Transdisciplinary multistage system modeling: migrant entrepreneurship in the digital economy

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Abstract

Purpose – The dynamics of modern life lead to societal changes that affect innovation systems. Entrepreneurship is an important driver for fostering adaptive capacities of innovation systems in such uncertain and complex environments. This study aims to gain a detailed understanding of how (innovative) entrepreneurship can promote innovation systems, leading to more sustainable societies. A particular focus is placed on migrant entrepreneurship in the digital economy, as a concrete implication of innovative entrepreneurship, and its role within the Austrian innovation system.

Design/methodology/approach – In order to develop a shared system understanding from a scientific and practical perspective, transdisciplinary multistage system modeling was applied. The transdisciplinary discourse involved 14 experts, and several system models were iteratively co-created during the course of the research.

Findings – The main result demonstrates the interrelationship between the innovation system and migrant entrepreneurship in the digital economy, which includes six core reinforcing loops: (1) the mindsets of entrepreneurs, (2) the role of international collaboration, (3) the role of entrepreneurial education, the financial sphere in regard to (4) government and (5) private funding, as well as (6) the impact of formal procedures.

Originality/value – The authors present and discuss the relational dynamics of this complex phenomenon as well as the applied transdisciplinary approach, with the aim of identifying a potential way to improve the sustainable impact of (migrant) entrepreneurship considering the case of the Austrian innovation system.

Keywords Innovation systems, System modeling, Causal loop diagrams, Transdisciplinary approach, Knowledge integration, Digitalization, Sustainability implications, Migrant entrepreneurship

Paper type Research paper

1. Introduction

The increasing dynamics of modern life and multidimensional societal changes including past and current crises lead to higher levels of uncertainty and complexity (see concepts of

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transformations and transitions in, e.g. Hölscher *et al.*, 2018; Olsson *et al.*, 2014). Innovation systems and their adaptive capacity to respond to emerging needs become crucial factors for the viability of societies. Fostering learning capabilities of individuals, organizations, as well as regions, innovation systems can enable initiatives for coping with complex problems and challenges caused by societal changes (see Lundvall, 1985, 2010; Lundvall *et al.*, 2002).

An important role in the promotion and implementation of innovative advancements is provided by entrepreneurship, in which new business models attempt to satisfy emerging needs in the market (Lindholm-Dahlstrand *et al.*, 2019). Conceptual approaches toward entrepreneurs, which particularly consider personality traits, risk attitudes, motivations, etc. (see Kerr *et al.*, 2017), allow for a better understanding of *individual* patterns and their impacts on business-development paths. However, they do not provide a *system-based view* of how entrepreneurship is embedded in a broader context of innovation systems, and particularly how this can reinforce their adaptive capacities, which have an impact on sustainability (see in Laws *et al.*, 2004).

A fundamental societal change can be observed in digital transformations, which generate new challenges and opportunities in the context of innovation systems. For instance, new business ideas induced by digitalization (see, e.g. Bouwman *et al.*, 2018; Li, 2020; Loonam *et al.*, 2018; Nambisan, 2017) may foster innovation systems in exploring new market niches and thereby addressing complex societal challenges. *Digital entrepreneurship* as a multi-faceted phenomenon (see Satalkina and Steiner, 2020a, 2020b) opens a variety of new avenues that remain to be discovered and utilized. In a globalized world, this requires different ways of observing and understanding the market to identify and exploit emerging entrepreneurial opportunities. This leads to a more inclusive economic sector, in which a diversity of entrepreneurs and innovative (and sustainable) business models are needed. Migrants, i.e. persons who are according to the UN definitions originally born in a different country as the one in which they currently live [1], bring at least a culturally different understanding compared to persons born in the country they live in. In the case of *migrant entrepreneurship* (see Baycan-Levent and Nijkamp, 2009; Collins, 2003; Dabić *et al.*, 2020; Hunt and Gauthier-Loiselle, 2010; Kloosterman and Rath, 2001; Kratzmann and Hartl, 2019; Zubair and Brzozowski, 2018), cultural diversity, different mindsets and competences reveal new niches for such business opportunities, which would probably not be discovered by local entrepreneurs (OECD and European Union, 2019).

Although diversity is desirable from the perspective of innovation systems, it also brings potential barriers in addition to the beneficial effects outlined above. To deeply understand the relevant factors of the innovation system in the context of integrating culturally diverse entrepreneurs, a systemic approach is needed that takes into consideration political, cultural, economic and social aspects to name just a few. Such a holistic approach requires the knowledge and experience of various concerned stakeholders, including experts in science *and* practice. The overall goal of this paper is therefore both to analyze the innovation system as well as to apply and reflect on a specific transdisciplinary approach.

First, we aim to better understand how (culturally) different entrepreneurship patterns are integrated into a specific local innovation system. Here, we take an emphasis on the phenomenon of *migrant entrepreneurship in the digital economy* (MDE) that affects the whole innovation system. Second, we investigate how the knowledge exchange, which equally concerns the perspectives of science and practice, can be applied to enhance a systemic understanding of such a complex and multi-dimensional phenomenon. Here, we aim to provide additional insights on the *transdisciplinary approach* that can be applied for the analysis of different problems and challenges, particularly when the integration of the perspectives of science and practice on an equal basis is advantageous.

Following the aforementioned goals, we integrate the knowledge and experience of key stakeholders in a *transdisciplinary system modeling* as part of an empirical research for

complex problems. In this study, we focus on the Austrian innovation system that due to its geopolitical position builds a bridge between Eastern, Western, Southern and Northern Europe attracting entrepreneurs with migration background. Hence, the guiding question in this study is which factors influence the integration of MDE within the Austrian innovation system. We focus on a (cultural) difference that outlines the relevant business competences and knowledge of migrant entrepreneurs compared to entrepreneurs, who were born in Austria.

The article is organized as follows. Section 2, "A transdisciplinary approach to multilevel knowledge integration", describes the applied methods that served as a basis for collaboration and mutual learning between the involved stakeholders. Section 3, "Methods and research design", gives an overview of the empirical sequential process of the system model development and describes the qualitative methods that were used for collection and analysis of the data. Here, we outline the transdisciplinary framework and multistakeholder discourse applied during the research. In section 4, the results of the multistage system modeling are presented. Finally, the main findings are discussed in section 5, and an outlook on innovation systems and the application of the transdisciplinary process used is summarized in section 6.

