government, independence with different institutional spheres, hybrid professional HEIs' forms, and renovation of high-skilled manpower) additionally play a critical position in accelerating regional knowledge spillover process. More specifically, it can be said that this thematic chapter has mainly demonstrated entrepreneurial ecosystems and social innovation ecosystem's influence on regional knowledge-based economic growth.

In addition, also from the future research perspective point of view, this research recommended that the presence of initiative leaders' authoritative decision-making skills in HEIs will nurture innovation through implementing industrial competitiveness, enhancing regional knowledge production within the region, and solving problems that arise among higher education institutions either for proper access to education or for improving the quality of education, the social innovation system and/or process that contains some powerful instruments that encourage researchers, policymakers, and young generations to have an innovative mindset. Thus, in a nutshell, it can be speculated that the existing knowledge spillover within the institutions has influenced the creation of new knowledge and cross-disciplinary areas of research. It empowers regional small firms and HEIs to cope with economic, social, and industrial challenges. In this chapter authors mainly explore the impact of entrepreneurial universities' ecosystems, boosting HEIs' knowledge development process and knowledge spillovers and encouraging social innovation. Additionally,

it is essential to highlight that current research on entrepreneurial universities' dynamic capabilities and emerging approaches have coined considerable attention due to its key enabling inspirations that facilitate HEIs and small firms (SMEs) to meet the socioeconomic development and regional sustainable development goals.

Furthermore, from the HEIs' regional knowledge-based economic development point of view, this new instrument of upcoming regional innovation strategy (RIS) will attempt to address economically critical issues from regions from different least developed countries (LCD) or developed countries (DC) and underdeveloped countries (UDC) nationally as well as internationally. Therefore, it is expected that regional policymakers, academicians, industrialists, and entrepreneurs will provide extra attention, especially for the benefit of regional science, regional economic geography, and regional economic sociology, and expand the international business opportunities for future generations through HEI's initiatives and promotional activities. As a result, the implementation of entrepreneurial spirit, the regional development strategy will remove impediments to globalization, due to the prominence of entrepreneurial universities, i.e., HEIs, innovation-driven regional knowledge-based economic development, and societal development. Therefore, it can be assumed that this *regional knowledge development strategy and entrepreneurial university's strategic* initiatives will have the potential benefit of enhancing sustainable regional economic constancy.

Furthermore, the analysis revealed that both activities, to some extent, have global relevance. To confront global difficulties, nowadays the role of HEI's entrepreneurial discovery process will not only facilitate regional knowledge spillover, but it will also enable and facilitate to determine and combine the best feasible path forward, i.e., how regions may strengthen their present resources' competitiveness while also creating social value in this changing world. According to the findings of this study, implementing entrepreneurial universities' dynamic capabilities and knowledge-inclusive perspectives may be a more challenging and sophisticated approach. Therefore, from the regional economic development point of view, nowadays, this approach is fascinating to most of the promising HEIs of EU member countries.

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Cultivating the Impact of Sustainable Entrepreneurship: A Discussion of Upscaling Approaches in Entrepreneurial Ecosystems



Kristin Krebs, Christine Volkmann, and Marc Grünhagen

Abstract There is substantial knowledge about the peculiarities of founding entrepreneurial ventures in general. However, comparatively little is known so far about the characteristics of establishing sustainable ventures aiming at solving ecological or social problems in society. It is particularly uncertain how sustainable entrepreneurs could attain a successful upscaling of their venture ideas to expand their impact from a local niche at origin towards reaching broader society-wide impact. At this junction between local niche and the wider societal regime or landscape level, entrepreneurial ecosystems may play a key role in providing instrumental support for sustainable ventures. Entrepreneurial ecosystems offer initial support in the formation of new sustainable ventures but, also later, helping sustainable entrepreneurs in the upscaling of their sustainable venture ideas. In this chapter, we explore how entrepreneurial ecosystems could support the expansion of sustainable ventures and help overcome the barriers and dilemmas for successful sustainability upscaling.

The conceptual chapter discusses selected issues in the upscaling of sustainable ventures in the ecosystem context alongside typical barriers and dilemmas in sustainability upscaling. The contribution attempted in this chapter is to build a bridge between the literature strand on upscaling within sustainable innovation and the discussion of supportive ecosystems in the field of entrepreneurship. For example, we address the composition of ecosystem stakeholders and the importance of keeping a shared sustainability orientation in the ecosystem while integrating diverse stakeholders who provide resources for the upscaling process. The discussion in this chapter is based on reviewing recent literature on the upscaling phenomenon in sustainable innovation as well as on entrepreneurial ecosystems and sustainable entrepreneurship. In particular, we suggest that upscaling in entrepreneurial ecosystems may be understood as an open-ended evolutionary process, with ecosystem networks and stakeholder collaboration providing stable spaces for reflexive discourse and learning.

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1 The Need for Growing Sustainable Entrepreneurship Beyond the Local Niche

At the heart of venturing into a sustainable future, and in light of the urgent need to address climate change and meet other environmental challenges for society constituted in the UN's Sustainable Development Goals and their possible impacts (Pizzi et al., 2020; United Nations, 2015), two strategic thrusts will be key—to act fast and on a broad, ultimately global, scale. Sustainable entrepreneurs and their ventures can contribute substantially to meet these goals (Volkman et al., 2021) by “solving societal and environmental problems through the realization of a successful business [...] and promoting sustainable development through entrepreneurial corporate activities” (Lüdeke-Freund, 2020, p. 667; Schaltegger & Wagner, 2011). At the same time, from an entrepreneurship policy perspective, society should ask how societal stakeholders can support individual sustainable entrepreneurs in their journey to achieve impacts for wider society. Little is known so far as to “how ecosystems can specifically promote sustainable entrepreneurship” (Volkman et al., 2021, p. 1047). A critical step in this endeavour will be for sustainable entrepreneurs and their ventures to grow beyond their local supportive domain at the outset with the help of surrounding immediate regional stakeholders. In this chapter, we will reflect from a theoretical, conceptual perspective on the question:

How could entrepreneurial ecosystems support the expansion of sustainable ventures and help overcome the barriers and dilemmas for successful sustainability upscaling?

Considering the above research question, this chapter aims at bridging two strands of literature: first, the discussion of upscaling in the field of sustainable innovation and, second, the discussion of entrepreneurial ecosystem support for sustainable entrepreneurs and their ventures. As sustainable ventures may have to overcome specific barriers and dilemmas in the process of upscaling, it will be fruitful and important to explore how external support by ecosystem stakeholders could help to meet these challenges.

