

## **Building up proximity relations to boost digital solutions in rural areas: The DRABE**

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### **Introduction**

In the last decades, agrifood sector and rural areas have been widely affected by deep changes, characterised by the emergence of cutting-edge innovations, one of the most important of which is digitalisation. How digital innovation may contribute to build up both smart rural areas and sustainable farming sectors is an emerging topic, which is to be explored through the lens of sociotechnical transition (Geels, 2002). According to the Long Term Vision for rural areas of the EU (EC, 2021), digitalisation is considered a strategic tool for developing resilient and sustainable farming sector and rural areas. However, as recognized in the Long Term Vision, the rural cannot be considered as a unique, but multiple context-related paths of rural development should be considered as possible. Consequently, with reference to rural digitalization two issues emerge (Torre et al., 2020): the first one concerns the role of policy on infrastructuring rural areas. The second one relates to the selection of “best fit” smart development solution, which should take into account regional specificities. This paves the way to a critical issue to be addressed, concerning the “digi-grasping” mechanisms in rural areas, related to both directionalities of digital innovations and non-neutrality of the process (Fielke et al., 2021; Schnebelin et al., 2021).

Therefore, contextualizing digital technological innovation in rural contexts brings about rejecting one-size-fits-all solution and replacing them with best fit approaches. From a methodological point of view, how better designing a smart specialization strategy implies considering relational assets and networks, spatial dimensions, as well as regionally specific modes of governance (Torre et al., 2021; Foray, 2015). Consequently, proximity relations (Gilly, Torre, 2000; Gallaud, Torre, 2022) must be explored in the long process of building up smart and sustainable agriculture. Digital innovations will inevitably have an impact on the relationships (local/distant) that farm enterprises engage with one

another and with the emerging digital technologies, which calls for new lens of analysis. More precisely, the new digital transformations call for an ecosystemic approach, rooted on a Digital Business Ecosystem (DBE), defined as a *collaborative environment made up of different entities that co-create value through information and communication technologies (ICTs)* (Nachira, Dini & Nicolai, 2007). DBE studies helps to understand how local production systems collaborate, compete and interact with more distant systems, when enacting digital solutions. In this context, our paper tries to provide an original contribution to literature, by applying and revising DBE concept to the “rural complexity”. With this purpose, starting from an ecosystemic perspective, the paper aims to analyze the mechanisms of building up digital business ecosystems in rural areas: we will label these as *Digital Rural and Agricultural Business Ecosystems* (DRABE). The role of the DRABE on boosting sociotechnical transition towards sustainable farming systems is also questioned, with special reference to agroecological transition. This addresses key issues related to both directionality and non-neutrality of digital innovations. Set against this background, research questions are:

- a) what is a DRABE and how a DRABE is built?
- b) Which proximities are called into question when the DRABE is under construction?
- c) How a DRABE affects transition towards more sustainable farming systems, like in case of agroecological transition?

The paper is structured as follows: starting from ecosystem perspectives, next section (par.2) tries to identify and define the DRABE concept, while the following section (par. 3) excavate the repercussion on knowledge dynamics. New territorial knowledge dynamics pave the way to new relational configuration, which will be analysed under the perspective of proximity relations (par.4), which play a fundamental role in shaping the DRABE, through the long process of agroecological transition which will be explored in the fifth section. Some conclusions will conclude the article.

## **2. The DRABE**

Recent changes in the agrifood and rural systems are shaped by three keywords pointed out by Klerkx (2020): transformation, disruption, pluralism. As far as transformation is concerned, farming systems are continuously changing the way of producing, trading and consuming. These changes drivers take on different natures (economic, natural, technological), one of the most important of which are technological, that entail possible disruptive effects on the agrifood system. The outcome is pluralism, that is the emergence of diversified farming systems, characterised by different networks and actors, within different and alternative paradigms. Facing these complexity has required a change in the analysis of knowledge transfer and innovation adoption, moving from innovation systems to innovation ecosystems. As a matter of fact, ecosystem thinking is gaining ground in boosting

collective action aimed to foster transition towards more sustainable farming system (Pigford et al., 2018). Actually, ecosystem perspective stresses the interdependencies among actors within a business environment through enabling their capabilities and roles (Moore, 1996).

