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UNVEILING THE RESOURCES OF DIGITAL PIONEERS: AN AGENCY PERSPECTIVE ON DIGITAL SOCIAL INNOVATION IN RURAL GERMANY

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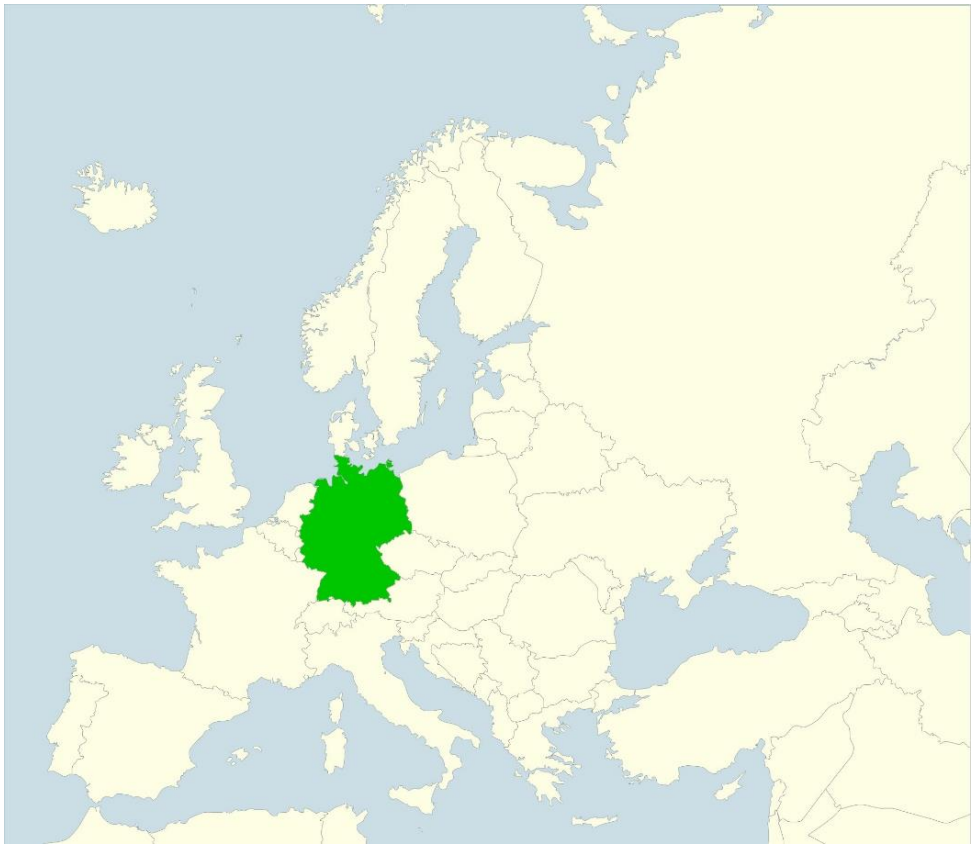

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Abstract: Rural digitalisation is often approached from a structural research perspective, focusing on broadband infrastructure and socio-economic contextual conditions. Such perspectives tend to neglect the agency of individual and collective actors in these areas. Our comparative case study addresses this gap by focusing on Digital Pioneers in two structurally different rural regions in Germany. Our analysis of 40 semi-structured qualitative interviews with selected pioneers is based on the research question of how these key actors access resources to realise digital social innovation. A categorization of our data shows three general patterns: Access to motivational resources on an individual level, access to network-based resources through various types of social relationships, as well as access to region-based resources by analytically linking agency and socio-spatial contextual conditions. We conclude that Digital Pioneers can become intermediary key players in regional governance constellations. At the same time, additional policy support or reversion is needed to facilitate access to network- and region-based resources in particular.

Keywords: Digital pioneers, digital social innovation, agency, resources, rural Germany

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Zusammenfassung: Die Digitalisierung ländlicher Räume wird oft aus einer strukturellen Forschungsperspektive betrachtet, die sich auf Breitbandinfrastruktur und sozioökonomische Kontextbedingungen konzentriert. Solche Perspektiven neigen dazu, das Handeln individueller und kollektiver Akteure in den entsprechenden Regionen zu vernachlässigen. Unsere vergleichende Fallstudie setzt an dieser Lücke an, indem wir Digitale Pioniere in zwei strukturell verschiedenen ländlichen Regionen in Deutschland betrachten. Unsere Analyse von 40 teilstrukturierten qualitativen Interviews mit ausgewählten Pionieren basiert auf der Forschungsfrage, wie diese Schlüsselfiguren Ressourcen erschließen, um digitale soziale Innovationen zu verwirklichen. Die Ergebnisse der Kategorisierung unserer Daten zeigen drei übergeordnete Muster: Zugänge zu motivationsbasierten Ressourcen auf der individuellen Ebene, Zugänge zu netzwerkbasierten Ressourcen durch verschiedene Arten sozialer Beziehungen sowie, durch die analytische Verknüpfung von Agency und sozialräumlichen Kontextbedingungen, auch Zugänge zu regionsbasierten Ressourcen. Wir resümieren, dass Digitale Pioniere intermediäre Schlüsselfunktionen innerhalb regionaler Governancestrukturen einnehmen können. Dazu benötigen sie aber verstärkte oder an ihre Bedürfnisse angepasste politische Unterstützung, insbesondere um netzwerk- und regionsbasierte Ressourcen besser nutzen zu können.

Stichworte: Digitale Pioniere, digitale soziale Innovation, Agency, Ressourcen, ländliches Deutschland

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Highlights

- Individual or collective actors take on pioneering roles in digital social innovation processes
- Their agency is strongly oriented towards addressing crucial challenges in rural development
- Their capabilities depend on access to motivational, network-based and regional resources
- Such Digital Pioneers can become key intermediary players in regional governance
- However, their access to network- and region-based resources requires policy support or reversion

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1. Introduction

Recent studies on digital transformation indicate the multidimensional effects on social, ecological and economic matters. Following the understanding as a non-linear process that implies profound changes in

social systems, our interest in digital transformation is characterized by a spatial perspective, focussing on the interplay of key actors` agency and regional context conditions. From that angle, digital transformation emerges as a result of complex multi-level governance and as uneven spatial development, based on an uneven distribution of resources (Maschke et al., 2021, p. 25). In this context, rural regions are often seen as being at a disadvantage (Cowie et al., 2020).

On the other hand, digitalisation is seen as having great potential for the development of rural regions to mitigate uneven spatial development. This applies to economic value creation (e.g., Falter and Jóhannesson, 2022; Ferrari et al., 2022) as well as to basic service provision[4] (e.g., Lindberg and Lundgren, 2020; Rundel and Salemink, 2021) and social cohesion (e.g., Thewes et al., 2024; Vercher et al., 2021). At the same time, digital transformation in rural regions faces particular challenges (e.g., Salemink et al., 2017): a lack of digital infrastructure, low institutional density and a low number of clusters in the areas of research and development, as well as comparatively small digital-savvy milieus in the populations.

In view of these challenges, at present no saturation of digital standards, with respect to infrastructures as well as usage patterns, can be identified in German rural regions. Rather, there are individual or collective actors who take on pioneering roles and achieve positive economic, social or ecological effects by using digital information and communication technologies. Accordingly, we developed the concept of "Digital Pioneers", following current studies that identify the driving, transformative power of key figures, for example, social entrepreneurs (Richter, 2019), smart villagers (Zerrer and Sept, 2020), or spatial pioneers (Christmann, 2019; Faber and Oswalt, 2013; Matthiesen, 2012). As a main characteristic, the Digital Pioneer is understood as a transformative agent who opens new paths of collective action through the use and implementation of information and communication technology (ICT). Additionally, we define Digital Pioneers as single or collective actors, whose activities range from the private to the public and the civil society-sectors. Possessing knowledge about region-based needs and assets in their specific field of action (e.g., agriculture, entrepreneurship, mobility, health, and co-working) as well as digital literacy[5], they implement not only technical digital solutions but also distribute new social practices by means of digital tools. Accordingly, many of our Digital Pioneers are not immediately recognisable as technology experts. Some would not even categorise themselves as such. Rather, they manage to implement effective and efficient solutions with the targeted use of digital tools.