A strong emphasis has been put on how entrepreneurial ideas and ventures come into the world in the first place, and how this could be induced by entrepreneurial ecosystems and their stakeholders. However, beyond orchestrating the initial genesis of good entrepreneurial ideas, the above ecological call to act swiftly and strive for broad impacts requires further attention towards carrying sustainable ventures built on these ideas further into the world. This is since generally “[i]nventions with the potential to create positive ecological and social effects need to leave their niches to turn into effective sustainability innovations” (Lüdeke-Freund, 2020, p. 665; Boons et al., 2013).

Towards this end, sustainability and transition research offers a rich discussion on the phenomenon of upscaling towards society-wide sustainability (e.g. DiVito & Ingen-Housz, 2021; Augenstein et al., 2020; Bento & Fontes, 2021). In this chapter we consider *upscaling* as “an overarching theme embracing a qualitative shift where new ways of doing, thinking, and organizing interfere with the dominant structure and institutional context” (see van den Bosch & Rotmans, 2008, p. 33 and the second section below). In particular, sustainable entrepreneurs and their ventures could develop novel sustainable products, services or production procedures and aim at upscaling these innovations. These innovations and the business opportunities of sustainable entrepreneurs can be furthered by different forms of upscaling: embedding them into an existing socio-spatial context, translating them to another context (e.g. neighbouring regions or countries) and expanding them in size (Von Wirth et al., 2019). In the course of upscaling their ventures alongside these generic forms of upscaling, sustainable entrepreneurs will need to gain acceptance and legitimacy within the regime level (Augenstein et al., 2020; Bento & Fontes, 2021). Typically, there are barriers in this diffusion process from local, sustainable start-up ventures to fully fledged (inter-)national sustainable businesses. Cellina et al. (2018) highlight issues with societal acceptance in this process. Augenstein et al. (2020) highlight further dilemmas surrounding the understanding and communication to arrive at a shared common sense of novel sustainable innovation. In particular, they stress (ibid.) a possible “scaling aversion dilemma” as individuals—be it in civil engagement or sustainable entrepreneurship—may be sceptical of growing an idea or invention of a more sustainable product or service beyond their local domain (e.g. the region they live in).

Stakeholders surrounding individual sustainability inventors and entrepreneurs in regional entrepreneurial ecosystems may play a crucial role in overcoming such barriers in the critical early phase of upscaling (cf. the specific challenges of scaling sustainable entrepreneurship in Sect. 4). This may be, e.g. both by organizing institutional support for novel sustainability venturing and by motivating resource providers to avoid the self-selection of local sustainable entrepreneurs out of growing the impact of their ideas in an aversion to go beyond their protected local niche (e.g. as this may contradict with their initial purpose or as an expansion may necessitate an undesired orientation on aspects of economic and managerial efficiency). *Sustainable entrepreneurial ecosystems* at the regional or local level are domiciled at a critical junction when aiming at a successful upscaling of novel sustainability-oriented ventures as they represent “an interconnected group of actors in a local geographical community committed to sustainable development through the support and facilitation of new sustainable ventures” (O’Shea et al., 2021, p. 1097; Bischoff & Volkmann, 2018; Cohen, 2006).

By their very nature, such ecosystems are primarily concerned with assisting and nurturing sustainable entrepreneurship at their own proximal level. While ecosystems may “manifest on various levels. . . and the boundaries are permeable” (DiVito & Ingen-Housz, 2021, p. 1058), ultimately, sustainable ventures originate from the context of their local or regional ecosystem, which may be considered as a “regional development strategy with the objective of nurturing sustainable new ventures that

create social, environmental, and economic value in a community” (O’Shea et al., 2021, p. 1098). At the same time, helping the sustainable ventures in their ecosystems to grow (even beyond the local community) is also an integral part of the entrepreneurial establishment process. Sustainability research and research on sustainable entrepreneurship need to further explore possible tentative approaches for entrepreneurial ecosystems to contribute to meet the challenges and barriers in the upscaling of sustainable entrepreneurial ventures derived from the springboard of original local support. The chapter will highlight selected starting points for resolving this upscaling challenge in entrepreneurial ecosystems. We discuss different aspects, such as the potential for collaboration with other (inter-)national ecosystems and networks, the composition of stakeholders in the ecosystem who can facilitate upscaling of growing sustainable enterprises beyond initial local start-up support, or the scope for growing the ecosystem as a whole to improve the impact of valuable sustainable ventures.

The remainder of the chapter is structured as follows. The second part will briefly introduce the generic process of initial invention, innovative venture formation and further upscaling and growth of sustainable enterprises. This interim part is important for embedding the upscaling process into other concepts of entrepreneurial development such as the generic entrepreneurial process of opportunity recognition, evaluation and exploitation. In particular, for the challenge to grow the impact of sustainable ventures through upscaling, the exploitation phase will be important. Hence, in the third part, we will discuss the nature and barriers (or dilemmas) of upscaling sustainable enterprises embedded in the overall context of sustainable innovation. Because of these upscaling barriers and dilemmas, young sustainable ventures may require external support (e.g. resources and know-how) to grow their impact. One way to think about such a support infrastructure is to consider an ecosystem of external stakeholders to promote sustainable ventures. The fourth section introduces characteristics of entrepreneurial ecosystems relevant for gauging the issues and opportunities to support upscaling sustainable ventures within and beyond these ecosystems in the final part of the chapter.

2 Upscaling Within the Sustainable Entrepreneurial Process

So far, upscaling has been primarily discussed in the context of broader sustainable innovation (cf. Augenstein et al., 2020; DiVito & Ingen-Housz, 2021). Hence, an exploration of upscaling in the more specific domain of sustainable entrepreneurship and surrounding entrepreneurial ecosystems requires further clarification. Generally, upscaling refers to “a qualitative shift where new ways of doing, thinking, organizing interfere with the dominant structure and institutional context of an experiment” (van den Bosch & Rotmans, 2008, p. 33). In the context of sustainable entrepreneurship, this goes beyond solely economic growth and geographical expansion (van

den Bosch & Rotmans, 2008, p. 34f.). Contrarily, upscaling sustainable ventures refers to a diffusion, acceleration or amplification beyond niche experimentation (Augenstein et al., 2020). To demarcate the upscaling of sustainable entrepreneurial ventures from the broader context of sustainable innovation, the nexus between the two phenomena is understood best from a process perspective.

Typically, the emergence of innovation in society is conceived as a generic process of earlier invention (e.g. based on a novel technology), introduction to society as an innovation and subsequent diffusion. Traditionally, venture formation is considered an overall entrepreneurial process of opportunity recognition, evaluation and exploitation (Shane & Venkataraman, 2000) linked to the market logic of the specific product, service or process innovation. For sustainability, the two phenomena of sustainable venturing (as green or social entrepreneurship) and innovation have been linked earlier, e.g. by Schaltegger and Wagner (2011). At the focal actor level, the former is pursued by individual entrepreneurs founding sustainable business ventures, while the scope of the latter is broader, for example, ignited by eco-activists, NGOs, employees of established organizations or within social movements and citizenship involvement. Obviously, the two groups of actors are closely related. Sustainable entrepreneurship may be considered one path of innovative societal change, in this case as initial entry and further scaled growth within the marketplace or society (ibid.). Upscaling, in general sustainable innovation, may be more geared towards reaching a higher impact for social stakeholders and improving societal well-being (DiVito & Ingen-Housz, 2021). Our discussion in this chapter zooms in on approaches towards upscaling as a furthering of sustainability, in particular for social and ecological benefits, through entrepreneurial activities initiated and to be expanded by entrepreneurs and surrounding supportive ecosystem stakeholders (see the next section for a further differentiation of upscaling itself).