As many authors point out, innovation systems analyse interaction and governance mechanisms among actors involved in value extraction from innovation, while the ecosystem perspective, emphasizes the co-evolution of innovation and the co-creation of value (Lioutas et al., 2021; Pigford, et al. 2018; Autio, Thomas 2014).

Recent literature offers a clear definition of innovation ecosystems. To the best of our knowledge, the definition provided by Granstrand and Holgersson (2020), raises essential issues to better understand the working mechanisms within an innovation ecosystem:

*An innovation ecosystem is the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors* (Granstrand, Holgersson, 2020, p.3). What should be stressed in this definition is:

- a) the artifacts concept, which includes “*products and services, tangible and intangible resources, technological and non-technological resources, and other types of system inputs and outputs, including innovations*”;
- b) the relations of competition or cooperation among actors, institutions, artifacts.

By recalling the aforementioned disruptive nature of some technologies, like digital innovation, this definition holds a critical importance in addressing new directions of the farming systems (directionality) and in impacting differently on local actors (non-neutrality) (Fielke et al., 2020). As a matter of fact, digital technologies foster cutting-edge innovations, *that cut across traditional industry/sectoral boundaries, embrace networks, ecosystems, and communities, while accelerating ideation, development, and evolution of associated often radical products and services*” (Nambisan, Lyytinen, Yoo, 2022, p.2).

Set against the business ecosystems framework, digital business ecosystem may represent a step forward in the analysis of “*socio-economic development catalysed by ICTs, (which emphasizes) the coevolution between the business ecosystem and its partial digital representation: the digital ecosystem*” Nachira et al., 2007, 5). As suggested by Senyo et al. (2019), a digital business ecosystem (DBE) is articulated in two pillar:

- ✓ The business ecosystem as an economic community where different actors interact with the purpose of producing valuable goods and services for final customers, who are themselves part of the ecosystem (Moore, 1996).

- ✓ The digital ecosystem as a virtual environment which involves digital entities, for instance, hardware, software applications, etc. (Senyo et al., 2019).

As a consequence, it is possible to define a digital business ecosystem as a *collaborative environment made up of different entities that co-create value through information and communication technologies (ICTs)* (Senyo et al., 2019, p.52).

Drawn on the previous definitions, a digital rural and agricultural business ecosystem (DRABE) may be identified as a digital business ecosystem whose architecture (set of actors and relations involved) is mainly located in rural context and whose engine is the farming sector. According to this definition, the DRABE maintains a strong territorial embeddedness: first of all, because the relational architecture is rooted in rural contexts; secondly, because the farming sector plays a key role. As a matter of fact, interactions among the various components of the DRABE should facilitate the transition towards more sustainable farming systems (like in case of agroecological transition), being it grounded on the ecosystem perspective which focuses on niche innovation.

Nonetheless how a DRABE born and develops is to be questioned, through exploring pre-existent relationships among actors: indeed, digitalization may act as game changer aiming to either reposition and transform prior networks or completely replacing them with new relational configurations. As pointed out by Autio (2017), disruption mechanisms activated through digitalization are boosted by digital affordances, which makes it possible to perform existing functions more effectively, or perform entirely new functions. For instance, disintermediation mechanisms working along digitalized supply agrifood chain facilitate direct interactions through cutting out intermediate transactions, such as in online trade platforms. On the other side, digital solutions engender re-intermediation through internet-based platforms (Autio et al., 2017). As outcome, new entrepreneurial models and ecosystems emerge which are characterized by the changing locus of entrepreneurial opportunities and the change of entrepreneurial practices (Autio, 2017). Nonetheless, how aforementioned dynamics impact on rural context is to be questioned, by considering types of rural areas and farming systems. As far as types of rural areas are concerned, it has to be considered how rural areas cannot be considered with a unique “profile”, but they are fragmented in various typologies (OECD, 2014). Among these typologies a variety of farming systems need to be explored, with the purpose of verifying the aptitude to adopt digital technologies as key tools for stimulating transitions towards sustainable agricultural systems.