Hence, digital transformation in rural areas is analysed through the lens of agency approaches (e.g., Emirbayer and Mische, 1998), emphasising "the capacity of socially embedded actors to appropriate, reproduce, and, potentially, to innovate upon received cultural categories and conditions of action in accordance with their personal and collective ideals, interests, and commitments" (Emirbayer and Goodwin, 1994, pp. 1442–1443).

Our contribution addresses several blind spots in previous social science research. Generally, spatial smartness discourses are strongly urban-oriented ("smart city") and have largely ignored rural regions (Cambra-Fierro and Pérez, 2022; Sept, 2020). Binder and Witting (2022, p. 270) exposed this urban bias in knowledge provision, identified as the most dominant discourse in a bibliometric analysis of English language texts from the Web of Science Core Collection published before 1st of January 2020 (n=10.254). Regarding digital transformation in rural areas, few studies have focused on basic service provision (e.g., Lindberg and Lundgren, 2020; Mettenberger et al., 2021), and few others on value creation (e.g., Anderson et al., 2016; Rietmann, 2021; Townsend and Noble, 2022). Nevertheless, the discourse on smart villages in particular, has gained momentum in recent years (e.g., Cvar et al., 2020; Slee, 2019; Zerrer and Sept, 2020), addressing the differing conditions for smart solutions in rural and urban areas, for example, concerning settlement density and spatial distances in everyday life. Moreover, much of the contributions

[4] In the German context, the corresponding term "Daseinsvorsorge" is used for all services in the broader sense that the individual needs to lead an adequate life and which are therefore regularly subject to state influence when they are provided in a fundamentally market-based manner (Milstein, 2018; cited after Adam Hernández and Schneider, 2022).

[5] Concepts of digital literacy include multiple dimensions. Douglas Belshaw (2021) for example boldly defines eight elements as "Cultural", "Creative", "Constructive", "Communicative", "Confident", "Cognitive", "Critical" and "Civic". We refer to the definition by Daniel Calderón Gómez (2020, p. 223), who describes digital literacy as "distinctive dispositions, competencies, and attitudes subjectively internalized during the biographical process of domestication of technology."

are limited to an application-based and quantifying perspective (García-Ayllón and Miralles, 2015; Parada, 2017). Many spatial science analyses view digitalisation from a technology-centric perspective, while little attention is paid to connections with social innovation (Sept, 2020, p. 198). In addition, most case studies of smartness research consider rural regions as territorial units, such that urban-rural relationships and supra-regional social networks play a subordinate role (Shearmur et al., 2017). Studies on digitalisation in rural regions often focus on the structural dimension of spatial development and hence pay less attention to the micro level of key persons and their agency (with growing exceptions such as Christmann, 2014; Döringer and Eder, 2020; Rundel and Salemink, 2021; Slee, 2019). Such key persons and their role in rural regional development have been regarded as "spatial pioneers" in some studies. However, these works lack a focus on the specific contextual socio-spatial conditions of digital transformation processes.

Against that background, our paper is led by the research question: *How do Digital Pioneers use resources to foster digital transformation in rural areas?* We conducted qualitative, semi-structured interviews (n=40) with pioneers from two regions of Mecklenburg-West Pomerania and Baden-Württemberg, which are both described as "very rural" according to the Thünen typology (Küpper, 2016).

The structure of the paper is organised as follows: Section 2 identifies relevant research strands and reflects approaches to *digital social innovation* and *agency*. Section 3 describes the methodology, including the selection of case study regions, the sampling of digital pioneers, as well as the design, realisation and analysis process of our semi-structured qualitative interviews. In Section 4, we present our empirical findings on the use of motivational, network-based and region-based resources by Digital Pioneers. Section 5 discusses those findings against the background of the current state of research. In the concluding section 6, we summarise the central arguments of our paper and outline their relevance for future research activities.

2. Taking an agency perspective on digital social innovation in rural areas

Digital transformation is closely connected to innovation processes. These processes often refer to technical innovation, e.g., the development of new software solutions for companies or public institutions. But this perspective does not take into account the socio-spatial conditions for technical innovation. With the concept of social innovation (for an overview, see Neumeier, 2012), we follow the Moulaert (2010, p. 7) definition, describing it as "new ways of organising co-operation, new dynamics for society building, […], a concept, linking concrete down-to-earth, bottom-up initiatives to necessary transformations in governance." Therefore, social innovation developed by Digital Pioneers may be constitutive for digital transformation. This means, technical innovation must be given additional meaning through social practices (Howaldt and Schwarz, 2010, p. 89; Sept, 2020, p. 198). Digital social innovation thus describes social practices as improving well-being with the help of digital technologies (Qureshi et al., 2021, p. 647). Such technologies are used as "solutions for a wide range of social needs and at a scale and speed that was unimaginable before the rise of the internet" (Bria, 2015, p. 9).

Whilst research on digital social innovation misses corresponding perspectives (Sept 2020, p. 199), initial studies indicate that social innovations are primarily the result of the agency of key players and their networks (e.g., Christmann et al., 2023; Richter and Christmann, 2023; Unthan et al., 2022; Zerrer and Sept, 2020). We refer to the notion of agency for tackling individuals' capacities to act and make choices within societal structures (Keim-Klärner et al., 2021, p. 18). Agency therefore relates to the micro-level of the individual (ideals, interests, commitments), embedded into socio-spatial context (Emirbayer and Goodwin, 1994). Hence agency is seen as the source of the (re)production and transformation of the structure, as "relationally situated, subjectively interpreted, and circumscribed" (Keim-Klärner et al., 2021, p. 18). To operationalize agency in rural spatial settings and to analyse its concrete aspects, we relate to the concept of resources, understood through a functional perspective, indicating a specific set of assets that determine individual capabilities: "Resources are these means, instruments and permissions, structured by habitus and dispositions" (Blokland et al., 2016, p. 15). What is not made explicit in this definition is the interdependence with the socio-spatial context.

Regarding the latter, Christmann (2014) observed in Berlin-Brandenburg and Bavaria that civil society actors took the initiative and realised locally effective social innovations with the help of digital technologies. These key persons thus acted as mediators of social, political, cultural, ecological or economic processes of change. In a recent qualitative study, Zerrer and Sept (2020) highlight the role of so-called "smart villagers": civically engaged older community members with their main or temporary residence in the region. These people want to contribute to improving local services through digital solutions. In doing so, they are helped by knowledge acquired in their professional lives in the areas of technology, management and communication Mettenberger and Küpper, 2019), as well as direct contacts to regional decision-makers. Digital social innovations and smartness approaches driven by key individuals are increasingly coming to the fore not only in academic debates but also at the interlinkages with rural and regional development in practice, e.g., within the 'local heroes / Localne face' approach (University of Ljubljana, n.d.), the German practice-research-project "Digital Villages" (Fraunhofer IESE, n.d.) or the EU projects "SmartVillages" (Interreg Alpine Space, n.d.) and "Carpe Digem" (Interreg and European Regional Development Fund, n.d.) which target public, private or civil society actors to enhance spatial conditions for the emergence of integrated digital ecosystems.

Key figures of digital social innovation processes thus exhibit characteristics that have long been attributed to so-called "spatial pioneers" in the revitalization of urban areas (Matthiesen, 2012) or in the discourses on urban and regional development (Christmann, 2019). Spatial pioneers appear as vitalisers of spaces with a particular need for renewal, as transformation profilers or as networkers in small-scale organisational structures (Matthiesen, 2012). In German language research, spatial pioneers are primarily considered in the context of rural basic services, as they can complement state provided offers with their welfare-oriented actions (Faber and Oswalt, 2013). For example, spatial pioneers advocate the modernisation of the water, gas or electricity supply or improved access to health, school education, leisure or culture (Faber, 2013). Here too, the central importance of social networks is emphasised since the pioneers, as intermediary actors, help promote relations between civil society and public institutions.