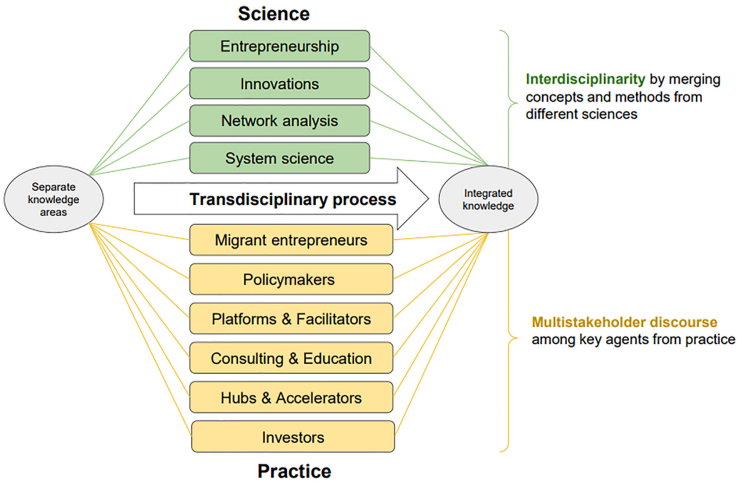
2. A transdisciplinary approach to multilevel knowledge integration

A system-based view on the integration of MDE within the Austrian innovation system requires the knowledge of different stakeholders that combines the expertise of science and practice (see Norström *et al.*, 2020; Pohl *et al.*, 2021). This transdisciplinary approach includes various scientific disciplines as well as experience from practice and thus goes beyond the boundaries of (inter)disciplinary discourses (Siedlok and Hibbert, 2014) providing a more holistic perspective of such a complex phenomenon. A variety of collaborative research methods are built on the involvement of scientists and practitioners (Vaughn and Jacquez, 2020), ranging from a *team science approach* that deals with cross-disciplinary collaboration (Stokols *et al.*, 2008) to *citizen science* that includes public participation and education (Dickinson *et al.*, 2012) or *community-based participatory research,* which relates to the equal collaboration of different partners (Wallerstein, 2018). In order to integrate the knowledge of different stakeholders an appropriate participatory technique should be chosen, considering the peculiarities of the analyzed phenomenon (Krütli *et al.*, 2010; Stauffacher *et al.*, 2008). *Transdisciplinarity* attempts to understand ill-defined, ambiguous and real-world challenges that often result from complex societal changes and can hardly be outlined with distinct system boundaries (see Mobjörk, 2010; Pohl *et al.*, 2021; Renn, 2021). This approach emerged in the 20th century as a response to new societal needs and challenges, the comprehension of which could not rely solely on the dominant role of science but required alternative ways of knowledge integration (see Elzinga, 1997; Pohl *et al.*, 2021; Popa *et al.*, 2015). It connects different forms of epistemics, where scientists provide theories and method-based evidence, while practitioners deliver "contextualized" practical experience related to a specific challenge (Scholz, 2020; Scholz and Steiner, 2015). This framework enables a basis for a deliberate mutual learning between science and society, which allows for developing a joint understanding of a complex real-world problem and becomes a prerequisite for elaborating *socially robust orientations* for potential solutions (Popa *et al.*, 2015; Renn, 2021; Scholz and Steiner, 2015). This socially robust transdisciplinary knowledge integration strives to generate sustainable impact in the context of a specific phenomenon, rather than merely implementing short-term innovations (see, e.g. Norström *et al.*, 2020; Pohl *et al.*, 2021; Schäpke *et al.*, 2018; Scholz, 2020). However, transdisciplinary approaches also entail new challenges such as the involvement of practitioners, normativity and biases in existing knowledge, the evaluation of the impacts of a transdisciplinary project (see Lawrence *et al.*, 2022), as well as

the question of control and power balances within the entire process of knowledge integration (see, e.g. Rosendahl *et al.*, 2015). Accordingly, an important principle that should be regarded as a part of a transdisciplinary approach relates to the "equal appraisal" of knowledge from science and practice (Scholz, 2020). In other words, the knowledge of stakeholders from science and practice should be "equally valuable" (Mobjörk, 2010) when a transdisciplinary approach is applied for understanding a complex problem and the development of socially robust orientations.

3. Methods and research design: transdisciplinary multistage system modeling

The transdisciplinary framework applied for this study is based on the methodology developed by Scholz and Steiner (2015). It allows analyzing MDE and its impact on the innovation system based on knowledge integration from *various scientific disciplines* (i.e. interdisciplinarity) and *relevant practical fields* (i.e. multistakeholder discourse) (see Figure 1). Overall, the transdisciplinary process included 14 participants: 3 representatives from science (authors of this paper) and 11 representatives from practice.



Source(s): Based on Scholz and Steiner (2015)

Figure 1.
The framework of the applied transdisciplinary process: interdisciplinary applied research and a multistakeholder discourse

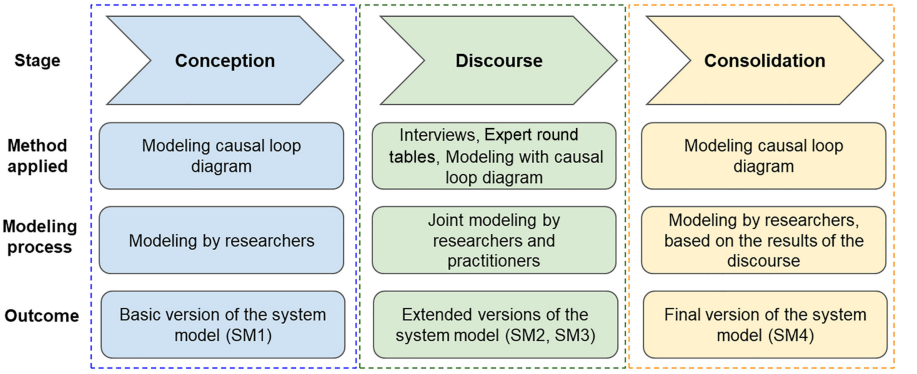


Figure 2.
Design of the transdisciplinary multistage system modeling

In order to provide a transdisciplinary multistage system modeling, we designed a sequential process (see Figure 2) that consisted of three consecutive stages: conception, discourse and consolidation. This approach allowed us to gradually develop system models, based on causal loop diagrams, in which knowledge and expertise from science and practice were reflected, discussed and integrated in a transparent manner.