Contextualization of digital technologies within digital business ecosystems brings about new perspectives of analysis related to knowledge appropriation and dynamics.

### **3. Knowledge dynamics in the DRABE**

Interaction among actors and artifacts within a DRABE may engender different DRABE configurations, where actors' capability of shaping knowledge dynamics may mark different DRABE's profiles. Thus, an in-depth analysis of knowledge transfer mechanisms is needed, under the hypothesis that the DRABE is the outcome of a cumulative process of combinatorial knowledge storage within a rural system, which is boosted by different capabilities of territorial anchoring (Crevoisier, 2016). More precisely, complex and uncertain mechanisms of knowledge dynamics, identified as multi-functional or diffused focused learning, boost more circulatory and structuralist approaches to the analysis of territorial knowledge dynamics in rural areas (Crevoisier, Jeannerat, 2009). Circulatory approaches call for territorial anchoring, which takes place through discovering and strengthening local resources by linking them with more distant knowledge and resources (Kebir et al., 2017). The anchoring process implies mobility towards new contexts, in our case, rural contexts: this call for moving from the Traditional Innovation Models (TIMs) to a broader paradigm of Territorial Knowledge Dynamics (TKDs), in which knowledge is no longer a cumulative phenomenon that characterizes a single location but rather a combinatorial one that dynamically develops in multi-location and multi-scalar ways (Crevoisier, 2016). In this context, the anchoring milieu is the local (rural) capability of mobilising and attracting knowledge from elsewhere, as outcome of the involvement of the rural entrepreneurial ecosystem. As pointed out by Crevoisier (2011, p. 13), *The anchoring milieu can be defined as a set of local players (firms individuals, public authorities, research and training organisations, local entrepreneurs, medias, cultural institutions, NGO,...) who interact locally and with distant and/or mobile players in order to develop ever more advanced (efficient or meaningful) knowledge on the basis of competition/cooperation rules.*

Set against the background of the transition towards sustainable farming system, like in the case of agroecological transition, a "mission oriented innovation systems" (MIS) emerges, where actors operate in multi-local and multiscale institutional contexts and networks with the purpose of adopting innovative solutions aiming to provide answer to societal challenges and pursue societal mission (Hekkert et al., 2020), in our case agroecological transition. *MIS can thus be seen as a temporary innovation system in which policy makers and other actors aim to coordinate innovation activities, with the objective of developing a coherent set of technological, institutional and behavioral solutions* (Hekkert et al., 2020, p.78).

The pertinence of the territorial approach is evident when differences between territories in appropriation of new knowledge emerge, like in case of digital technologies, bringing about enlarging digital divide and feeding vicious circles in rural areas. This means that local rural systems continue playing a fundamental role in attracting and anchoring pertinent knowledge, within a broader perspective of territorial models, where the key element is not only the individual actor but the

relation, which is meant as an institution, proximity, a convention or a territory (Crevoisier, 2014). Accordingly, new relational configurations may emerge in cases of digital innovation, which may reconfigure proximity relation and setting up new territorial proximities.

#### **4. Which proximities are involved in DRABE creation?**

As said before, local rural systems continue playing a fundamental role in shaping future trajectories of development characterized by digital innovations. Therefore, we reject potential critics concerning risks of “local traps”, by sharing Hinrichs’s (2003) perspective on two types of localization: the first one is a defensive localisation, which stresses the absolute relevance of local and local good; the second one views local in continuous interaction with the global, bringing about openness towards diversity and multiple paths of local rural development. Diversity is here conceived as the outcome of different relational architecture and different working of the anchoring milieus, which brings about different profiles of territorial proximity. In order to clarify how digital solutions pave the way to different relational configurations, a key question concerns how the DRABE shape proximity relations. This calls for questioning differences between digitalisation and digitisation, the last one being the process of integration of digital solution into the social practices, which may boost new social activities or changing the existing ones (Brunori et al., 2020). Consequently, digital innovation is identified as *game changers, because their adoption deeply transforms the wide context in which both routines and interactions take place due to their connection with multiple elements of the socioeconomic system* (Rolandi et al., 2021).