Similar to our study, Unthan et al. (2022) highlight the agency perspective in regional development, using the "pioneer" label. The authors argue that social innovation is a solution for local problems and try to illustrate factors that foster or hinder social innovation in rural areas. Their research on creative approaches to achieve socio-ecological transition places the emphasis on the agency of individual and collective actors, without highlighting digital literacy as a crucial sampling aspect, as described by the concept of digital social innovation (Qureshi et al., 2021). Focusing on UNESCO-protected biosphere reserves, the methodological sampling relies on a specific regional setting that is characterized by a protective legislative framework. The results indicate, firstly, a link between the physical-material environment and the creative approaches of the actors (Unthan et al., 2022, p. 224). Their motivation is described as the dual conflict of preservation and change: the wish to maintain the landscape and the perceived necessity of change. Secondly, motivations are based on multilocality that is understood as a co-presence of actors at different localities. Therefore, urban-rural relationships and the relational concept of the region constitute an important factor for transformation. Although Unthan et al. (2022) do not focus on the impact of ICT for agency, the results are interesting and are reflected in the discussion chapter (4), where they are contrasted with our findings.

The agency of the spatial pioneers in rural areas described in the current research corresponds to concepts of "place-based leadership", as reflected in positions in urban and regional development (e.g., Acuto, 2013; Beer and Clower, 2014; Beer et al., 2018; Budd and Sancino, 2016; Sotarauta et al., 2017). These debates emphasise that key persons do not act outside social systems, but are significantly influenced by socio-spatial contextual conditions (Benner, 2020; Gailing and Ibert, 2014; Grillisch and Sotarauta, 2020; Sancino and Hundson, 2020). A complementary perspective with a stronger focus on the socio-spatial conditions analysed at the local scale has been shaped through debates on urban areas with their respective neighbourhood effects (Atkinson and Kintrea, 2001; Buck, 2001; Sampson, 2001). These discourses revolve around the central question: How does the socio-spatial context (usually small-scale) in its infrastructural, social and symbolic dimensions influence the everyday practices and orientations of individuals?

In contrast to that, peripheralisation research can be understood as an upscaling perspective, but which explicitly focusses on the contextual conditions of resource-scarce rural regions (e.g., Beetz et al., 2008; Naumann and Reichert-Schick, 2012). It thereby highlights a specific structural condition, shaped by less advantageous local factors compared to urban areas. It also shows the interdependence of economic, social and political factors, characterising peripheralisation as a multidimensional process (Binder and Matern, 2020, 1049), along with the resulting multiple problem constellations. Further focus lays on the relations between centres and peripheries, between rural areas and urban agglomerations (Siedentop and Stroms, 2021), classified as core-periphery relations (Raagmaa, 2015). The socio-spatial context of peripheral rural regions bears specific potential and challenges for digital transformation. Digital solutions may help to overcome physical distances without time expenditure, saving distances and serving smaller locations (Küpper and Mettenberger, 2020). Likewise, debates on territorial peripheralisation problematise the resource bottlenecks of structurally weak rural regions as they come to bear on financial, personnel and infrastructural (e.g., broadband) aspects, among others, and can impede the development of effective digital basic service solutions (Mettenberger/Küpper, 2021; Naumann and Reichert-Schick, 2012).

Theories of agency, place-based leadership and peripheralization all emphasise social networks as essential resource access points. Hence, social networks are understood as constitutive for agency as well as for structure perspectives. From an agency perspective, such network-based resources are broadly discussed as social capital (Bourdieu, 1986). Social capital in social networks offers a much-referenced point of departure. A distinction is often made between “strong” and “weak” relationships, with the latter having particular potential to open up access to new information. Accordingly, certain social relationships can bridge “structural holes” (Burt, 2004) between otherwise separate networks of people and open up specific access to resources. Similarly, different forms of social capital can be distinguished: “bonding social capital” refers to contacts within specific groups of individuals (such as close relatives, friends and neighbours), “bridging social capital” refers to connections between different groups, e.g., neighbourhood initiatives and public departments (Larsen et al., 2004, pp. 65–66). In addition, “linking social capital” can be understood as connections to authorities with special power resources, such as key institutions in the field of action or funding agencies (Woolcock, 2001, p. 11).

In our study, we focus on the functional bridging and linking dimension of networks as “building bridges between various sectors and (geographical) contexts” (Novikova, 2021, p. 73). Critical voices, however, point out that social capital approaches are determined by the reconstruction of relationships, but do not go on to examine the source of the resources that are actually transferred via these relationships. The debates outlined show that access to the resources of Digital Pioneers emerges from the agency of individual and collective actors. Nevertheless, the respective scope for action is influenced by the socio-spatial contextual conditions. Meanwhile, the socio-spatial structure is (re)produced through agency. This reciprocal relationship will be further analysed. As said, the spatial environment should by no means be ascribed a rigid influence in the sense of the spatially deterministic understanding of a container. We follow the definition of a region as a relational concept. Nevertheless, their socio-spatial status as “very rural” was a precondition for the selection of the two case study regions, as indicated in the following section.

3. Case study design and methods

Our research design is based on a comparative research design, combining several purposeful sampling strategies (Patton, 1990, pp. 169–183). As we are interested in pioneer-driven digital social innovation in the specific spatial context of *rural* areas, we identified areas in Germany that are characterized as “very rural” according to the Thünen typology (Küpper, 2016; Thünen Institute, n.d.). The latter differentiates rural from non-rural areas in a continuum with threshold values, basing on six structural indicators. Its “very rural” end is characterised by low settlement density and population potential, high shares of agricultural and forest land, single- and two-family houses, and poor accessibility to large centres (Küpper, 2016). Thereby, we defined a consistent context variable. To establish a dimension of comparison and to follow a maximum variation sampling strategy for abstracting key insights from place-specific aspects

(Patton, 1990), the next step was to select two federal states with highly different socio-economic and digitalisation-related context conditions. At the time of our sampling in 2021, we found these differences to be very pronounced between Baden-Württemberg in the southwest and Mecklenburg-Western Pomerania in the northeast of Germany. To do this, we first compared the socio-economic context conditions using the Thünen typology. It provides a continuum of good and less good economic regional situations, based on the following indicators: average unemployment rate, average gross wages and salaries, median income, average municipal tax revenue, average net migration balance of 18–29-year-olds, vacancy rate of housing, average life expectancy of women, average life expectancy of men, and average high school dropout rate (Küpper, 2016). According to this, all rural districts in Baden-Württemberg, except one (not in our final sampling), are in a "good socio-economic situation". By contrast, in Mecklenburg-Western Pomerania, all rural districts are categorized by a "less good socio-economic situation" (Thünen Institute, n.d.). Looking at the development over time, a socio-economical shrinkage and growth index, based on demographic indicators (population development, net migration, labour force development) and economic indicators (employment trends, unemployment rate, basic trade tax revenue), available for the period 2011–2016 (BBSR, 2017) expressed, that Baden-Württemberg was shaped by growing rural districts, whilst those in Mecklenburg-West Pomerania were shrinking or in no clear direction of development. Regarding specific digitisation conditions by the indicator of households' broadband availability at a district level, 2017 data showed a much better supply in rural Baden-Württemberg (Thünen Institute, n.d.).

In further steps, individual and collective actors potentially driving digital social innovations were identified through online research focussing on all rural regions in Baden-Württemberg and Mecklenburg-West Pomerania. Doing so, we used grey literature, databases and systematic keyword research via Google. On this basis, two regions were selected that are home to a comparatively large number of (potential) Digital Pioneer activities: a region in northeast Baden-Württemberg that is constituted by four districts and one in southeast Mecklenburg-West Pomerania that contains two districts (see Figure 1 and Tab. 1). Regarding the aspects of socio-economic situations, growth or shrinkage and broadband availability described above, both regions face detrimental context conditions, as their broader spatial surroundings do.