In the *conception stage*, we outlined the first basic version of the system model (System Model 1, SM1). The boundaries and environment of SM1 are related to the regional scope (i.e. Austria) and core dimensions and layers of the innovation system (see section 5.1). The main factors and relations were specified according to the defined system boundaries. The conception stage was conducted in an interdisciplinary manner by three researchers with different scientific backgrounds, i.e. the authors of this paper, who have expertise in innovation, entrepreneurship, finance, systems sciences, sustainability and network research.

In the *discourse stage* the empirical data of the practical perspectives of stakeholders for the system modeling were collected (see section 3.1) and modeled (SM2 and SM3). To identify appropriate stakeholders of relevant practical fields, we searched for experts representing the following roles: (1) (inter)national policymakers, (2) migrant entrepreneurs, (3) facilitators and providers from platforms, (4) business consultants and educators, (5) managing directors of hubs and accelerators, and (6) investors and business angels. We involved experts with heterogenous demographics as well as complementary experience and knowledge.

In the *consolidation stage*, the collected data were further analyzed by the researchers. Based on the findings, the final system model (SM4) was developed (see section 5.3).

3.1 Data collection and analysis

The collection of the original data was performed by conducting semi-structured interviews and expert round tables (ERTs) with selected key stakeholders (see Appendix for further details). Following the approach of *qualitative semi-structured interviews* (see Kallio *et al.*, 2016), the main questions were prepared prior to the conversations. They covered the main topics of the study and considered the findings of the SM1 (see Table 1). The aim of the interviews was to learn how the representatives of the different practice fields perceive the

Stakeholder groups	ID	Specific interview topics
Policymakers	PM	• Innovative entrepreneurship and migration policies (Austrian and European)
Migrant entrepreneurs	ME	• Integration and social positioning of migrant entrepreneurs • Implementation of digitalization in business models
Platforms and facilitators	PF	• Patterns of the innovative startup environment in Austria • Impact of digitalization on the startup environment • Conditions of the Austrian business environment for conducting digital business (involving also the impact of migrants) • Societal impact of startup activity of digital and future paths
Consulting and education	CE	• Peculiarities of migrants' entrepreneurial activities • Role of migrant entrepreneurs for digital business transformations • Interconnection between an entrepreneurial activity and social position (i.e. support or disruption)
Hubs and accelerators	HA	• Patterns of the innovative startup environment in Austria • Conditions of the Austrian business environment for conducting digital business (involving also the impact of migrants)
Investors	I	• Digitalization of business and overall economic situation • Digital startups within the innovation system

Table 1. Interview topics according to the domains of interviewees

innovation system in Austria and, more specifically, how they assess the role of MDE. Therefore, the semi-structured framework was considered as the most appropriate for our research, since it allows to structure the conversation, but does not have to be followed strictly, providing rather the general outline of the interview (Gill *et al.*, 2008; Kallio *et al.*, 2016). Ten interviews were conducted between November 2019 and March 2020.

To analyze the interviews, we applied elements of *thematic analysis* that is considered to be a flexible method for qualitative data analysis (Clarke and Braun, 2017; Kiger and Varpio, 2020). Following the procedure of Braun and Clarke (2006), the thematic analysis in our research comprises four main steps.

First, to structure the data obtained after the interviews we generated initial codes that were grouped according to the five main topics:

(1) *Key factors:* Core issues with respect to specific topics of the study (see Table 1)

(2) *Comparisons:* Cultural differences that were mentioned with respect to Austria and other countries

(3) *Business environment:* Supportive and restrictive factors that characterize the Austrian business environment, particularly with respect to innovative businesses

(4) *Migrant entrepreneurship:* Factors that were mentioned as supportive and/or restrictive for migrant entrepreneurship

(5) *Innovation system:* Supportive and restrictive factors that characterize the Austrian innovation system.

Second, we analyzed the data of the interviews that were relevant for the outlined main topics. Third, according to the extracted data, we identified two main themes: (1) specific characteristics of the Austrian business environment and (2) factors affecting migrant entrepreneurship activities. Finally, we developed a map of the analysis, that included the relevant factors according to the two themes as well as corresponding to stakeholders that mentioned them (see Table 2 in section 4.2.1).

In order to encourage an extensive discussion between the experts from science and practice, ERTs were conducted within the discourse stage. In the aforementioned interviews, the researchers asked about and analyzed the knowledge of the experts; by contrast, in ERTs the participants were invited to learn from each other and, alongside the researchers, to develop a common understanding of a phenomenon.

The ERT method has been (further) developed in recent years to address complex phenomena from different perspectives. The approach began in Japan in 2017 to answer transdisciplinary research questions and continued in Europe and South America in the following years (Scholz *et al.*, 2018; Viale Pereira *et al.*, 2020). Following this research tradition within this study, five experts from practice (see Appendix for further details) participated in two digital workshops to discuss and to further develop the first system model collaboratively. The two ERT meetings took place in July 2020, and each meeting consisted of a one-hour online session using the meeting software Zoom and the system modeling tool Vensim PLEx64. In the first ERT, researchers presented SM1 and collected feedback from the experts from practice. Based on their suggestions, the system model was redesigned, resulting in the second system model (SM2). In the second workshop, SM2 was presented. All participants further discussed divergent viewpoints, shared their knowledge, and, finally, developed the system model 3 in a joint effort (SM3).

4. Results

4.1 Scientific perspective: a conceptual framework

The basic version of the system model (SM1) was developed in order to provide a foundation for an extended transdisciplinary modeling process. We applied the approach of *multilayered*

innovation systems (see Steiner, 2017, 2018) that was adapted for the case of digital entrepreneurship (see Satalkina and Steiner, 2020a) (Figure 3).