The aforementioned definition of DRABE is consistent with a new perspective of innovation in rural areas which has been identified by Torre et al., (2021) as territorial innovation. This is not limited to production process, but it involves organizational, social and institutional innovation. However, when digital technologies are considered, it is necessary to verify how spatially dispersed knowledge is mobilized and anchored in territorial rural systems within a process called as combinatorial knowledge dynamics (Jeannerat, Crevoisier, 2016). This may bring about new hierarchies which are created and ordered by different capabilities of knowledge anchoring. As a matter of fact, digital technologies call for multilateral platform-based coordination which may change relationship among actors, through building new proximity relations (Bernela, Ferru, Rallet, 2022). Nonetheless, we posit that the role of territory is not downsized, in that the territory rural game brings about different anchoring mechanisms also in case of digital technologies. Actually, as pointed out by Crevoisier and Jeannerat (2009, p.16), *it is the territory that characterizes innovation by means of its relations with others, including those at a greater distance away, by the way in which it structures the legacy of its past and by the way it permits itself to make projects for its future.*

This is coherent with: a) the idea of non-neutrality of digital innovation, especially in boosting ecological transition (Schnebelin et al., 2021) and b) the different paths of digi-grasping in rural contexts (Fielke et al., 2020; 2021), which stimulate an in-depth analysis of the anchoring mechanisms of combinatorial (local and mobile) knowledge through the working of different kinds of proximities. Consequently, territorial (digital) innovation is drawn on the working of territorial proximities, mainly geographical and organized proximity (Gallaud and Torre, 2022). However, a rigorous analysis of building process of performant DRABE should pursue a multilevel process of proximities, involving also institutional proximity, in the sense expressed by Boschma's (2005) seminal paper. More precisely, we make reference to the macro dimension of institutional proximity, that can be considered as "*enabling factors, providing stable conditions for interactive learning to take place effectively*" (Boshma, 2005, 68). More precisely, institutional proximity is realized when institutions at macro level are able to set up conducive environments for rural entrepreneurship (De Rosa et al., 2022). A typical example is the recent evolution of European rural policies. In the long term vision for rural areas, strong, prosperous, resilient and connected rural areas are promoted through a set of guiding initiatives, the introduction among which digital connectivity takes on a fundamental importance. This will set up new policy offering, whose "consumption" may provide farmers and rural areas with new opportunities, which, if well exploited, may engender smart rural development.

Beyond institutional proximity, it is necessary to explore territorial proximity, through the analysis of geographical and organized proximity. By following proximity school of thought, organized proximity relies on two main logics (Gilly, Torre, 2000):

- ✓ logics of belonging, which refers to the actors' belonging to the same network, for instance a rural localized system,
- ✓ logics of similarities, meaning that actors share similar norms and values or systems of representation.

How to evaluate the working of the two logics brings about analyzing the relational configuration of the actors involved in the DRABE, by excavating bonding, bridging and linking ties<sup>1</sup>. If, on the one side, bonding ties boost incremental innovation, on the other side, bridging and linking ties allow a wider access to formal and mobile knowledge, by taking advantage from experience developed elsewhere and, consequently, opening up new windows of opportunities to diversify business models (Cofré-Bravo et al., 2019). Therefore, digital innovation needs to set up all the three types of

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<sup>1</sup> By following literature on social capital (among others: Woolcock, 1998; Angeon, Callois, 2006), bonding ties concern very strong horizontal relations among people of the same community (family, ethnic groups), which may present points of weakness underlined by Mark Granovetter (1985). Bonding ties involve more "distant" actors and may be also extraterritorial, connecting different actors localized in different contexts. Finally, linking ties involve vertical relations with people in power, like connections with political or financial institutions.

relationships to promote a “disruptive-type” of innovation. More precisely, a balanced relational architecture should qualify the DRABE, through empowering ambidexterity<sup>2</sup> in relational configuration (Cofré-Bravo et al., 2019; Klerkx et al., 2017; Vecchio et al., 2021). What effectively “balanced relational architecture” means, cannot be *a-priori* identified, depending on direction the farming systems is taking on and on how digital solution may either boost or not transition. This is particularly true in case of transition towards more sustainable farming systems, an example of which is surely agroecological transition.

