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Far away and yet so close: urban–rural linkages in the context of multilocal work arrangements

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ABSTRACT

Digital technologies allow knowledge workers to work from multiple locations in both urban and rural areas, creating urban–rural linkages. Information and communication technologies (ICTs) play a critical role. We used a novel mixed-methods approach to combine quantitative data from laptop and smartphone tracking with qualitative data from ethnographic walk-along observations and semi-structured interviews to analyse the creation of urban–rural linkages and temporary proximity in multilocal work arrangements. The results show that multilocal knowledge workers create urban–rural linkages on demand, thereby generating temporary proximity between the urban and the rural. Yet, the economic embedding of these workers in the rural is limited.

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INTRODUCTION

Since the beginning of the 21st century, digitalization has fundamentally changed work practices, particularly those of knowledge workers. Advances in information and communication technologies (ICTs) and transportation enable multilocal work practices at varied workplaces while still being connected to co-workers and supervisors (Messenger, 2019; Nadler, 2014). In this regard, rural regions are emerging as places of work for knowledge-intensive work activities (Clark, 2018; Vesala & Tuomivaara, 2015). In Switzerland, an increasing number of

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knowledge workers from cities seek to temporarily work in rural areas such as, for example, mountain regions.¹ In turn, policymakers in mountain areas are attempting to upgrade their broadband infrastructure, and they have started to create a support infrastructure, such as co-working spaces, for knowledge workers (Bürgin & Mayer, 2020). These multilocal knowledge workers can be seen as pioneers, as they engaged with multilocal work arrangements before the Covid-19 pandemic forced many employees to adapt such work practices.

There may be prospects that multilocal knowledge workers create urban–rural linkages through their technological practices and mobility patterns. Multilocal practices of work that alternate between two locations, such as a city and a mountain region, can connect the urban and the rural and technological advances play a key role (Lichter & Brown, 2011). We focus on the urban–rural linkages created through the activities of multilocal knowledge workers, and on how they use ICTs to engage with individuals and groups across distant geographical locations. Through such linkages, rural and urban areas become economically and socially interwoven through various flows such as, for example, people, knowledge and information (Atterton, 2016; Davoudi & Stead, 2002; Tacoli, 1998). Therefore, the spatial attribution of economic activities and their effects become geographically broader and not limited to just the urban or the rural. Indeed, as the literature shows, economic linkages between urban and rural emerge through mobility patterns of highly skilled workers (Bosworth & Venhorst, 2018). However, it is not just mobility that creates and influences urban–rural linkages. Technological advances through digitalization have also significantly strengthened urban–rural linkages (Lichter & Brown, 2011; Weber & Freshwater, 2016). Combined, these factors enable a possible shift of economic activities from single to multiple urban and rural locations.

Urban–rural linkages can occur through the active use of digital devices, which not only brings the effects of the linkages but also the digital technology itself into focus. ICTs and specific communication applications create proximity at the touch of a laptop or a smartphone, which calls into question both the relevance and the temporal nature of geographical proximity (Torre, 2008; Torre & Rallet, 2005). Since the advent of the digital age, knowledge and information are no longer bound to a single location, but can easily be transferred across geographical distances through ICTs (Forman & van Zeebroeck, 2019). However, a focus on the technology itself and on the empirical evidence has largely been absent from research on urban–rural linkages.

As a result, there is a need to better understand the creation of urban–rural linkages through ICTs and specific communication applications on digital devices in the current context of new multilocal work practices. In addition, there is also a research gap on the social and economic embeddedness of knowledge workers who work in the rural temporarily. Our study aims to address those issues by examining urban–rural linkages that are created through digital communication activities of multilocal knowledge workers. We focus on the following research questions:

- Why, and to what extent, do communication activities from multilocal knowledge workers created through digital devices such as laptops and smartphones differ between the urban and the rural?
- How do multilocal knowledge workers deal with distance from their co-workers, supervisors and/or clients during multilocal work arrangements and the use of ICTs?
- How, and to what extent, are multilocal knowledge workers embedded in the local structure of the rural, and what economic benefits result to them?