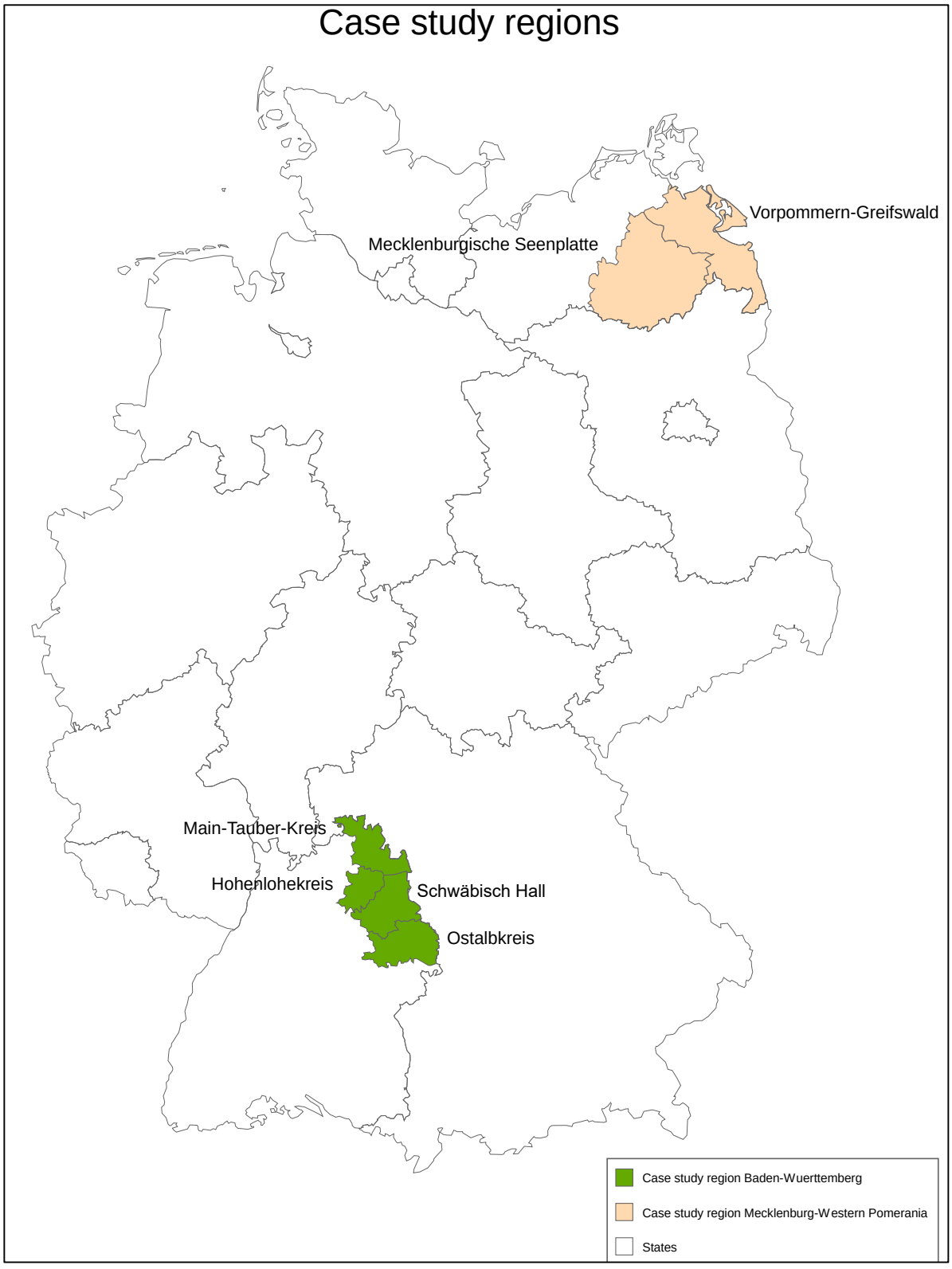

Fig 1. Map of the two German regions. Source: own elaboration based on (c) Geo-Basis-DE / BKG2021

Tab 1. "Rurality", "Socioeconomic Situation", "Socio-economical Shrinkage and Growth" as well as "Broadband availability" within the case study districts (Thünen Institute n.d.; BBSR, 2017). Source: own elaboration based on Thünen Institute, n.d. and BBSR, 2017

District	**Rurality (2016)** (Source: Thünen Institute, n.d.) (the higher the value, the more rural the region)	**Socioeconomic Situation (2016)** (Source: Thünen Institute, n.d.) (the lower the value, the better the situation)	**Socio-economical Shrinkage and Growth 2011–2016** (Source: BBSR 2017) (Scores between 0 and 24)	**Households' Broadband Availability (2017)** (Source: Thünen Institute, n.d.)
Baden-Württemberg				
Main-Tauber	0.83 („very rural")	-0.7 („good situation")	growing, 14	70.3%
Hohenlohe	0.7 („very rural")	-1.27 („good situation")	growing, 16	78.7%
Schwäbisch Hall	0.75 („very rural")	-1.03 („good situation")	growing, 15	73.1%
Ostalb	0.56 („very rural")	-1.18 („good situation")	growing, 17	80.7%
Mecklenburg-West Pomerania				
Mecklenburgische Seenplatte	0.55 („very rural")	1.98 („less good situation")	shrinking, 9	61.3%
Vorpommern-Greifswald	0.56 („very rural")	1.97 („less good situation")	shrinking, 9	61.1%

In these regions, we used the snowball method and asked 190 actors, such as mayors, heads of administration, district staff and LEADER representatives, to recommend other (potential) Digital Pioneers in their regional area. In addition, we launched a call for participation that was published in the official gazettes, social media and websites. Hence, while the online research mostly identified actors in the public sector, the snowball method in particular led us to actors in the private sector. We received numerous recommendations for potential Digital Pioneers that we were not able to identify with our initial methodological approach of desk research. From the list of potential Digital Pioneers generated online and via recommendation, 192 individuals, projects, schemes and initiatives were selected that appeared particularly promising in terms of digital social innovation. Digital social innovation was operationalized through the indices "effect (public service, living conditions, social cohesion, economic value creation)", "innovation (generally new, new for the region)" and "pioneerdom (related to effect, related to innovation)". Basing on that, we started prioritizing within our collection. Finally, we identified a shortlist of individual or collective actors that were perceived as Digital Pioneers by local actors, that described themselves as Digital Pioneers in reaction to our call for participation or that were identified by our initial desk research.

Based on that shortlist of Digital Pioneers in our two case study regions in southeast Mecklenburg-West Pomerania and northeast Baden-Württemberg, 40 of them agreed with our interview request. However, the pioneers are not evenly distributed between the two regions; we have interviewed 23 pioneers in Baden-Württemberg and 17 pioneers in Mecklenburg-West Pomerania (see Tab. 1). Pioneers are individuals, companies or public institutions. There are newly founded projects or companies, but also classical entrepreneurships or already well-established companies, universities or other public institutions. Related to the notion of digital social innovation, our sample includes solutions for a wide range of social needs (Sept, 2020, p. 199) based on heterogeneous technologies from the generations of web 1.0, 2.0 and 3.0 (Thewes et al., 2024, pp. 48–49). With our sampling strategy, we aimed to include digital pioneers from areas that have so far received less attention in smartness research and to go beyond the publicly visible projects. We therefore prioritised particularly promising fields of action based on online research and recommendations from key informants. Hence, we have concentrated on five different areas, in which the most promising solutions can be found: Entrepreneurships and Start-Ups,

Co-Working, Agriculture, Health and Mobility. Based on our prioritization, the distribution of projects to the five fields of action varies greatly between the two regions (see Tab. 2).

Tab 2. Number of interviews, variation between fields of action and regions. Source: own elaboration

	Entrepreneurships/ Start-ups	Co-Working	Agriculture	Health	Mobility	Total
Baden-Württemberg	10	4	3	1	5	23
Mecklenburg-West Pomerania	8	7	1	1	-	17
Total	18	11	4	2	5	40

Before the interviews began, a data management plan, along with an information letter and consent form for the interviewees, was approved by the legal department of the Brandenburg University of Technology. Among other things, participants were assured that interview quotes would be published only in pseudonymised form.