At the operational level, the two process thrusts of invention-innovation-diffusion and opportunity recognition-evaluation-exploitation both may evolve in open-ended processes. In their discussion of a convergent process model of sustainable entrepreneurship, Belz and Binder (2017) explore a multiphase process of recognizing a social or ecological problem and subsequent opportunity, the identification of a double, then triple, bottom-line resolution, followed by the market entry with a new sustainable enterprise. In particular, in their study the authors (ibid.) found that social, ecological and economic sustainability dimensions may be taken on board sequentially (rather than all at once) in a process unfolding over time.

Two linkages between these levels seem most important for our discussion in this chapter. First, within this co-evolution, pressing social and ecological problems within a societal domain or regime and subsequent opportunities to be recognized will be acted upon by individual sustainable entrepreneurs at the grassroots level. Second, in the pursuit to enlarge the impact of their opportunities, sustainable entrepreneurs have to tackle the central challenge of upscaling to gain acceptance from surrounding societal institutions and obtain resource support from benevolent immediate ecosystem stakeholders in particular. These stakeholders may team up with individual sustainable entrepreneurs at the local community level at the start,

trying to scale into the wider societal regime to address the social and ecological problems previously identified with a broader impact. This interrelated co-evolutionary perspective of surrounding regime context to be made more sustainable through upscaling by individual sustainable entrepreneurs and supporting stakeholders will also be suggested as a fruitful avenue for further research at the end of this chapter. In the following two sections, we will introduce sustainability upscaling more specifically and highlight the characteristics of (sustainable) entrepreneurial ecosystems as the arena in which upscaling attempts of sustainable entrepreneurs will unfold.

3 The Upscaling Challenge: Characteristics and Barriers of Upscaling Sustainable Enterprises

To maximize their positive social and ecological impact, sustainable enterprises have to take the leap from niche to mainstream. Within the entrepreneurship context, upscaling refers to the maximization of purely economic concerns, such as profit and market share. However, sustainable enterprises see their purpose in contributing to global sustainable development (Schaltegger & Wagner, 2011). Hence, a solely business-focused approach to upscaling does not apply to the context of sustainable entrepreneurship; therefore, the process and dilemmas of scaling sustainable entrepreneurship require further investigation.

3.1 Upscaling of Sustainable Entrepreneurship from a Transition Perspective

Sustainability and transition research offer a rich discussion on the phenomenon of upscaling towards society-wide sustainability (e.g. DiVito & Ingen-Housz, 2021; Augenstein et al., 2020; Bento & Fontes, 2021). The business models and opportunities of sustainable entrepreneurs can be promoted by embedding them into an existing socio-spatial context, translating them to another context (e.g. neighbouring regions or countries) or scaling them in size (Von Wirth et al., 2019). These modes of upscaling face the need to gain acceptance and legitimacy beyond the initially protected niche they originated from (Augenstein et al., 2020; Bento & Fontes, 2021).

In these options for scaling, sustainable entrepreneurship often challenges the logic of the market system and seeks to offer alternative approaches (Palzkill & Augenstein, 2021). Generally, enterprises can intend to achieve a balance between adaptation to existing structures, for the purpose of scaling up within existing markets to establish sustainable alternatives in the system from within (Wells, 2016, p. 5). Nonetheless, in practice, entrepreneurs often feel like they are risking

a compromise of their own sustainable values, leading them to avoid upscaling and keep their sustainability-oriented organizations relatively small (Hockerts & Wüstenhagen, 2010, p. 487). As upscaling refers to a path of change outside the niche to the regime level within the multilevel perspective on system transitions, this offers a crucial background on the discussion of upscaling sustainable ventures. The multilevel perspective conceptualizes the transition of sociotechnical systems as a complex and profound process of change across various levels (Geels, 2011). System transitions are understood as “major, non-linear changes in societal cultures, structures and practices [...] that arise from the coevolution between economy, society and ecology” (Loorbach & Wijsman, 2013, p. 22). Sociotechnical systems are divided into three levels (landscape, regime, niche), each defined by a different degree of structuration, meaning the degree to which actors are bound by dominant structures (Geels, 2011; O’Shea et al., 2021). There have also been attempts to integrate sustainable entrepreneurship into the multilevel perspective, concluding that sustainable entrepreneurs could be key actors in sustainability transitions (i.e. Hörisch, 2015; Schaltegger et al., 2016; Wells, 2016). Nonetheless, the role of business in societal transitions requires further exploration, especially with attention being paid to firm size (Loorbach & Wijsman, 2013, p. 27). Generally, Hockerts and Wüstenhagen find that smaller, less established businesses are more likely to “pursue sustainability related opportunities” (Hockerts & Wüstenhagen, 2010, p. 481). As entrepreneurs do not need to fear destroying their own, established business models, they can exert pressure on incumbents by creating radical sustainability-oriented innovations (Hörisch, 2015). As sustainable entrepreneurs can oftentimes be characterized as idealists, they set high sustainability standards and experience high levels of credibility (Hockerts & Wüstenhagen, 2010). Currently, most sustainable enterprises find themselves on the niche level, where they take on the crucial role of pioneering sustainability transitions, wanting to expand into the regime and ultimately the landscape level (Hockerts & Wüstenhagen, 2010; Geels, 2011). However, they face barriers in this diffusion process from local, sustainable start-up ventures to fully fledged (inter-)national sustainable businesses.

3.2 *Upscaling Dilemmas*

According to Wesseling et al. (2020) and Huijben et al. (2016), niches may scale up and try to become a part of the regime through a “fit and conform” approach within the space of given structures. Alternatively, they can aim to “stretch and transform” the given space by establishing their own alternative values and logics (Huijben et al., 2016, p. 2). Both approaches are deemed as promising, especially in the context of landscape pressure, where sustainable entrepreneurs offer a new solution (Wesseling et al., 2020, p. 156). Sustainability-oriented entrepreneurs are often confronted with a trade-off between opportunities to scale them from the niche and the radicality of their activities and when there is a lack of landscape pressure (Smith & Raven, 2012, p. 1030). Hence, it is crucial for sustainable ventures

operating at a niche level to find a productive way to deal with this dilemma (Palzkill & Augenstein, 2021).