## 5. Agroecological transition and directionality of digitalisation

As pointed out in previous paragraphs, digital solutions may pave the way to boost societal mission, like agroecological transition. How to match digitalization and agroecological transition is a key issue deserving attention. As a matter of fact, directionality of digitalization is a little explored field of research, which deserves more attention, with the purpose of clarifying:

- a. which directions digital solution may take on when an agroecological transition is ongoing;
- b. eventual Upa Tree effects (Checkland, 1976) caused by digitalization, which may either exclude some actors from the benefits of digitalization or becoming a privilege for the few.

These aspects need clarification, in account of the complexity characterizing agroecological sociotechnical transition. Agroecology is a relatively recent field of research which is gaining ground in both developed and developing countries. According to van der Ploeg et al. (2019, 46),

*Agroecology is an approach to farming and food systems that is based, as much as possible, on the use of natural resources and ecological principles and on closing biological cycles at farm or local level. Labour and knowledge play a key role in this. The centrality of natural resources (produced and reproduced on the farm and/or obtained through direct, socially-regulated exchange from farmers and other actors in the food chain) implies a high degree of autonomy that translates into a pillar of economic and ecological resilience*

Adoption of agroecological practices provides a sound contribution to promote a sociotechnical transition, by involving societal aspects and not only technological ones, so strengthening the resilience of the farming activity and the rural areas (van der Ploeg et al., 2019). This is secured through involving a diversified set of agricultural practices making farming activity more sustainable, diversified and remunerative (van der Ploeg, 2021).

Set against this background, agroecological transition brings about building up “multiperformant” farming systems, whose impact on rural areas has to be considered from a multidimensional perspective (Lucantoni et al., 2021). How agroecological transition may be stimulated and promoted by digital solutions and which direction may be taken on within agroecological transitions boosted by digitalization remains an interesting topic to be explored more in-depth (Schnebelin et al., 2021).

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<sup>2</sup> Ambidexterity is defined by Turner et al. (2017: 504) as “exploiting existing and exploring new networks to access, combine, create, or disconnect capabilities”.



Surely agroecology entails a strategic portfolio of innovative projects, involving social, organizational, digital, which as identified as coupled innovations (Mazzucato, 2016; Meynard et al., 2017). How digitalization may empower and/or speed up this transition is an interesting field of analysis to be explored in future researches.

### **Conclusions and policy implications**

This paper represents a first attempt to identify a new configuration of an entrepreneurial rural ecosystem, we have labelled as DRABE, in account of the relevance of digital innovation in shaping future trajectories of territorial rural development. The shared definition of DRABE enlightens some critical issues which are of paramount importance to evaluate processes of transition towards sustainable agricultural models, the most important of which are neutrality and directionality.

As far as directionality is concerned, it is worth underlying that digital innovation addresses different paths of development in farming activities and rural areas. As underlined by Schnebelin (2022), digital technologies for information and communication typify agroecological transition, by reconfiguring production systems through the support of digital solutions. As far as neutrality is concerned, we agree with the idea of non-neutrality characterizing digital technologies adoption, in account of different social mechanisms at work (Brunori et al., 2020). Set against this background, the disruptive characters of technological innovation linked to digital solutions may emerge, as pointed out in recent literature (Klerkx, 2020). Risks of elite capture are evident, in account of the low propensity to adopt this kind of innovation.

Consequently, a relevant role in this context is played by policies, whose task is to encourage digital innovation as tool to stimulate transition towards more sustainable farming systems, by strengthening their resilience. The long term vision for rural areas clarify connected rural areas as a pillar for planning future modern rurality: in this context, the recently approved common agricultural policy provides both direct and indirect tools for supporting digital transition, for instance through funding advisory services, cooperation or investment on digitalization. How farmers will be able to exploit these opportunities remains to be questioned.

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