On this basis, 40 qualitative and semi-structured "problem-centred" (Witzel, 1989) interviews were conducted in 2021 and 2022. Due to the COVID-19 pandemic, the interviews with the Digital Pioneers were conducted remotely via telephone or video chat and lasted between 60 and 120 minutes. For the design of our guideline, the objective of the overall project "Digital pioneers in rural regional development" was decisive: to understand the socio-spatial contextual conditions under which digital pioneers introduce knowledge, resources, networks and social innovations to the regions; thereby deriving policy recommendations for various stakeholder groups. Hence, the central aspects of the guideline were: 1. Descriptions of the respective projects and their digital components; 2. The interviewees' involvements in those projects, as well as their digital literacy; 3. the genesis, objectives and challenges of the projects, 4. the influences of rural and regional context conditions; and 5. final assessments and outlook. Additionally, the social relationships of the pioneers relevant as access to resources were reconstructed. This was done using systematic "name generators" (e.g., Mollenhorst et al, 2008: 62) to identify and further characterise the various relevant individuals and institutions, including their locations and fields of activity. Although a relatively narrow questioning technique was employed, the interviewees provided detailed and self-structured narratives. During the first interviews, it became apparent that aspects addressed by the subsequent questions had already been covered in the initial narratives. Consequently, some interviews deviated from the guideline's sequence, with aspects anticipated by the interviewees explored in greater depth through follow-up questions. The initial interviews also revealed that interviewees generally discussed the key challenges for their projects in great detail. Therefore, it was crucial to consistently inquire about how these challenges reflect the specific rural context conditions of the respective region. The interview data was coded using the MAXQDA software. In the process of data analysis, eleven deductively generated upper categories oriented to the guideline and twenty-nine partly inductively generated subcategories from the data material were formed.

Based on these process-oriented categories which were closely aligned with the guidelines and processes of projects' genesis and implementation, the research team conducted an interpretation process to identify the essential resource accesses for the agency of the sampled pioneers. This analytical process revealed three interplaying spatial-relational dimensions described in more detail below. Interview passages labelled with different central codes were incorporated into each dimension, as illustrated in the "concept map" (Kukartz and Rädiker, 2024) below (Figure 2).

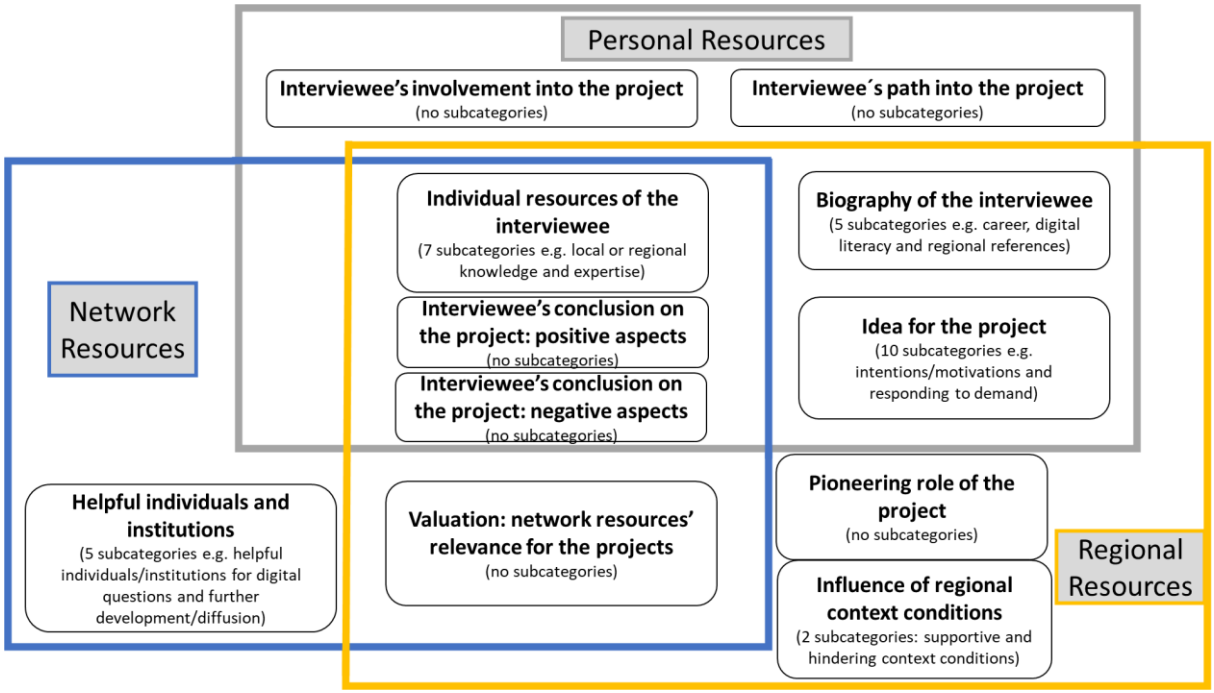

Fig 2. Concept-Map of MAXQDA codes (Kukartz and Rädiker, 2024), basing the three analytical dimensions of personal resources, network resources and regional resources. Source: own elaboration

4. Results

In the following section, we present the key results of the qualitative interview data. To analyse agency in different socio-spatial contexts, we define "resources" as the particular set of assets that determine individual capabilities. In our interview narratives, three main types of resources can be distinguished, each of which will be discussed in a subchapter: motivational resources at the micro-level, network-based resources at the meso-level and region-based resources at the macro-level. Hence, we analysed the categorisation of empirical data according to the category of social distance. While motivational resources rely on an immediate distance, e.g., the micro-level, network resources refer to an intermediate level, e.g., the meso-level, while region-based resources refer to a larger social distance, e.g., the macro-level. At all three scales, agency can be observed interplaying with socio-spatial contextual factors, as the respective MAXQDA codes show. Nevertheless, there are differences in the configuration of the interactions. With regard to motivational resources, individual references to the socio-spatial context are significant, whereas, with regard to region-based resources, structural conditions are relevant for an extremely large number of actors, as will be explained in more detail in the following three sub-sections.

4.1 How Digital Pioneers make use of motivational resources

To understand how and why Digital Pioneers in rural regions use and rely on motivational resources, a closer look at their objectives is crucial. In our material, we identified five overarching goals, Digital Pioneers want to achieve with the help of ICT. At least one of those goals is relevant for each of the pioneers, often there are several. The first objective is to test and establish new products and processes, e.g., in a classic entrepreneurial context. Secondly, actors want to optimize their processes or products in order to save costs and resources. A third aim, that appeared to be especially relevant for pioneers who were categorized as private actors, is to strengthen competitiveness. Fourthly, actors want to facilitate access to their products and services, which was especially apparent in the data collected under the impact of COVID-19. As the fifth objective, pioneers work on improving local supply, if necessary, with new forms of organization, to address local needs.

These five objectives were achieved with different forms of digital social innovation. Technical novelty can be observed, regarding concrete software or hardware components or completely new digital solutions. However, the decisive factor for efficiency and effectiveness is usually a target group and purpose-oriented use and adaptation of the technical possibilities. Often, the pioneers also react to the need for action in their company, their sector or even their region. Many of them consider the use and continuous development of digital technologies to be very important, especially in their projects, initiatives or companies, but also beyond them. The exception here is the field of co-working spaces in both case study regions where digital technologies are declared important for attractive and efficient offers, but other aspects such as social interactions and networking between co-workers are seen as more relevant.

Intrinsic motivation

The pioneers' objectives are driven by multiple motivations that we categorize as intrinsic, pragmatic, region-oriented, generational and functional. First, the pioneers have a strong *intrinsic motivation* to bring about positive change in their field of activity. They use different personally available resources (expertise, time, money, digital literacy) to develop processes and products in order to expand knowledge and gain new insights through digitalization. In addition, some pioneers describe the development of personal contacts and networks through new digitalization projects as a motivation.