In the protected niche exist different logics than on the regime or landscape level. How can sustainable enterprises persist in a market- and profit-oriented regime while following different logics and eventually contributing to sustainable systemic change? The challenges associated with upscaling efforts of sustainable ventures can be categorized as a fundamental dilemma (Augenstein et al., 2020; Augenstein, Palzkill et al., 2020). Common barriers leading to the failure of sustainable ventures are a lack of vision and ambition in regulation, the dominance of large, incumbent firms that act in closed networks as well as old routines and beliefs among business actors (Klein Woolthuis, 2010). From a business perspective, Cellina et al. (2018) stress particular problems with societal acceptance in this innovative change, for instance, low stakeholder and institutional receptiveness or “sticky” traditional ways of doing things and resource deployment lock-ins. Augenstein et al. have identified three dilemmas concerning the upscaling process of sustainable niches from a transitions perspective (2020):

1. The *Babylon dilemma*, which refers to challenges of inter- and transdisciplinary knowledge integration
2. The *simplification dilemma*, highlighting how an oversimplified interpretation of transition processes can be harmful
3. The *scaling-aversion dilemma*, describing a hesitation to scale by innovative actors (e.g. sustainable entrepreneurs or activists) themselves

With regard to sustainable ventures, entrepreneurial ecosystems could provide a potential environment to overcome upscaling challenges, since networks and capacity building are critical in this context.

4 The Potential Role of Entrepreneurial Ecosystems

Having discussed the nature of upscaling the business ideas and ventures of sustainable entrepreneurs, we next introduce the ecosystem context in which the process of establishing and upscaling sustainable ventures is embedded. Generally, an entrepreneurial ecosystem is “a dynamic community of interdependent actors [...] and system-level institutional, informational, and socioeconomic contexts” (Audretsch & Belitski, 2017, p. 4). Typical elements of entrepreneurial ecosystems directed at the support of new ventures are, e.g. social networks of actors (who may provide resources and knowledge), physical and financial resources as well as human capital and knowledge (available to the resource base of sustainable ventures) or means of consumption (demand for sustainable products and services) and entrepreneurial outputs (new ventures or corporate entrepreneurial activity) (Stam & Van de Ven, 2021; Kansheba & Wald, 2020).

4.1 Entrepreneurial Ecosystems in the Context of Sustainable Entrepreneurship

Within the universe of entrepreneurial ecosystems, entrepreneurial ecosystems have been characterized above as those groups of community actors supporting sustainable ventures and development (O’Shea et al., 2021). For example, O’Shea et al. (2021) discuss a sustainable ecosystem in Helsinki, Finland, aiming at replacing non (or less) sustainable materials (e.g. plastic or cotton) with novel cellulose-based products in existing industries. Such efforts of sustainable entrepreneurship focal in these ecosystems generally envision the creation of “future goods and services that sustain the natural and/or communal environment and provide development gain for others” (Patzelt & Shepherd, 2011, p. 632). In contexts of industry innovation like in the example above, typically, sustainable entrepreneurs have to balance complex trade-offs between socioecological and economic sustainability (DiVito & Ingen-Housz, 2021; Hahn et al., 2015). Principally, in the face of such trade-offs when competing against existing non-sustainable businesses, the recognition and exploitation of sustainable business opportunities may be comparatively more complex and challenging (Patzelt & Shepherd, 2011; also see the discussion of additional challenges in terms of gaining acceptance and acquiring resources faced by sustainable entrepreneurs further below). At the same time, sustainable (and other) entrepreneurs cannot build their ventures independently in isolation from the resource provision and support of external stakeholders (Schaltegger & Wagner, 2011; Stam & Van de Ven, 2021). Considering the importance of entrepreneurial context (Volkman et al., 2021; Pankov et al., 2021; Welter et al., 2019) beyond personality-based entrepreneurship (Stam & Van de Ven, 2021), the issue of suitable forms of tailored support for sustainable entrepreneurs in entrepreneurial ecosystems (Bischoff, 2021) is pivotal.

4.2 Challenges of Sustainable Entrepreneurship

On the one hand, it has been supposed that challenging and uncertain entrepreneurship may grow in traditional entrepreneurial ecosystems in general with beneficial flows of resources and knowledge between actors (Kuratko et al., 2017). However, on the other hand, the functioning of specific ecosystem support for sustainable entrepreneurship is still unclear (Volkman et al., 2021; Fichter et al., 2016). DiVito and Ingen-Housz (2021, p. 1058) reason that “sustainable entrepreneurs may require different ecosystems where actors interact and provide support in significantly different ways than in traditional entrepreneurial ecosystems” (also cf. Neumeyer et al., 2019). For the discussion of approaches to support the upscaling in the context of entrepreneurial ecosystems for future research, it seems most suitable to further explore the principal challenges faced by sustainable entrepreneurs. This is at the heart of establishing and growing their ventures beyond their initial niche in

interaction within their local ecosystem. To provide adequate support, entrepreneurial ecosystems will have to assist sustainable entrepreneurs in tackling a range of potential challenges different from productive for-profit entrepreneurship:

- Long-time horizon towards establishment and institutionalization of sustainable ventures: sustainable entrepreneurs aim to solve “grand societal issues —for example, climate change, water preservation and poverty (DiVito & Ingen-Housz, 2021, p. 1064). Providing entrepreneurial responses to these millennium problems by developing and establishing sustainable goods and services takes particular time. This may require long-term relationships in ecosystem networks with other stakeholders, including other firms alongside changing value chains (ibid.). Principally, the route to institutionalizing novel sustainable approaches that may transform industries or other societal domains may be very long. And it requires gaining acceptance beyond the initial ecosystem niche where a sustainable solution for an ecological problem has emerged and where initial interaction with community stakeholders may provide initial benevolent legitimacy (Kuratko et al., 2017).
- Entrepreneurial process of establishing sustainable ventures requires different actors: the process of recognizing, evaluating and exploiting sustainable business opportunities features different stages. In the latter exploitation stage, entrepreneurial (or even managerial) actor mindsets may play an important role in organizing and expanding sustainable ventures within an ecosystem (Kansheba & Wald, 2020). Earlier on, the discovery of sustainable opportunities may be triggered by “recognizing an a priori social or ecological problem” (O’Shea et al., 2021, p. 1098; cf. Belz & Binder, 2017). At this initial stage, activist groups may be important to raise an ecological problem in the first place upon which later technological, entrepreneurial and managerial efforts to invent and market sustainable products or services may come into play. During technical invention and entrepreneurial market entry, founders of sustainable ventures may encounter additional regulatory complexity when establishing sustainable manufacturing procedures. Overall, “the recognition and exploitation of sustainability opportunities may require different actors —those that highlight the issues, those that invent alternative products or materials and those that take entrepreneurial action” (DiVito & Ingen-Housz, 2021, 1064). For a functioning (sustainable) entrepreneurial ecosystem supporting the entire entrepreneurial process, many different and heterogeneous players will likely have to come together with sometimes diverging interests.
- Dispersion of benefits and outcomes of sustainable entrepreneurship: in sustainable entrepreneurship, outputs may be spread more widely with comparatively more collective benefits for society. These external effects make it harder for sustainable entrepreneurs to internalize the value of the innovations they have made (York & Venkataraman, 2010). In consequence, sustainable entrepreneurs may face additional barriers to attracting external financing (DiVito & Ingen-Housz, 2021) and more difficulties in their long-term market establishment when competing with non-sustainable businesses (York & Venkataraman, 2010).