The core focus of *SM1* was the reciprocal influence between MDE and the different dimensions of the innovation system. The three vertical levels referred to the individual, organizational and regional layers of this innovation system. The horizontal dimensions were categorized as (1) the societal and cultural dimensions concerning societal stability and security; (2) the economic and financial dimensions, which included the economic capacity and productivity of a region as well as its business activity; and (3) the human and knowledge dimension, which included the human and intellectual potential of a region. MDE was considered a starting element of the model fostered by economic, political, social and other factors. Within SM1, the following four reinforcing loops were identified:

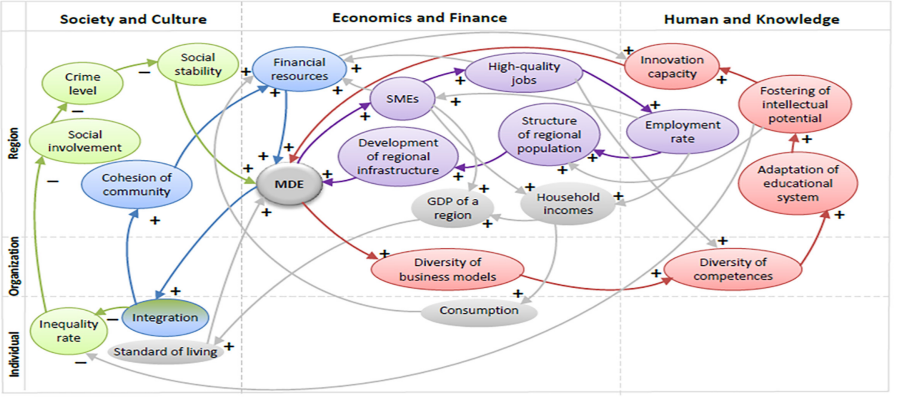
(1) Social and security loop (green) – MDE positively affects migrants' integration, thereby decreasing inequality and increasing their recognition and involvement, which may positively impact a region's social stability.

(2) Financial loop (blue) – this loop highlights the connection between the cohesion of migrant communities and the availability of financial resources.

(3) Economic and infrastructure loop (purple) – MDE directly impacts the development of small- and medium-sized enterprises, determining the creation of new jobs and the involvement of human resources that change the population pattern and stimulate the development of necessary infrastructure for the region.

(4) Human and intellectual loop (red) – new business models determined by digitalization require relevant competences of potential employees, oriented on the knowledge-based model of the economy that, in turn, determines the adaptation of the educational system and the development of intellectual potential contributing to the innovation capacity of a region.

Beyond the main loops, additional elements and interconnections (gray) were distinguished that emphasized the impact of MDE (e.g. on capital flows and the productivity of the region).



Note(s): (1) Feedback loops (marked by colors): green – social and security loop; blue – financial loop; purple – economic and infrastructure loop; red – human and intellectual loop. (2) Gray – Additional variables and arrows beyond the loops (3) Integration is the key variable for two loops

Figure 3.
System model 1 – basic version

4.2 Practical perspective: interviews and ERTs

4.2.1 Interviews. Overall, most practitioners considered the Austrian business environment as rather supportive but comparatively slower in establishing innovative startups than other countries such as Germany, the UK, France, Estonia, Croatia or Israel. One of the interviewees stated:

> "... the push that you give doing your business is way higher [in Croatia] then it is here [in Austria]. Here, things are done rather "in gloves" than straightforward." (ME) [2]

Austria is considered a fairly good place for starting a business, due primarily to its *secure system* and *high quality of life*. In addition, there is *high interest by the government* in the development of innovative startups. Although *governmental financial support* is strong (compared to, e.g. China), there is a lack of *private investment* (compared to, e.g. Silicon Valley). Practitioners mentioned a lack of supportive mechanisms specifically for migrant innovative startups and, particularly, those from third countries. Several practitioners mentioned *geopolitical advantages* for business opportunities since Austria (and especially its capital, Vienna) is considered a "bridge" between Western and Eastern Europe:

> "Vienna still functions as an international hub. There are more possibilities." (ME)

> "When it comes to Eastern European countries, I think Vienna is a good base, for example, for getting to Prague, to Budapest. This is maybe one of the main reasons why startups come to Vienna." (CE)

The presence of a *variety of scientific institutions* is another factor for the development of innovative startups. Most of the interviewees mentioned *administrative and bureaucratic procedures* as a restricting factor for starting a business in Austria (compared to, e.g. Estonia). This factor is also important in relation to startups with migrant founders since, in addition to basic procedures for startup establishments (e.g. getting relevant licenses), it is also necessary to acquire *official residency* (or a visa) and *work permits*. Existing mechanisms for obtaining residency permits for entrepreneurs in Austria (i.e. Red-White-Red card for entrepreneurs) are more complicated and time-consuming compared to, e.g. Great Britain, France or Estonia. This is also the reason that, in Austria, migrant startup founders are sometimes associated with academic work as they already have contracts and official residency due to their university affiliation. One of the interviewees mentioned that migrants of the second generation have a better "entrepreneurial spirit" as, in most cases, they already have citizenship and, thus, do not face additional obstacles:

> "If you're talking about first-generation migrants who do not have Austrian citizenship, it [entrepreneurship] is really a big problem. Second generation, they are very open, very interested in starting a startup. They have a huge entrepreneurial spirit. I think it's higher than the Austrian." (CE)

Another peculiarity and restricting factor of the Austrian business environment relates to the *entrepreneurial culture* (including readiness to take risks, motivation to innovate and international orientation). According to the opinions of practitioners, innovative entrepreneurship in Austria is not highly popular since it is not considered a "viable career path":

> "We like to protect ourselves from change. We like to keep things as they are. These are things that are absolutely opposite to Schumpeter's "creative destruction." Here it is very much about protecting the institutions, the existing companies." (PF)

According to several experts, one of the major factors that restricts the development of innovative startups in Austria is the *fear of failure*. This is also evidenced by the data from the Austrian Startup Monitor (Leitner *et al.*, 2018, 2019), which show that, although the rates

of failure among startups are low, the rates of success are not especially high (PF, who is also the co-author of the report).

In that case, migrant entrepreneurship is considered a particularly positive process because of a better *entrepreneurial spirit* that relates to *high "eagerness"* to start a business, as well as a higher rate of international orientation. Several interviewees mentioned the integration of *specific knowledge and experience* (also related to cultural background) of migrant entrepreneurs as a particular advantage for the business environment. Migrant entrepreneurs considered the influence that the Austrian *social surrounding* has on their integration as very supportive. In addition, they suggested that an important factor for migrants' integration is their "personal readiness" and "openness" toward integration. Some migrant entrepreneurs mentioned the factors of *gender issues* and *cultural stereotypes* but did not declare these to be significant factors regarding the business environment image or migrant entrepreneurship development.