Pragmatic motivations

Furthermore, Digital Pioneers express *pragmatic motivation* to improve the effectiveness and efficiency of their companies or service providers with the help of digital technologies coupled with their specific expertise. Building on this, the motivation of the Digital Pioneers to find a specific solution for a concrete problem was high.

Region related motivations

However, motivations are often linked to personal identifications with rural regions. There are three main kinds of such *region-oriented motivations.* Firstly, it is important for many pioneers to explicitly develop rural areas and to unfold regional potentials. Thus, numerous interviewees want to highlight positive economic and private location factors, partly in comparison to urban areas. Digitalisation and especially ICT are seen as possibilities to show that innovative solutions and approaches to economic, social and ecological issues can also be found in rural areas. Or, more generally, that there is activity in rural areas with a positive impact for the region.

Secondly, the awareness that rural regions can and should be developed, is often motivated by biographical ties to the respective locations. Referring to this, an entrepreneur located in southeast Mecklenburg-West Pomerania reflects on his attachment to a place:

> *"Personally, I think it's very nice to find something in rural areas because I think it's always such a shame when all start-ups are always founded in Berlin, Munich and so on, even though there are extremely good opportunities here, especially in the context of digitalisation. [...] Exactly right, I think it's more important that the added value, i.e., the taxes that you pay later, also stay in rural areas. I also come from a rural area and maybe I'm trained to do that due to my upbringing."* (Interview 16_12-10-21)

In this quote, it is not only about the development of rural areas in general, but specifically about the region with individual place attachment, from the pioneers' point of view. There is a strong belief that those places can and should be strengthened economically and socially. Consequently, it is frequently a conscious decision on the part of the Digital Pioneers to locate the project, the company or the initiative in the region where they grew up. Furthermore, thirdly, digital Pioneers express a self-image that people in their rural regions should and do want to help themselves. In calling for self-responsibility they allude to the actively engaged citizen. Corresponding challenges and needs for action are experienced in daily life. Consequently, biographical regional embeddings bear important motivational resources for

pioneering activities. Feelings of belonging and place attachment strengthen the individual interest in digital solutions for place-related problems. Likewise, regional- and local-specific knowledge helps with the implementation of tailored digital solutions. Furthermore, regional contacts and networks can facilitate the implementation of digitalisation, as we will further elaborate on in chapter 4.3.

Generational type of motivations

The so-called *generational type of motivation* also has a strong individual and biographical dimension. For many pioneers, the compatibility of family and work facilitated by the rural quality of life was a further driver to settle in the respective regions and hence become active there and not elsewhere. The most common motivation of the Digital Pioneers, expressed by many of them, was that they wanted to move back to live closer to the broader family for reasons of social support and cheaper housing. Or as a co-worker and mother from Mecklenburg-West Pomerania put it: *"[...] then you have a family and all of a sudden your priorities shift and the longing to move back into the countryside, to be closer to your grandparents, for example, somehow outweighed this to some extent."* (Interview 23_22-10-21)

Functional motivations

The last type of motivational resource is the ability to access funding programs. The capacity to raise public funding was mentioned by several public Digital Pioneers, but only played a minor role in the sample. However, in some projects, public money enabled something new to be tried out, which was understood as a *functional motivation.*

To sum up, Digital Pioneers rely on resources that can be categorized according to intrinsic, pragmatic, region-oriented, generational and functional motivations to establish agency in rural regions. These different types of motivation shape the Pioneers' objectives, which link the activity to information and communication technologies. According to the level of analysis, all the data presented here refers to the micro dimension, close to the individual persons. However, such motivational resources overlap with network-based resources that will be discussed in the next subchapter.

4.1 How Digital Pioneers make use of network-based resources

Complementary to motivational resources, Digital Pioneers' network contacts with individual and collective actors resp. institutions bear special importance. They give access to resources which are not available through individual motivations, knowledge and abilities. The pioneers themselves rate the various network resources as very helpful and to an extent essential.

We could identify five different forms of network resources which are listed as follows: *informal network resources* refer to like-minded peers. Network resources in the *field of action* are business networks and developers, chambers of commerce and industry, and transport companies. *Political and public network resources* include support through local, regional, federal state and national politics and public institutions. *Scientific network resources* are regional universities, topic-specific networks. *Technical network resources* are, in particular, companies or actors offering ICT development and maintenance. As described in more detail in the following subchapters, these network resources shape agency at the meso level.

Informal network resources

Regarding *informal network resources*, many Digital Pioneers report strong networking and social connections in their regions. As a result, there are many personal contacts. Information exchange and regular consultancy is given by peers in an informal setting. These contacts are mostly acquaintances, friends, family and informal relationships. A good example is given by a farmer:

> *"We have had a self-help group for 20 years, we call it that. It [the project idea, the authors] came about as a result of a joke. We meet every 14 days and make a field meeting, then we drink*

a bottle of beer in the evening and eat something, so that we have our little network." (Interview 7_27-09-21)

Hence, a process which was initially a friendly relationship developed into a network among farmers that promotes knowledge exchange, e.g., regarding digital solutions in order to improve processes. Similar phenomena were found in the respective fields of entrepreneurship and co-working.

Network resources in the field of action

Our sample of Digital Pioneers rate *networks related to their field of action* as particularly important. Those contacts can be both formal and informal structured. Regular exchange is especially helpful for the implementation of projects in the respective public or economic sectors. Resource access through information exchange and the receipt of practical support takes place on different levels. On the one hand, pioneers talk about direct contact with another company or individual. For example, one entrepreneur speaks of a conversation with another start-up, another of a specific key person in one's field of action who had special expertise in patents and legal issues. On the other hand, we identified narratives on larger networks that the Digital Pioneers use to obtain expertise concerning the digital components of their projects, companies and initiatives. Either new networks are established, e.g., as advisory boards or already existing networks are used. These networks are often initiated by other institutions such as the Chamber of Industry and Commerce or political bodies.

The networks in the field of action are not only relevant for the exchange of expertise on digitalisation or the development of projects and companies. They can also help new projects or, in particular, start-ups to establish themselves better in the region.

Political network resources

Through political and public sector network contacts, Digital Pioneers obtain access to *political network resources*, in particular regarding administrative and financial support. In this context, an entrepreneur from Baden-Württemberg describes the resources that were crucial for implementing digital solutions in his business:

"*When it comes to implementation, the municipal administration is still important. I also have relatively good contact with state and federal politics, which is also a very decisive advantage, and then it's also about [xx] University or the Innovation Centre [xx].*" (Interview 4_14-09-21)

Many pioneers benefit from personal, trusting and uncomplicated relationships with representatives of ministries, administrations and other key institutions operating beyond the regional level. Such networks can exist in completely different spatial dimensions. In some cases, interviewees talk about their village, town or district, and in others about state or federal ministries as important cooperation partners.

Other important public and formal network partners were the local chambers of crafts, regional economic development agencies, the employment agency and the Chamber of Industry and Commerce (IHK). Through these networks, various resources, such as expertise, support in financing or implementation or recruitment of skilled workers were accessed.

Scientific network resources

An entrepreneur from Baden-Württemberg stresses the nearby university's role as a *scientific network resource*:

„The university is an important source, not only in the person of the rector but also with respect to other members of the teaching staff, lecturers and professors." (Interview 6_16-09-21)

Universities are repeatedly mentioned in both regions as very important partners, in professional and technical questions, as well as regarding cooperation. There is often a close exchange with the regional universities, and with the help of this knowledge transfer, digital solutions are jointly sought in

the projects, companies and initiatives. Furthermore, the universities are also repeatedly mentioned in connection with skilled workers. New employees are recruited via the institutions.