4.3 Conditional Aspects of (Sustainable) Entrepreneurial Ecosystems

The agenda of entrepreneurial ecosystems to support sustainable ventures and their entrepreneurs may unfold alongside the above principal challenges. Supposedly, most of these challenges and the further issues that result from them in the task to build sustainable ventures may also play a role when it comes to growing these ventures by scaling their impacts in society. During such upscaling, sustainable entrepreneurs and their ecosystems may also have to overcome the specific barriers discussed in chapter three above. At the same time, generic elements or conditional aspects of sustainable entrepreneurial ecosystems offer starting points for developing specific forms of support for growing sustainable ventures striving to balance the pursuit of ecological, social and economic value creation (Klofsten et al., 2016). In their discussion of the composition of functional, entrepreneurial ecosystems, DiVito and Ingen-Housz (2021) put forth the following conditional aspects fuelled by an array of interrelated ecosystem elements (Stam & Van de Ven, 2021). These conditional aspects also differentiate sustainable entrepreneurial ecosystems from traditional entrepreneurial ecosystems:

- Sustainability orientation of actors: While many different actors may be required to propel sustainable venture creation as reflected in the challenges of sustainable entrepreneurship introduced above, a potential catalyst to enduring support of sustainable entrepreneurs may be a shared motivation for sustainability by ecosystem stakeholders. O’Shea et al. (2021, p. 1099) found that a “shared wish for sustainability and a supporting emotional climate enables the collective creation not only of new knowledge but also of socio-ecologically impactful business, and hence, such communities are meta-enablers for a sustained engagement with the ecosystem beyond an individual’s efforts at venture creation”.
- Recognition of sustainable opportunities and resource mobilization: Such a common agenda of stakeholders’ sustainability orientation to address pressing ecological sustainability issues to make a targeted aspect of community life more sustainable might also be the anchor, not only for disseminating the importance of these issues but also for mobilizing and assembling resources to develop solutions and bringing them to bear in society and the marketplace. Such sources of potential resource support will also have to be considered when sounding out possibilities for further increasing the impact of sustainable ventures through upscaling. This is since it will require prolonged resource acquisition for sustainable venture projects to expand beyond their original community ecosystem.
- Collaborative innovation of sustainability opportunities: A further potential force of entrepreneurial ecosystems at the local community level may be the scope to co-operate across different sustainable ventures and other sustainable development initiatives with stakeholders supporting various sustainability projects in the network.

- **Markets for sustainable goods and services:** For sustainable entrepreneurship, in particular, ecosystem communities may serve as an initial springboard or showcase of demand for products and services rooting from sustainable venturing (York & Venkataraman, 2010). Such demand volumes may both support further experimentation with adequate designs and production procedures before future expansion and help build a viable showcase when targeting additional geographical target groups and convince societal institutions in the course of upscaling and transformation.

These integral conditional aspects suggested recently by DiVito and Ingen-Housz (2021) may assist sustainable entrepreneurs in different parts of sustainable development from initial agenda setting of novel ecological and sustainability issues across interim steps of founding and crafting an initial resource base for ventures to developing sustainable product and service solutions. In addition, however, these conditional ingredients may also be considered potential entry points to support sustainable entrepreneurs towards future growth and scaling beyond initial establishment. This is the central concern of this chapter. In the literature on entrepreneurial ecosystems, so far the discussion about entrepreneurial ecosystems has mainly centred around supporting the early-stage formation of ventures (rather than their later expansion and growth). And where expansion has been considered, this has been mainly done from the perspective of economics. In this perspective, the literature has mainly looked at business growth of ventures in the marketplace but not through the lens of expanding the impact of sustainable ventures and their ideas in society through upscaling. In the next section, we will therefore delve further into our discussion of supporting and orchestrating upscaling of sustainable entrepreneurship in the ecosystem context. This discussion will address different approaches alongside potential barriers and dilemmas to upscaling and the possible challenges faced by sustainable entrepreneurs introduced in the previous sections above in correspondence with the conditional aspects of sustainable ecosystems just highlighted.

5 The Scope for Supporting Upscaling of Sustainable Entrepreneurship Beyond Regional Entrepreneurial Ecosystems

Within the broader society, ideas or inventions for more sustainability may be introduced and scaled from social movements such as eco-activist groups or civil involvement activities in communities. As such, these activities may be embedded genuinely in a more prosocial context to solve environmental and other problems for society. In comparison, upscaling derived from sustainable entrepreneurial venture projects may be geared more towards introducing sustainability in an economic market logic format. This may have important implications for upscaling in entrepreneurial ecosystems, e.g. concerning the characteristics of external stakeholder

support and perceptions of capturing societal versus individual benefits from sustainable entrepreneurial activities (cf. DiVito & Ingen-Housz, 2021). Overall, the discussion of upscaling dilemmas as well as the typical challenges faced by sustainable entrepreneurs has shown that scaling the impact of sustainable ventures may be quite difficult. In similarity to sustainability scaling from naturally social or ecological activism in the niche, sustainable entrepreneurship will also require a stable space (cf. Augenstein et al., 2020) for—in this case, entrepreneurial—experimentation and learning at the local ecosystem level. Apart from the few born global start-ups, also in entrepreneurship, most venture projects, including sustainability-oriented start-ups, start small at the community level (Stam & Van de Ven, 2021) and will be anchored in a local support system. And any substantial growth will also imply moving outside the local supportive niche. As difficult a task as this may be in the end, entrepreneurial ecosystems at the local or regional level will be a natural starting point for sustainable ventures to pursue further upscaling to increase their impact.

The trade-off between impact and profit or more abstractly radicality and conformity poses the ultimate upscaling barrier (Smith & Raven, 2012). In order to tackle this overarching dilemma and avoid trade-offs, especially regarding impact and profit, a transformation at the regime and landscape level is needed. A purely local or regional-focused ecosystem will not be able to achieve this kind of transition while operating in the niche. Hence, some ecosystems will become independent from local or physical boundaries and expand to a national or international level (DiVito & Ingen-Housz, 2021). Some ecosystems have produced independent initiatives working on a higher level to ultimately support actors coming out of the niche. The Purpose Initiative is one successful example for this development. It aims to promote “steward-ownership”, a new kind of legal entity, which promises to enable enterprises to preserve their purpose even when growing outside their niche (for further information see <https://purpose-economy.org/>).