In Table 2, the main characteristics that were mentioned in the interviews are clustered according to the rate of their impact on the development of innovative businesses and particularly MDE (i.e. highly supportive, somewhat supportive and restrictive).

4.2.2 Expert round tables. The results of the interviews served as a basis for further joint modeling. According to the research design (see Figure 2), the stakeholders were invited and five of them were able to take part in the ERTs to further adapt SM1.

The experts were provided with SM1 (see Figure 3) prior to the ERTs, and it served as a baseline for further adaptation. Some of the factors of SM1 were considered less important from a practical perspective (e.g. GDP of a region, consumption) and, thus, were excluded from the later versions of the model. During the two ERTs, several new factors (e.g. formal procedures, practical and scientific collaboration, competences, digital ethics and value) and linkages were consequently identified. The discourse during the ERTs allowed us to focus on the entire chain of mechanisms – from the personal decision-making of migrant entrepreneurs to their final involvement into the innovation system and further interaction with its agents. As a result, SM2 and SM3 were developed during the ERTs.

In SM2 (Figure 4), we gained three additional dimensions that shifted the focus of the model from a macro level, emphasizing aspects such as migrants' integration, competences and education, and interdependence of cultural and business patterns.

The three new dimensions were identified as follows:

(1) *Legal environment and procedural framework:* Formal procedures to regulate entrepreneurial activities of foreign residents (including legal rules) were identified as an important factor for MDE, affecting either directly or through the image of the system environment. Language barriers (including language used in official forms and communication difficulties with relevant authorities), the slowness of official proceedings and the necessity of carrying additional costs due to the complexities of formal procedures (e.g. for local lawyers) are some of the problems that can confound the procedural "equality" of migrant and native entrepreneurs, thus restraining MDE.

(2) *Integration and cultural diversity:* Different cultural backgrounds of migrant entrepreneurs are sources of different worldviews and attitudes (e.g. gender roles, religious traditions) that, being integrated into a business, have an impact on the development of new products, services and business models, thereby determining the diversity of business perspectives. In addition, such integration enhances the connection between migrant and native entrepreneurship, in some cases influencing further community cohesion.

(3) *Collaboration and networking:* Collaboration on different levels (i.e. between science and practice) was highlighted as an important driver for entrepreneurial activities. On

Table 2.
Core characteristics identified and elicited during the interviews

	Migrant entrepreneurs	Policymakers	Platforms and facilitators	Consulting and education	Hubs and accelerators	Investors
Characteristics of the Austrian business environment	(1) International access (1) Support in establishing a business (1) Governmental financial support (1) Collaborative culture (2) Supportive governmental framework for startups (2) Integration of startups in the business environment (incl. banking system support) (2) Business "mentality" (2) "Conservatism" of a system (3) Difficulties finding employees (3) Local orientation of business (3) Lack of a comprehensive innovation strategy at the country level	(1) Projects for entrepreneurial mentoring (also for migrants) (1) Interest of the public in innovative startups (1) Financial business support (1) Corporate business culture (2) Necessary information is available but finding it is difficult (3) Administrative and bureaucratic procedures (3) Low "culture" toward innovative startups	(1) Great quality of life (1) Geographic advantages (3) Entrepreneurial culture (3) Low internationalization (3) Administrative and bureaucratic procedures (3) Language barriers (3) Entrepreneurial education (3) Private funding	(1) Geographic advantages	(1) Interest of big corporations in innovative startups (3) Administrative and bureaucratic procedures (3) Pace of bureaucratic processes (3) Motivation to innovate (3) Financial resources (3) Low readiness to take risks (3) Fear of failure	(2) Investment opportunities (good amount of public but lack of private funding) (2) Number of professionals and experts in a field of digital startups (2) Educational system for developing startup culture

(*continued*)

Table 2.

	Migrant entrepreneurs	Policymakers	Platforms and facilitators	Consulting and education	Hubs and accelerators	Investors
Factors affecting migrant entrepreneurship activity	(1) Social environment supports integration (1) Residency permissions and relevant formalities (2) Legislative issues for third-country founders (3) Language barriers (3) Arrangements for integration (e.g. family residency) (3) Personal challenges related to integration (e.g. time)	(1) International network (1) Experience of self-establishment (1) Readiness for cultural adaptation (2) Migration policies for attracting migrant founders (3) Lack of social network (3) Difficulties seeking necessary information (3) Need for professional integration (3) Adaptation to new business cultures (3) Language barriers (3) Measures for fostering migrant innovative startups (particularly third-country nationals) (3) Attraction of innovative startup founders from abroad (3) Administrative regulations	(1) New conditions of life/work (1) Flexibility (1) Commitment to the aim (1) International perspective	(1) Entrepreneurial spirit (particularly for second-generation migrants) (1) Special knowledge (compared to natives) (3) Difficulties with legalization (i.e. citizenship, work permits)	(1) Readiness to found an enterprise (1) Resilience (1) Self-positioning and market penetration (1) Entrepreneurial skills (3) Language barriers	

Note(s): (1) Highly supportive; (2) Somewhat supportive (with certain weak points); (3) Restrictive

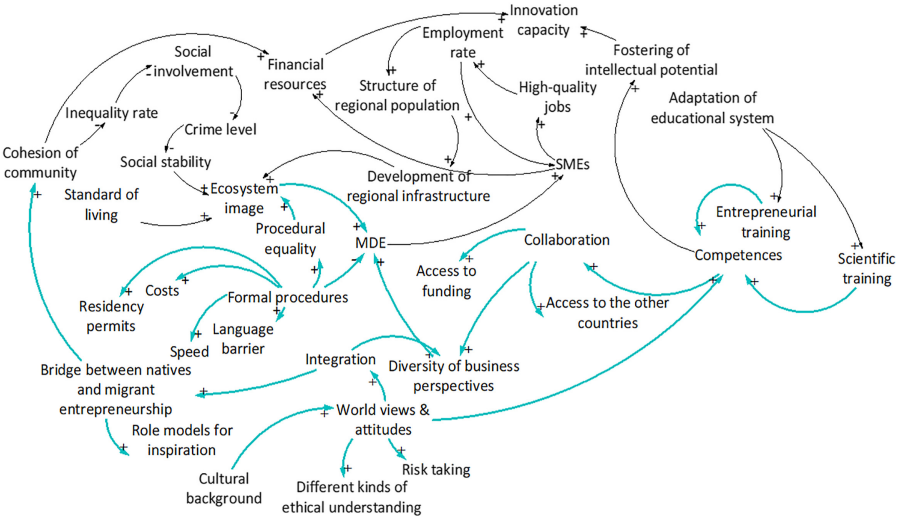


Figure 4.
System Model 2 – First extended version

Note(s): Relations between the new factors compared to System Model 1 are highlighted in blue

the one hand, it might provide measures for the development of businesses (i.e. providing access to funding and cooperation with new partners). On the other hand, it becomes a driver for the transformations in entrepreneurship, in accordance with the needs of modern societies (including the development of system innovations). Such collaboration requires relevant competences, the development of which calls for both entrepreneurial and scientific training.