Technical network resources

Besides the kinds of network resources already mentioned, *technical network resources* are also very important. It is true that many pioneers were already able to receive support on digital issues through the networks described above. Hence, network access to technical network resources can work via the aforementioned contacts in the field of action or universities. However, for specific questions or complex solutions in particular, further persons or institutions were called in once again. These network partners are exclusively relevant for solving technical issues and thus differ from the other contacts. Large tech corporations are often mentioned here. However, such specialised companies could also be smaller and regionally based. These specialised companies supply the projects, companies and initiatives with hardware and at the same time advise on technical issues.

However, it should also be noted here that some of the Digital Pioneers themselves have so much technical expertise that they need little or no support in technical matters. In addition, many pioneers continually educate themselves and try to solve technical questions themselves via various trade journals, further education or online media.

4.2 How Digital Pioneers make use of region-related resources

The comparative research design of our study relies on a contrasting approach. The two regions reveal similar spatial context conditions, as they are both classified as “very rural” according to the Thünen typology. What is different are the socioeconomic context factors, and therefore the emerging structural conditions for digitalisation. In addition to the motivational and network-related resources presented so far, our data also shows some phenomena where the pioneers’ access to resources is clearly shaped by such spatial context conditions existing equally or differently in both regions. In this case, we speak of region-related resources.

Historical ownership and regional identities

The respective spatial structures are perceived differently by the spatial pioneers from Mecklenburg-West Pomerania and from Baden-Württemberg. For example: In Baden-Württemberg, land parcelling on the basis of historical principalities still persists in the contemporary mindset, as mentioned by a pioneer in the workshop. As a result, intra-regional networking would be hindered. This is proved by the spatial dimension of a local network of Baden-Württemberg-entrepreneurs that is characterized by strong local ties. By contrast, the spatial conditions in Mecklenburg-West Pomerania are perceived as fostering intra-regional networks, and accordingly thinking. This difference is one of the main results of the workshops with Digital Pioneers from the sample that were conducted in both regions. In line with that, the Digital Pioneers in the northern rural areas were much more strongly networked with each other than the pioneers in the southern rural areas.

Spatial order (regiopolises, metropolises)

This specific local spatial configuration seems to have important effects on the spatial dimensions of the pioneers’ networks. Without any metropolis nearby, the Digital Pioneers in Baden-Württemberg refer to the regiopolis Heilbronn, a city with more than 100,000 inhabitants in a peripheral location (Aring and Reuther, 2008) as an important reference point. In contrast, pioneers from Mecklenburg-West Pomerania stress the crucial role of large metropolises at a greater distance, concretely Berlin and Hamburg, while the nearby regiopolises are highlighted less.

However, in both regions, close regional networking, i.e., everyone knows everyone else, fosters support: “But what makes it particularly easy are relationships, i.e., contacts and networks, that already exist and that existed because people knew and know each other.” (Interview 42_15-12-21) Such regional

networking plays a major role for many and is repeatedly associated with often living at very close quarters with relevant people in rural areas.

Land prices and soft location factors

Regarding important *favourable conditions mentioned in both rural contexts,* a first one is low land prices, especially in comparison to urban areas. This makes it cheaper for companies wanting to settle or to expand, as some Digital Pioneers mentioned in the workshops. The beautiful landscape was also mentioned as a rural advantage, opening up resource access with respect to questions of life quality. The Digital Pioneers mentioned that the beautiful surroundings and low land prices can attract skilled workers. Co-working spaces benefited from that advantage because their clients like to work in rural peace. Another specific advantage of the Mecklenburg-West Pomerania region is seen in the proximity to large cities such as Berlin and Hamburg, combined with a distinct rural character.

Spatial clustering in the regions

In Baden-Württemberg in particular, it is perceived as a great spatial advantage that the region has a large number of small and medium-sized market leaders (hidden champions), and due to their niche dominance and global leadership position, a clustering of economically successful companies. As a result, there are many regional business contacts, a close exchange (knowledge transfer), and common goals: "The incredibly high industrial density, the sense of community among the companies, because we have companies that partly offer the same products and also have the same roots and are in a healthy competitive relationship and still grow" (Interview 39_30-11-21). This strong regional tie is emphasised by several interview partners from different fields such as entrepreneurship and co-working. This is also expressed in the employees' mentality. Some Digital Pioneers speak of close and long-standing bonds between employees and their company. Companies strengthen such loyalty by supporting their employees in different phases of life (e.g., starting a family). This is seen as an advantage compared to urban regions.

Another advantage, possibly relevant for both regions, was mentioned in Baden-Württemberg: The rural character of the region brings with it a distinct potential need for digital solutions, and thus the possibility to implement projects in the first place, e.g., in the field of everyday mobility: "Because we are rural, the public transport is not very good, the necessity and thus also the acceptance of such a project is of course super, because organizing mobility yourself is extremely important." (Interview 18_13-10-21)

In Mecklenburg-West Pomerania, other spatial contextual conditions are partly favourable. In contrast to Baden-Württemberg, it was felt to be positive that there are fewer but bigger farms. The reason given was that this does not create a competitive situation. Rooted in the historical process of GDR land collectivization, the large parcels of land form a specific spatial context in Mecklenburg-West Pomerania for the agricultural field of action. Another pioneer recognized the advantage that many things are currently developing in the region, supported by some public and political actors.

Digital Infrastructure

In the following sections, *spatial contextual conditions obstructing Digital Pioneers' resource access* are addressed. As already mentioned, the provision of digital infrastructure in both regions is strongly dependent on the location of the pioneers' agency. In both regions, there is talk of a poor communication infrastructure that slows down or even prevents digitalisation processes. However, in Baden-Württemberg, more pioneers describe the availability of adequate digital infrastructures as a locational advantage and as a facilitation for the realisation of their projects than in Mecklenburg-West Pomerania.

Qualified workforce

In Baden-Württemberg and Mecklenburg-West Pomerania, the noticeable regional shortage of qualified workers and the challenges in recruiting new qualified professionals are mentioned. The Digital Pioneers

are aware that this problem generally also exists at a national level, but emphasise that it is additionally exacerbated due to the regional framework conditions of an economically strong but, for many external professionals, not so attractive, highly rural region. The shortage of skilled workers also plays a major role in the eastern sample region, despite a much weaker economic structure.

Customers, producers and like-minded people in the region

In the sample region of Mecklenburg-West Pomerania, several spatial contextual conditions that are very specific to the region were mentioned as hindering resource access. Among other things, the very sparse population means that distances are very long in some cases and that the target group for a particular project is smaller than elsewhere:

> *"I believe that our project would be much more successful financially and in terms of turnover if we lived in a region where people also live. There are unbelievably few people here, […], It is so sparsely populated and the distances to the producers are so long." (Interview 11_01-10-21)*

Based on this low population density, the consequence that there are very few like-minded people in the region is also mentioned as a challenge, so "that you don't have a real peer group" (Interview 16_12-10-21). It is noted that due to the aging population in the region, there is not always the competence and mentality to recognize the value of digitalization. It is pointed out that the success of the project may therefore partly depend on individuals.

5. Discussion

With regard to some fields of action and forms of resource transfer, the common assumption of highly urban focused economic clusters (e.g., Bonfiglio et al., 2017; Gust-Bardon, 2012) can be challenged. In the sample region of Baden-Württemberg, rurally based and centred clusters occurred in highly specialized fields of industrial production. They were constituted by hidden (or less hidden) champions (Rietmann, 2021; Zirbes and Rietmann, 2021), working together for comparative advantages. The definition of hidden champions alludes to a leading position in a niche. In Mecklenburg-West Pomerania, we discovered a densely connected cluster of co-working-spaces which, however, were closely interlinked with urban-, especially Berlin-based communities and institutions.

Nevertheless, urban-rural relationships (e.g., Siedentop and Stroms, 2021; Visvizi et al., 2019) are often decisive in determining which resources external to the region are made accessible. Urban-rural relationships that are helpful to Digital Pioneers can be of different natures. In some case, they are inherent in the pioneers' own biographies, so that knowledge, experience and network contacts acquired in the agglomerations are brought to the countryside (see also Dargan and Shucksmith, 2008). In other cases, network contacts are established and maintained over the distance between rural and urban locations (see also Townsend et al., 2016). In still other cases, the decisive urban-rural relationships are strongly institutionalised, for example, when funding programmes from state and federal politics are used or cooperation with globally active software providers is crucial. The importance of rural-urban linkages in the context of digitalisation suggests an understanding of smart planning regions in which smart city and smart country models are linked (Binder, 2022).