Augenstein et al. argue that to address dilemmas of upscaling, research and practice should more explicitly focus on the creation and stabilization of spaces for reflexive learning and critical discourse, on network and capacity building (2020). With regard to sustainable ventures, entrepreneurial ecosystems could provide just the right environment to overcome upscaling challenges. Such protected niches provide the space and support system for creating inventions, testing innovations and entrepreneurial experimentation. Sustainable entrepreneurs generally benefit immensely from interacting with each other, underlining the need for collaborative infrastructures (Patzelt & Shepherd, 2011). The Circular Valley in Wuppertal is an example for the creation of a sustainable entrepreneurial ecosystem. The initiative aims to build a supportive environment where sustainable entrepreneurs can develop their ideas in collaboration with stakeholders from business, politics, science and civil society. Ultimately, the goal is to advance the transition towards a circular economy in the Rhine-Ruhr region through entrepreneurial action (for further information see <https://circular-valley.org/>).

Within this upscaling task, sustainable entrepreneurs and their ecosystem stakeholders will encounter the above challenges for sustainable ventures and upscaling

dilemmas along the way against the background of important conditional aspects of sustainable ecosystems (DiVito & Ingen-Housz, 2021). This is in particular for resource mobilization and collaboration between stakeholders including the sustainable ventures themselves as envisioned in the above example of the Circular Valley. Correspondingly, this section discusses the potential role of entrepreneurial ecosystems in upscaling processes alongside the three scaling dilemmas above —the Babylon dilemma and the simplification dilemma (5.1) and the scaling aversion dilemma (5.2).

5.1 The Effect of the Babylon and the Simplification Dilemma on Upscaling in Entrepreneurial Ecosystems

The Babylon and the simplification dilemmas of upscaling are closely interconnected. Both were initially observed in the setting of transdisciplinary research on sustainability transitions (Augenstein et al., 2020). However, there is a case to be made for the appearance and overcoming of these dilemmas regarding upscaling sustainable enterprises in the context of entrepreneurial ecosystems.

Generally speaking, the Babylon dilemma refers to the challenge of understanding the precise meaning of upscaling; hence, its solution requires inter- and transdisciplinary knowledge integration (Augenstein et al., 2020). Since actors and stakeholders in entrepreneurial ecosystems are highly heterogeneous, their individual understandings of the process, purpose and objective of scaling sustainable enterprises are also very likely to vary (Bischoff & Volkmann, 2018).

With regard to the overarching dilemma of navigating the critical mass of conformity and radicalness when scaling from niche to regime and landscape levels, these tensions between different logics are likely to arise also in the context of entrepreneurial ecosystems. This is since entrepreneurs and stakeholders might follow widely diverse logics, which could potentially result in conflicts of interest. As mentioned, upscaling could also be interpreted as a solely market-based growth process. This definition is widely accepted and assumed within the entrepreneurship nexus and entrepreneurial ecosystems. As sustainable entrepreneurs rarely adopt a “growth-only” mindset and are more likely to focus on maximizing their positive impact, their own logics might clash with other actors, who follow traditional economic values. This applies in particular to financial stakeholders such as formal investors who are more likely to follow the maximization of profits as their ultimate goal. Within an entrepreneurial ecosystem, this draws the need for a shared sustainability orientation and a common purpose for the ecosystem. Building this kind of shared vision within an ecosystem, it might be tempting to only include stakeholders with similar values and logics sets. Although helpful in designing a designated protected niche for sustainable entrepreneurs, a homogenous group of stakeholders will unlikely produce the best support system for upscaling outside of the niche. In line with the overarching dilemma of upscaling concerning the tension between

conformity and radicalness, including a diverse group of actors with values ranging from radical niche activist to regime-conforming business angel is most likely to result in a successful upscaling process. A balance of actors following niche, landscape and regime logics will provide a suitable environment for creating disruptive sustainable enterprises.

In order to attempt to overcome the Babylon dilemma, a shared understanding of upscaling sustainable entrepreneurship across the entire ecosystem is needed to a certain extent (DiVito & Ingen-Housz, 2021). However, this does not entail the non-existence of diverting values and logics, as a plurality of understandings is necessary and space for reflexive discourse between actors is needed. Otherwise, the process of upscaling is going to be disturbed by oversimplification. Actors who possess a certain level of transformative literacy and can unite multiple logics become critical in this dilemma (Singer-Brodowski & Schneidewind, 2014), possibly acting as boundary-spanning relationship promoters (see below for the discussion of such promoter roles to support sustainable entrepreneurship). Such boundary-spanning relationship building and communication may also help overcome institutional fragmentation as a typical barrier in upscaling (Cellina et al., 2018).

The simplification dilemma addresses the struggle between clearly defining processes of change by reducing them to more easily understandable concepts and replicable practices on the one hand and the necessity to grasp and embrace their complex nature on the other. Though accepting the intricacy of social change is challenging, innovation and transformation remain unpredictable and uncontrollable and need to be treated as such (Augenstein et al., 2020).

5.2 Approaching the Scaling Aversion Dilemma in Entrepreneurial Ecosystems

The scaling aversion dilemma as a barrier towards upscaling may be critical in particular because it undermines ambitions to scale promising sustainable venture projects right at the micro-level of ecosystem actors. Scaling aversion in the context of entrepreneurial ecosystems may arise in different forms:

- As an aversion of local ecosystem stakeholders critical to the support of scaling sustainable ventures
- Scaling concerns by sustainable entrepreneurs themselves
- Both emerging at the local or regional community level as an aversion to scale beyond the local niche towards a broader regime or even landscape level

Fundamentally, these forms of scepticism towards nurturing sustainable venturing originate from the above principal dilemma to handle the tension between pronounced and sometimes radical entrepreneurial sustainability ideas on the one hand, and requirements to portray conformity to a larger institutional regime, e.g. a

specific regional industry often functioning in a traditionally non-sustainable fashion, on the other (Palzkill & Augenstein, 2021; Sung & Park, 2018). To resolve this tension, Augenstein et al. (2020) suggest establishing learning and discourse spaces such as entrepreneurial ecosystem architectures allowing for experimentation with different resolution paths with regard to the above principal tension. This may be particularly valuable for sustainable entrepreneurship as it is especially difficult to scale into existing economic regime structures such as an established supply chain with standardized product and material flows by showing conformity.