Further reflections and consolidations allowed to identify a fourth additional dimension in the SM3 (Figure 5), namely the *mutual learning process,* which is a knowledge exchange between migrant entrepreneurs and decision makers within the innovation system.

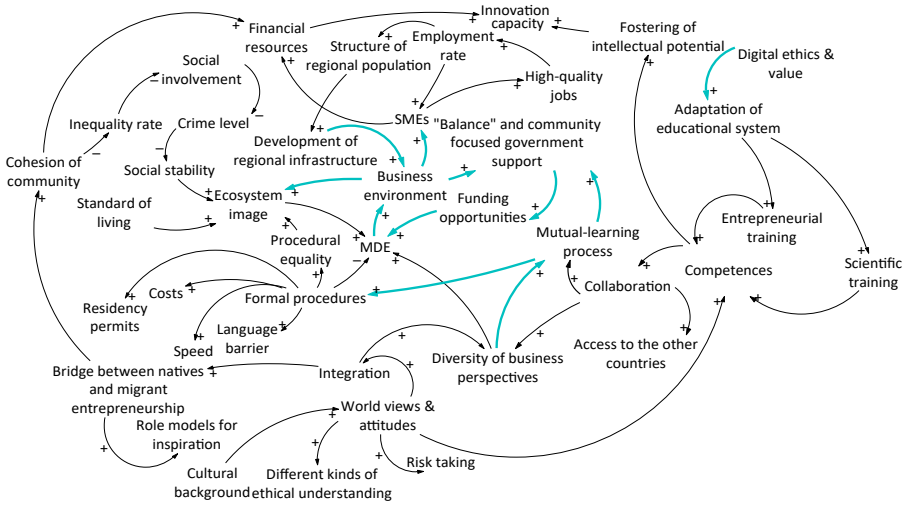
The importance and main outcomes of such mutual learning processes relate to *balanced support* (including financial support) from the government and authorities that should be based on understanding the needs of certain business communities. SM3 includes the reference to *ethical issues and values* in terms of digital transformations and digital entrepreneurship. Digital ethics and values, as important elements in entrepreneurial education, relate to the understanding of potential vulnerabilities, generated by digital entrepreneurship, including both risks and opportunities. Further reflections also allowed for redefining some of the factors within the model, particularly by altering the interlinkages, as well as replacing chains of elements with compound factors (e.g. procedural "equality" includes a simplification of formal procedures).

4.3 Consolidated system model

In order to consolidate the final version of the system model, we integrated the analyzed data collected from the interviews. This allowed for revising and restructuring the preceding system models as the final System Model 4 (Figure 6).

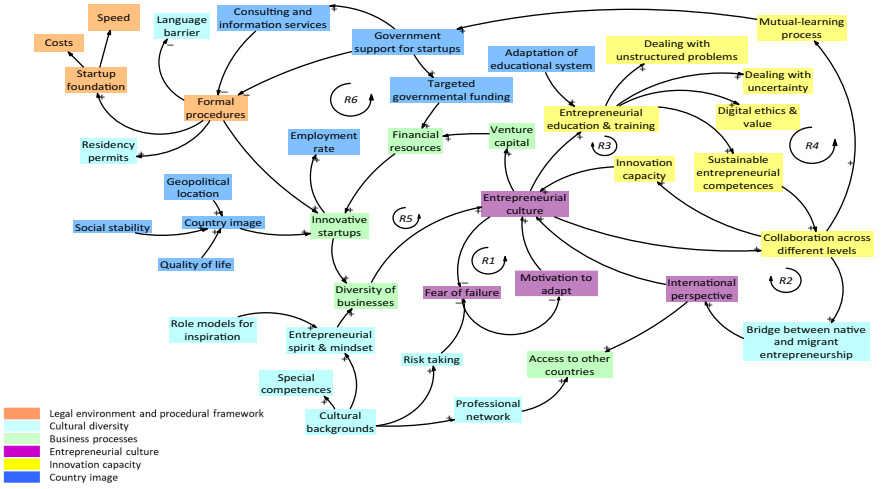
SM4 includes the following six core dimensions:

(1) *Legal environment and procedural framework*, which focuses on legal and formal procedures necessary for a *startup's foundation* (including *costs* and *pace of*



Note(s): Relations between the new factors compared to System Model 2 are highlighted in blue

Figure 5.
System Model 3 – Second extended version



Note(s): The colors highlight different dimensions; Ri - reinforcing feedback loops: *R1* - the mindsets of entrepreneurs; *R2* - the role of international collaboration; *R3* - the role of entrepreneurial education; *R4*, *R5* - the financial sphere in regard to government and private funding; *R6* - the impact of formal procedures

Figure 6.
Final version of the system model (SM4)

bureaucratic processes) and core factors specifically related to migrant entrepreneurship, such as procedures related to obtaining *residency permit*s and *language barriers* that complicate communication with legal authorities as well as official document processes.

(2) *Cultural diversity,* connected to the core factor of *cultural background,* includes different worldviews and attitudes and, therefore, determines different *entrepreneurial spirits and mindsets.*

(3) *Business processes* illustrate relations between factors that provide an organizational entrepreneurial framework, including private funding (i.e. *venture capital*), *diversity of business models* and the rate of business internationalization (i.e. *access to other countries*). This dimension also includes *innovative startups* that integrate digital entrepreneurship initiatives (e.g. MDE), and are connected to small- and medium-sized enterprises.