Digital Pioneers do not necessarily have to be based in the rural regions of their projects, plans or initiatives. They can also have an impact on these areas from outside, as can be seen, for example, in two telemedicine projects or in the co-working scene. Many of the Digital Pioneers living in the study regions are also highly mobile in their everyday lives, and some even live multi-locally. As a result, they not only use resource access points in their regions of residence, but also specifically, in significantly more distant locations. This multilocality aspect of agency is in clear contrast to theoretical ideas of neighbourhood effects (Atkinson and Kintrea, 2001; Buck, 2001; Sampson, 2001), as these assume that the residential environment has a strong action-structuring significance.

If we contrast the Digital Pioneers, we have identified with the spatial pioneers described extensively in the literature (Christmann, 2019; Matthiesen, 2012), clear differences become apparent. Only some of

the Digital Pioneers are rural migrants who move out of the city to initiate and try out new things on their own. In many cases, it is precisely people who have been biographically connected to the respective region for a long time who implement effective digital solutions there (see also Roberts and Townsend, 2016). If one wants to use the potential of Digital Pioneers for rural regional development, it is therefore not only a matter of attracting people from outside, but at least as much a matter of retaining committed people in the regions. Family-friendly living conditions play a special role in this, as our interview data shows. Moreover, Digital Pioneers do not necessarily find new institutions, but sometimes also implement new approaches and impulses in existing institutions, such as farms or medical practices. Hence the digital pioneer differs from the spatial pioneer as digital competence is the necessary condition for pioneer activities. Furthermore, the group of Digital Pioneers is broader than that of space pioneers. In addition to visionary and creative actors, our sample also includes pragmatic problem solvers, private and public sector professionals, in line with "driving actors" according to Sept (2020). The notion of the digital pioneer can be framed as a hybrid category as it contains multilocal lifestyles together with embeddedness in the region.

With their actions, Digital Pioneers only fit to a very limited extent into regional downward spirals, as they are problematized in the peripheralization debates (e.g., Beetz et al., 2008; Naumann and Reichert-Schick, 2012). Through their supra-regionally oriented action spaces and everyday worlds, pioneers act in some respects independently of obstructive regional contextual conditions. In many cases, the main motivation is even directly aimed at turning regional negative processes into positive ones, or, the peripheral condition is seen as the starting point for the scope of action. In the contextual conditions of structurally weak regions, it is not only obstacles but also potentials that are seen, for example, with regard to vacant premises that can be used for co-working spaces. For many Digital Pioneers, the spatial and social distance to the political centres of power is not problematic either, as they are intensely networked with decision-makers at the state and federal level.

According to their own assessments, the pioneers benefit from resources that reflect different facets of place-based leadership (e.g., Acuto, 2013; Beer et al., 2018; Budd and Sancino, 2016; Sotarauta et al., 2017). In terms of the category "person", they fit with several characteristics out of which the three most important can be classified as expertise, creativity and competence. Expertise is understood as the relevant specialist knowledge, creativity is defined as thinking and acting outside established structures, and competence is described as the capacity to implement specialist knowledge (Binder and Witting, p. 274). Leadership is taken to develop paths for collective action, to grasp complexities and to develop common visions for the future (Beer et al., 2018).

Nevertheless, many projects did not arise solely from the personal motivations of the key persons, but were essentially shaped by the opportunity to receive funding. In this context, perpetuation beyond the funding period (Mettenberger et al., 2021) is problematised. With reference to the various facets of place-based leadership, this aspect alludes to the category of process, e.g., the forums that are included, in combination with regional knowledge and expertise. It is important who is to be included and in which forms these actors are to be included, either on the basis of hierarchical principles (top-down) or equality (bottom-up) (Binder and Witting, 2022, p. 272).

Our empirical results not only show differences and similarities between the two rural case study regions. They also indicate that the potential and challenges of digital solutions differ between rural and urban regions. Potentials and motivations are often related to the initial conditions of rural regions, such as low settlement densities and large spatial distances (Cvar et al., 2020). The hurdles in everyday work are also often explained by specific rural context aspects, such as deficient digital infrastructures or a comparatively small circle of digitally savvy people (Ferrari et al., 2020; Salemink et al., 2017).

6. Conclusion

Our study was designed to look at the question of how Digital Pioneers use resources to foster digital transformation in rural areas. Those Digital Pioneers in rural regions are individuals or collective key actors, who use digital information and communication technologies effectively and efficiently for this

purpose. For the most part, it is not a question of implementing completely new, particularly sophisticated or complex digital technologies as technical innovations. Rather, it is crucial to adapt existing solutions to concrete problems and local needs with new social practices in the form of digital social innovation.

This paper constitutes an attempt to classify the individual assets and capabilities of actors in rural regions with reference to the concept of resources. We have systematized a threefold categorization of motivational, network-based, and region-related resources (see also Tab. 3) in order to draw a more nuanced picture of agency in rural regions. Motivational resources can be categorized through five objectives: testing and establishing new products and processes, optimizing those processes, strengthening competitiveness, facilitating access to products and services, and improving local supply. These visions are underpinned by multiple motivations that we classified as intrinsic, pragmatic, region-oriented, generational and functional. Network-based resources, on the other hand, provide access to resources unavailable through the individual dimension. These were listed as five different forms: informal network resources, resources in the field of action, political and public network resources, scientific network resources, and technical network resources that shape Digital Pioneers' agency on the meso level. The third classification derived from our qualitative data analysis is the category of region-related resources, which shape agency in rural regions through the spatial context. In our comparative research design, region-related resources specify the regional characteristics that were systematized as historical ownership structures and regional identities, spatial order, land prices and soft location factors, clustering in the regions, digital infrastructure, qualified workforce, as well as customers, producers and like-minded people within the nearer surroundings.

Tab 3. Forms of resources to implement digital social innovation in rural regions. Source: own elaboration

Motivational resources	1. Intrinsic motivation 2. Pragmatic motivation 3. Region-oriented motivation 4. Generational motivation 5. Functional motivation
Network-based resources	1. Informal network resources 2. Network resources in the field of action 3. Political and public network resources 4. Scientific network resources 5. Technical network resources
Region-related resources	1. Historical ownership structures and regional identities 2. Spatial order (regiopolises, metropolises) 3. Land prices and soft location factors 4. Spatial clustering in the region 5. Digital Infrastructure 6. Qualified workforce 7. Customers, producers and like-minded people in the region

What is of key importance is the aspect that digital social innovation took place in socioeconomically weaker as well as in socioeconomically stronger rural regions. However, both interviewee sub-samples in western and eastern Germany refer to the common obstructive context factors of the lack of digital infrastructure or historically rooted land parcelling. Pioneering agency in our sample is closely interlinked with the context conditions of "very rural" regions. Nevertheless, the local needs that were mentioned differ in the sample. For instance, in the Baden-Württemberg interviews and a workshop, the aspect of labour shortage was highlighted several times. By contrast, pioneers in Mecklenburg-West Pomerania strongly refer to the challenge of great spatial distances.

Accordingly, the resources required for Digital Pioneers also go far beyond digital and technical know-how. Actually, pioneers cannot draw all the resources they need. Consequently, there is a need for targeted support through rural development policies, with respect to the region-related as well as to network related resources. Hence digital transformation is shaped by local bottom-up processes through key actors tackling complex local problems with new social practices. These Digital Pioneers act as intermediary actors within regional governance constellations. Consequently, they need support through established rural development networks such as LEADER, as well as a strengthening of the ties within existing rural networks. The concept of Digital Pioneers that promote digital social innovation includes the capacity to develop collective paths of action, alternative pathways and new ways of coproducing the region through digital social innovation.

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