Scaling Aversion of Ecosystem Stakeholders, Including Entrepreneurs

Different stakeholders relevant to sustainable ventures might articulate aversions to support scaling the impact of these ventures. Stakeholders from existing economic regimes following a traditional market logic (e.g. important suppliers and distribution partners or traditional local economic policymakers) may oppose sustainable innovations which interfere with existing economic structures and institutionalized routines. However, other stakeholders with a strong sustainability orientation may be concerned that attempts to scale into and de facto conform to an existing economic regime may deviate too far from the original sustainability purpose. For example, such an ecological dilution as sustainability gets introduced from within a system (Wells, 2016) may be averted, particularly by activist groups or NGOs who do not depend on economic market logic. In view of this problem, it may be imperative for entrepreneurial ecosystems to develop and strengthen a sustainability orientation among participating core stakeholders who aim to build and support sustainable entrepreneurial ventures (O'Shea et al., 2021) as a conditional feature of thematic ecosystems focusing on sustainability (DiVito & Ingen-Housz, 2021). Perhaps such a shared perspective may even be strengthened further by zooming in on a particular sustainability or green technology theme such as promoting specific forms of renewable energy or sustainable materials. Deliberately designed components of entrepreneurial ecosystems could actively select and invite stakeholders who share a principal ecological vision towards a sustainable society. At the same time, it will be required also to take on board further stakeholders who hold essential resources necessary for scaling sustainable ventures.

In addition to concerns about losing one's sustainability focus and original purpose, typically nascent and early-stage entrepreneurs aiming to expand the scope of their ventures worry about a lack of knowledge to run and grow their (sustainable) enterprise and difficulties to assemble an adequate resource base (Krueger, 2003). Because of these characteristic resource challenges and regulatory obstacles, entrepreneurs themselves often self-select out of growing their firms (e.g. in the renewable energy sector; Grünhagen & Berg, 2011) or even abstain from founding a venture as sustainable entrepreneurial intentions fail to manifest in the first place because of concerns that resource acquisition and market entry would be unfeasible (Vuorio et al., 2018).

The critical issue of resource mobilization for sustainable venture opportunities ought to be a genuine ingredient of sustainable entrepreneurial ecosystems within the niche in general (DiVito & Ingen-Housz, 2021). Ecosystems need benevolent stakeholders who favour sustainability solutions, e.g. alongside a shared

sustainability orientation or thematic ecological vision and provide resources to get sustainable entrepreneurs to start up initially. This may account for both material resources such as funding and tacit knowledge sources that flow in local ecosystems with close geographical proximity (DiVito & Ingen-Housz, 2021). In addition, an attentive local ecosystem niche could also fulfil an important function beyond helping entrepreneurs assemble a first resource base (Brush et al., 2001) in that the ecosystem provides a protected niche to build an initial showcase. Such a showcase would be instrumental in showing that the sustainable business ideas of founders do actually work, providing a proof of concept. This may be by stakeholders' offering upfront resources for experimentation or local/ regional markets for innovative product and service offers of sustainable ventures as a conditional aspect of a working sustainable ecosystem (DiVito & Ingen-Housz, 2021). The interaction and resource exchange with ecosystem stakeholders may thus provide a source of legitimization (Patzelt & Shepherd, 2011). Gaining legitimacy is critical for any new organization (Suchman, 1995)—for controversial sustainability ventures or ideas in particular. In this regard, a certain degree of diversity and institutional fragmentation (Cellina et al., 2018) of stakeholders in local entrepreneurial ecosystems may even be functional, since diverse stakeholders may have different interests and expectations towards sustainable ventures allowing entrepreneurs to select those stakeholders who are easier to convince (cf. Suchman, 1995). Acquiring resources for upscaling, i.e. additional to an initial source base operating on a merely small scale at niche level, will likely involve a long-time horizon towards establishment at a higher regime level to address ecological issues like climate and water preservation (DiVito & Ingen-Housz, 2021). For ecosystems, this may necessitate long-term collaboration and network relationships with supportive stakeholders to overcome institutional inertia surrounding adverse traditional stakeholders and non-ecological practices (Cellina et al., 2018).

In sum, the salient challenge of gaining passive acceptance and, more importantly, legitimated active resource support (Suchman, 1995) for a sustainable venture opportunity may result in substantial aversion with regard to a further scaling of sustainable ventures from the perspective of sustainable entrepreneurs or individual supportive stakeholders at the micro-level. However, through the lens of overall ecosystem support, “opportunities are networked, socially constructed occurrences that require coordinated efforts in entrepreneurial ecosystems” (DiVito & Ingen-Housz, 2021, p. 1071). In an ecosystem where stakeholders and entrepreneurs collaborate, actors may jointly develop opportunity confidence (O’Shea et al., 2021) to build and scale sustainable ventures together. The goal is to avoid individual entrepreneurs to refrain from striving for scaling their ideas in a posture of scaling aversion on ground of concerns that any scaling attempt would appear unfeasible with insufficient individual resources. In addition, sustainable entrepreneurs and the stakeholders around them might also have an aversion to crossing the border of their local niches or communities.

5.3 *Aversion to Scale Beyond the Community Niche*

Many initiatives in sustainable entrepreneurship and other forms of civic engagement for sustainability originate bottom-up from recognizing and acting upon identified ecological or social problems at the local community level. For scaling the impact of these initiatives, it will be essential to consider that many entrepreneurs and other stakeholders participating in bringing to life and establishing sustainable ventures may likely not strive for further dissemination towards the regime level or society in general (Augenstein et al., 2020; Pesch et al., 2019; Smith et al., 2014). The reasons for this potential hesitation of individual actors as they self-select out of scaling their ideas beyond the community level are still unclear in transition and sustainability research. For example, actors may have reservations against taking organizational or managerial steps to expand their ventures, including the additional efforts in resources and time this would require or an individual preference to address an ecological issue merely in one's own geographical or cultural niche. One critical aspect that could further contribute to scaling aversion in relation to the economic sustainability initiatives of sustainable ventures may be perceived risks of jeopardizing a sustainable venture's ecological mission and purpose when trying to scale and expand into a larger economic regime dominated by routines of economic cost and production efficiency (Hockerts & Wüstenhagen, 2010). Overall, navigating and reconciling this possible tension between maximizing the sustainability potential of an entrepreneurial idea by sticking to a radical approach and increasing adaptability to an established social-technological economic regime by conforming to established economic regime routines to a larger extent may be particularly difficult for sustainable entrepreneurs.