(4) *Entrepreneurial culture* relates to specific entrepreneurial patterns, such as the rates of business internationalization (i.e. *international perspective*) and collaborative culture (i.e. *collaboration between companies*). This dimension includes factors that characterize business patterns from a level of individual entrepreneurs, such as readiness to take risks, fear of failure or readiness to innovate (i.e. *motivation to change*).

(5) *Innovation capacity* focuses on factors that relate to continuous collaboration between various agents of the innovation system, including science and practice (i.e. *collaboration across different levels*), which should be a basis for *entrepreneurial education and training* in order to develop *sustainable entrepreneurial competences.*

(6) *Country image* characterizes the overall reputation of Austria concerning the support for innovative startups (i.e. *country image* and *government support for startups*) that should be based on *targeted governmental funding.* An important factor within this dimension relates to *consulting and information services* that are available for entrepreneurs, particularly at the startup stage.

Among the six dimensions of the SM4, we identified six major reinforcing feedback loops that demonstrate leverage points for the impact of MDE on the Austrian innovation system and indicate potential paths for fostering innovative entrepreneurship: (R1) the mindsets of entrepreneurs, (R2) the role of international collaboration, (R3) the role of entrepreneurial education, the financial sphere in regard to (R4) government and (R5) private funding, as well as (R6) the impact of formal procedures.

5. Discussion

5.1 MDE embedded in the Austrian innovation system

The identified feedback loops show that MDE can foster innovative startups and, therefore, the Austrian innovation system, particularly through the dimension *integration and cultural diversity*. The core factor here relates to the *entrepreneurial spirit and mindset.* Previous studies showed that an important difference between migrant and native entrepreneurs relates to attitudes toward risk (see, e.g. Batista and Umblijs, 2014; Kushnirovich *et al.*, 2018). This difference was also identified by the practitioners, who suggested that, compared to Austrian entrepreneurs, migrants are more prepared to take risks and are often faster to penetrate the market. It is important to mention that migrant entrepreneurs, particularly those who establish innovative (digital) startups, are mostly highly qualified professionals. Therefore, *special competences* and a *professional network* are additional significant determinants of their entrepreneurial spirit. The mentioned factors connect MDE directly to the dimensions of *business processes* and the *entrepreneurial culture* within the Austrian innovation system.

The results of the *discourse stage* showed that, with respect to entrepreneurship, the Austrian innovation system is rather supportive and stable. However, in terms of innovative

entrepreneurship, there are two main dimensions where practitioners see further potential, namely the *legal environment and procedural framework* and the *entrepreneurial culture* (see also section 4.2). Austrian bureaucratic procedures for establishing a company are considered too complicated and rather cumbersome, due to the involvement of numerous and varied institutions. The whole communication process requires a good knowledge of the German language, which is a significant limitation for migrant entrepreneurship as one interviewee stated:

> "It is really difficult to understand the legislative and policy "jungle" you need to go through in order to start a business in Austria. It is almost impossible if you do not have an Austrian lawyer supporting you in setting up a business." (PM)

A *collaboration across different levels* followed by *mutual learning* is particularly crucial since it leads to a shared understanding between decision makers on different levels of the innovation system (Scholz, 2020). This is of particular importance, considering innovation systems as interactive learning systems that enhance the distribution of knowledge and learning capabilities of individuals, organizations and regions in order to cope with new challenges (Lundvall, 1985, 2010; Lundvall *et al.*, 2002). As a result of such a mutual learning process, the government might foster innovative startups, on the one hand, by a simplification of *formal procedures* and the further development of *consulting and information service*s (see R6 in Figure 6). On the other hand, governmental support also includes *targeted governmental funding*, oriented on innovative startups within certain business domains or communities (see R4). The mutual learning process is a crucial factor for the development of an *entrepreneurial culture* and, particularly, for the "integration" of innovative startups:

> "I think that the startups are still not integrated into the whole system environment or into the business system. Maybe the government and the bigger organizations should have some special treatment for startups." (ME)

Such an integration concerns particularly the banking sector (e.g. pace of operations) and the support of big corporations. However, an important role in that case relates to the mindsets of entrepreneurs and especially to their "culture of failure," i.e. fear of failure and lack of motivation to adapt and innovate (R1). In order to develop innovative entrepreneurship, it is important "to bring a little bit of Silicon Valley spirit to Vienna" *(HA)*, particularly to foster disruptive innovations and build entrepreneurial communities. In addition, innovations in Austria are characterized by higher rates of government funding compared to private venture investments, while private capital is an important element that links innovative startups and entrepreneurial culture (R5).

For the development of innovation strategies in Austria, a transformation of the "startup mindsets from local orientations of business to international [mindsets]" (ME) is particularly critical. With respect to the internationalization of business perspectives, MDE is an important factor since, on the one hand, there is a direct link between *migrants' professional networks* and access to international communities and, on the other hand, collaboration between native and migrant entrepreneurs is another factor for fostering business internationalization (R2). Although scientists differentiate between the terms "migrant entrepreneurship" and "international entrepreneurship" (Elo *et al.*, 2018), practitioners suggest that, in terms of digital transformations, the term "international digital entrepreneurship" is more appropriate because, in regard to digital opportunities, "your company might be situated anywhere, but you can have access to a broader community" (ERT discussion). Furthermore, international and intercultural business ventures can be executed more intensively as a result of increased digital collaboration (also during current pandemic).

The discourse of the practitioners showed that (digital) business transformations play an important role for a sustainable societal development. The Digital Transformation

Monitor (2018) provides evidence that 9 of 10 European companies consider digital technologies to be a new business opportunity, while 70% of the investigated companies apply digital technologies for sustainable business activities. Digital entrepreneurship might become an important driver for coping with global challenges related to complex transitions (e.g. Grand Challenges [3]) (see, e.g. George *et al.*, 2016; George *et al.*, 2021; Markman *et al.*, 2019). This idea was also discussed by the involved practitioners: "I think that is definitely something underestimated at the moment, that entrepreneurs have a very big role in solving big societal problems" (PF). However, in order to address conditions of complex changes, entrepreneurs need to possess certain competences that will enhance their problem-solving capacities (Steiner *et al.*, 2013, 2015). "Dealing with uncertainty and unstructured problems [are the core competences that] are completely underrepresented in the Austrian education system at the moment" (PF). Such competences require relevant entrepreneurial education and training patterns and will further activate collaboration across different levels, leading to higher rates of adaptive and, thereby, innovation capacity of the whole system (R3).

5.2 Reflection on transdisciplinary multistage system modeling

In terms of complex societal changes, the transdisciplinary approach allows for continuous collaboration and mutual learning between various relevant stakeholders (Norström *et al.*, 2020; Pohl *et al.*, 2021; Scholz and Steiner, 2015). This is an important basis for comprehensive innovation management (at all levels) and the development of modern forms of nondiscrete interventions that can help to cope with complex problems. This aligns with the paradigm of a *system innovation* (OECD, 2016) that determines a cross-boundary collaboration and acts across single societal dimensions. As a framework for coping with systemic problems in a long-term perspective, system innovation connects agents form policy, business, science, etc. in a collaborative search for sustainability relevant avenues. From this perspective, transdisciplinary mutual learning relates to continuous collaboration between science and practice, which starts from a joint problem definition and leads to knowledge integration and the development of shared socially responsible solutions (Scholz, 2020). This approach differs to traditional qualitative studies and takes an emphasis on meeting at eye level. For this reason, the multistage system modeling was designed in a nondeterministic manner. The sequential stages (see Figure 3) provided the core direction and served for the orientation within the research design. The outcomes of each stage (i.e. System Models 1–4) allowed for continuous redefinitions of the multilayered framework of the innovation system, identifying or redefining its dimensions and layers corresponding to peculiarities of MDE. For example, in the basic version (SM1), the dimension that relates to the political, legal and institutional environment is initially missing. In addition, SM1 is based on three core layers (individual, organization and region), which do not provide a link to the international or global perspective of innovation systems. The multistage process allowed for thorough reflections and adaptations of the research design.

Besides the above-mentioned advantages of the transdisciplinary approach, such a discourse might have certain limitations. In addition to main constraints of the approach (Lawrence *et al.*, 2022; see Scholz, 2020), finding a "common language" between stakeholders with different levels of awareness, motivation patterns and viewpoints might be a challenge. However, this limitation was not of particular relevance for this study since neither the practitioners nor the researchers had ambiguous interests or positions in this study. It is worth mentioning that the ideal transdisciplinary process should be based on the equal involvement of co-leaders from science *and* practice in order to facilitate an extended mutual-learning between various agents (Lawrence *et al.*, 2022; Renn, 2021; see Scholz and Steiner, 2015).

Due to the available time and funding of the research project, the principle of co-leadership could not be implemented. Therefore, a certain bias with respect to the interpretation of the findings is still possible, especially because the part of science was represented solely by the authors of the research, despite the fact that the criteria of interdisciplinarity and multistakeholder discourse (see Figure 1) were respected and fulfilled. Hence, we recognize it as a limitation of an applied transdisciplinary process, which should be included to a greater extent in the future. In the follow-up research, we plan to form a team, integrating practitioners and scientists on an eye-level. It is also planned to apply the approach with the extended sample to investigate how different cultural patters determine differences in entrepreneurial activities and how this can further influence innovation systems and sustainability implications.

6. Conclusions and outlook

The research was based on an extended transdisciplinary discourse that led to an equitable collaboration between researchers and practitioners. The comprehensive system-modeling process was based on three iterative stages and allowed for an integration of knowledge from science and practice. As a result, six dimensions of the Austrian innovation system that are relevant for innovative entrepreneurship and, particularly, for MDE were defined: (1) legal environment and procedural framework, (2) integration and cultural diversity, (3) business processes, (4) entrepreneurial culture, (5) innovation capacity and (6) country image. The transdisciplinary multistage system modeling allowed the identification of six reinforced feedback loops in the final version of the system model. Relating to the different dimensions, these loops demonstrate how MDE is integrated within the Austrian innovation system. The results revealed that the Austrian innovation system is rather stable and supportive for entrepreneurship; the *country image*, in particular, is considered the most supportive one. On the contrary, potential improvements are relevant for the *legal environment and procedural framework* and *entrepreneurial culture*. As a part of a follow-up research, we plan to apply the described transdisciplinary multistage system modeling in various countries to analyze cultural differences of MDE in these diverse innovation systems. This study would provide additional insights on how entrepreneurship might be integrated into the development of system innovations and, especially, how it might be applied within a variety of specific fields and grand challenges of society such as food security, sustainable resource management, etc. Although this study provides evidence for the advantages of transdisciplinary system modeling, it is important to better understand potential implications and limitations of the approach for further cases that require a discourse between various stakeholders. Such a process could be particularly important regarding sustainable impacts of digital business transformations within complex transitions of various societal systems.

Notes

1. The UN Migration Agency (IOM) defines a migrant as any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence (see https://www.un.org/en/global-issues/migration).
2. Here and further the initials correspond to the IDs of the interviewed experts (see Table I).
3. https://grandchallenges.org/

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(The Appendix follows overleaf)

Appendix

Table A1. Participants from practice involved for the interviews and Expert Round Tables

Affiliation of participants	Participation in interviews/ERTs	Interview date	Interview duration (min)
Policymakers			
• *European Political Strategy Center* (European Commission)	Interviews	November 25, 2019	27
	Interviews	February 21, 2020	35
• *National Contact Point Austria* (International Organization for Migration Country Office, European Migration Network)	Interviews	March 4, 2020	45
• *Austrian Integration Fund*			
Migrant entrepreneurs			
• *Seasonax Capital.* Originally from Croatia, has a strong financial background in the international market environment	Interviews	February 14, 2020	54
	Interviews/ERTs	February 26, 2020	43
	Interviews/ERTs	March 13, 2020	25
• Future company that will provide project management and consulting services. Originally from Croatia, has worked in the financial sector for 18 years			
• *Xencio GmbH.* Originally from China; The company produces and provides digital products			
Platforms and Facilitators			
• *Austrian Startups*	Interviews	March 10, 2020	30
Consulting and Education			
• *accent,* the Tough Tech Business Incubator aiming to create a basis for highly innovative start-ups	Interviews/ERTs	December 3, 2019	32
	ERTs	–	–
• *tecnet equity,* financial and scientific expert, supporting innovative and technology-oriented companies			
Investors			
• *Business angel and impact investor*	Interviews	March 23, 2020	19
Hubs and Accelerators			
• *weXelerate,* a startup and innovation hub with an ecosystem of open innovation	Interviews/ERTs	March 18, 2020	29

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