Entrepreneurial ecosystems around green entrepreneurs may encapsulate scope for support in several ways for sustainable ventures standing at the junction of trying to scale to the regime level or remaining in the local niche. In terms of recruiting members for a local entrepreneurial ecosystem under the roof of a shared sustainability mission as introduced above, it may be instrumental for upscaling to select novel stakeholders who (also) strive for diffusion benefits beyond the niche in addition to seeking purely intrinsic benefits of a sustainability project at the local niche level (cf. Seyfang & Smith, 2007 for these two types of benefits). For example, this could particularly involve stakeholders who would like to combat climate change or global warming at a larger national or global geographical scale. Different types of support stakeholders may be important in cultivating potential diffusion benefits from scaling a sustainable venture idea; and a rich entrepreneurial ecosystem may well involve this breadth of different institutional actors (cf. generally Stam & Van de Ven, 2021). Notably, upscaling initiatives in an entrepreneurial ecosystem could actively take actors from (local/regional/regime level) politics on board (e.g. environmental, economic or innovation policymakers). These stakeholders may act as relationship promoters spanning boundaries and providing access to regime-level institutions for infusing novel sustainability practices within an existing regime (e.g. introducing a more sustainable supply chain practice as a process

innovation). Also, actors from the political domain may serve as power promoters capable of bringing additional resources behind the upscaling moves of sustainable ventures in an ecosystem, or they may contribute to institution building for more sustainability in a specific economic domain (cf. Koch 2005 who discuss the role of different innovation promoters in the context of regional new venture support networks). This deliberate integration of instrumental “stakeholders of scaling support” may also help address typical scaling barriers of insufficient receptiveness by regime institutions and other stakeholders external to the dedicated entrepreneurial ecosystem.

6 The Intersection of Entrepreneurial Ecosystems and Upscaling: Suggestions for Future Research

This chapter strived for opening a discussion on how entrepreneurial ecosystems may support the upscaling challenges of new sustainable ventures. For the exploration of this nexus, it will be pivotal to identify workable paths to successful upscaling and compositions of ecosystem stakeholders that enable to increase the impact of sustainable ventures beyond their original niche. In particular, stakeholder support for sustainable ventures should try to avoid problematic scaling aversion of enthusiastic entrepreneurs and supporters who brought a sustainable opportunity to life in the first place. The individual upscaling path and constellation of functioning support from regional ecosystem stakeholders will likely change in the course of time. In taking such a process perspective towards upscaling, Augenstein et al. (2020, p. 146) make the important suggestion for policymakers to enable the bottom-up “innovativeness of actors to allow greater contingency in future-oriented deliberations and experimentation. . .[to avoid]. . .the dead end into which innovation policy finds itself when action is guided towards instrumentalization and the idea of controlling the emergence and impact of specific alternatives” (also cf. Koch & Grünhagen, 2009).

This type of evolutionary flexibility and openness in approaches also seems advisable in principle to avoid framing oversimplified *ex ante* solutions and overcome the other barriers to upscaling—namely, the Babylon and oversimplification dilemmas—in the context of venturing in entrepreneurial ecosystems. Particularly, this is since there is no common narrative of simple final solutions and ideal-type procedures available yet, neither in upscaling and transition research nor in studies on entrepreneurial ecosystems. The discourse in this chapter pointed at key elements of navigating ecosystem support for sustainable ventures as they try to upscale their ecological ideas. In summation, it will be sensible for supporting ecosystem stakeholders to:

- Not only offer support during the founding stage of sustainable ventures (which traditionally is a primary focus of entrepreneurial ecosystems) but also provide assistance during subsequent steps in the upscaling process

- Actively address the typical challenges and dilemmas faced by sustainable entrepreneurs during upscaling
- Embrace non-economic approaches to expand and promote sustainable ventures beyond traditional economic growth strategies (e.g. via collaboration with other interregional or national ecosystems or by leasing with political institutions offering scope for further regime-wide diffusion)

These key elements offer ample opportunities for future research. For improving our understanding of the particularities of challenges and how they may be tackled in sustainability upscaling from entrepreneurial ventures, we suggest to further explore, e.g. the attitudes and underpinning belief structures of both focal sustainable entrepreneurs and those of immediate supporting stakeholders (especially those that may provide vital resources and knowledge for upscaling) in terms of potential scaling aversions. This could be studied empirically alongside the above constructs of feasibility (do we have sufficient resources and knowledge to (up)scale the impact of a sustainable venture?) and desirability (do we want to (up)scale beyond our local niche?). Improving our knowledge on the attitudes of sustainable entrepreneurs and stakeholders with regard to upscaling would also benefit our understanding of the critical scaling-aversion dilemma. Overall, more empirical research on the upscaling dilemmas and their role in entrepreneurial ecosystems is necessary. Towards this end, inter- and transdisciplinary research should study the effects of these dilemmas from various perspectives such as stakeholder collaboration and networks, as well as capacity building.

In the absence of clear-cut upscaling paths and established ideal-type upscaling models, Augenstein et al. (2020) rightly call for a more reflexive and pluralistic stance towards understanding and learning how to scale sustainability initiatives successfully (be it from civil engagement or entrepreneurship). In practice, this necessitates appreciating the particularities of the original niche from which these initiatives evolve as well as considering the characteristics of the broader scale regime level and how the two are perceived by the ecosystem stakeholders in the driver seat of the upscaling process. One way to take a more open, learning-oriented stance may be the approach of translocal learning networks (Loorbach et al., 2020). Such networks would be dually anchored to integrate the specificities of the local niche at origin and to go beyond towards the regime level in a kind of translocal diffusion of sustainability ideas. This would function together with a network of external actors who operate on a larger national or even international scale (for instance the “SEA Social Entrepreneurship Academy” may function as such network platforms to increase the impact of collaborating local niche initiatives; for further information see <https://seakademie.org/>). In terms of upscaling, such networks may complement the potential of corresponding local, community-based entrepreneurial ecosystems and serve as “meta-enablers for a sustained engagement . . . beyond an individual’s efforts at venture creation” (O’Shea et al., 2021, p. 1099).

Generally, furthering the collaboration and connection between transition and entrepreneurship research appears to be highly promising. Transition research in the field of sustainable innovation focuses on the specifics of multilevel regime changes

as novel sustainable problem solutions (e.g. more ecological production procedures in an industry) struggle to change existing (non-sustainable) approaches ranging from an initial niche solution across the regime towards the landscape level. Sustainable entrepreneurs and their ventures may provide important impulses to such sustainable innovation. However sustainable entrepreneurs face critical upscaling challenges as they strive to move beyond their initial niche. Especially regarding sustainable and institutional entrepreneurship, perspectives on transitions and transformation can be expected to be beneficial for understanding the role of entrepreneurs in change processes and “transformational entrepreneurship”. In these transformations it will be challenging for sustainable ecosystems to build and maintain a clear sustainability orientation, as well as the stakeholder relationships required throughout the long-time horizon to scale sustainable ventures. With regard to these specific challenges in entrepreneurial ecosystems, a transition approach, like learning from living labs for sustainable initiatives, is deemed fruitful. Seeing entrepreneurial ecosystems as an evolutionary construct (Stam & Van de Ven, 2021; O’Shea et al., 2021) and creating spaces for reflexive discourse could help overcome barriers and challenges.

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