To answer these questions, we engaged in an exploratory, mixed-methods, in-depth study investigating the experiences of multilocal knowledge workers and the creation of urban–rural linkages through their multilocal work practices. We used a mixed-methods approach that combines digital and analogue methods (e.g., Crabtree et al., 2015). We used quantitative digital communication tracking data to analyse the work patterns of six multilocal knowledge

workers who work in both cities and mountain regions in Switzerland, traveling between the two. We integrated these data into an ethnographic and qualitative approach (e.g., interview partners were able to see the geotracking data and interpret the data in the walk-alongs and interviews). This exploratory research answers the quest for new methods in economic geography research (Bathelt & Li, 2020) and in rural studies (Strijker et al., 2020) by combining heterogeneous data sources such as digital work tracking (digital footprints of laptops and smartphones), ethnographic walk-along observations and qualitative semi-structured interviews. Due to the exploratory and extensive nature of the fieldwork and data-gathering, the sample included six study participants. Recruiting a larger sample proved difficult due to the strict sampling criteria, the time-consuming nature of the methods for the study participants and the sensitive nature of the data collected. The data were collected between spring and autumn 2019 before the Covid-19 pandemic. While the data cannot be generalized, we find interesting patterns in both the qualitative and quantitative data.

Our findings contribute to emerging conceptualizations of urban–rural linkages (Akkoyunlu, 2013; Bosworth & Venhorst, 2018; Mayer et al., 2016; Organisation for Economic Co-operation and Development (OECD), 2013; Weber & Freshwater, 2016; Woods & Heley, 2017). First, the study illustrates that ICTs must be considered when analysing urban–rural linkages, as the creation of linkages through the use of ICTs is dependent on the availability of adequate digital infrastructure in the rural. The study shows that knowledge-intensive economic activities can temporarily shift from urban to rural areas due to the use of ICTs, but the connection to the urban is still indispensable. Second, the creation of urban–rural linkages through ICTs enables proximity between urban and rural ‘on demand’ when needed. Proximity enabled by ICTs is of a temporary nature, which is either actively created or passively received. Third, multilocal knowledge workers are mostly well embedded in the rural local structure. Yet, their connection to the urban through ICT is more important for their work activity than being well embedded in the rural local structure. Fourth, the mixed-methods approach that we develop and use presents a novel way to research urban–rural linkages.

LITERATURE REVIEW

Over the past decades, ICTs have significantly changed the way we work (Messenger, 2019), by altering the way knowledge-based work is performed in terms of time and space (Ojala & Pyöriä, 2018). These changes are based on technological advances that allow work-related activities to be performed in different locations, including urban and rural areas, while remaining connected (Nadler, 2014). This article starts from the premise that multilocal knowledge workers create urban–rural linkages and through their particular use of ICTs they can create temporary proximity to co-workers, supervisors and/or clients. Recent studies have shown that work activities, in particular knowledge-based work activities, have become increasingly location independent and multilocal (e.g., Burchell et al., 2020; Koroma et al., 2014; Ojala & Pyöriä, 2018; Pajević & Shearmur, 2017). In this regard, ICTs are an essential component of multilocal work practices because they make working in multiple locations (Hislop, 2013; Pyöriä, 2005) or even teleworking in rural areas possible (Clark, 2018; Vesala & Tuomivaara, 2015). This increasing flexibilization of working practices has the potential to change the connections between urban and rural places ‘as ICT and the immaterial character of “brain work” should allow workers to locate everywhere and independently of place, thus equally including rural and remote areas’ (Nadler, 2014, p. 54).

Working remotely while based in rural areas is not a new phenomenon, but it both increased in popularity and received interest of scholars with improvements in available technologies. Since the early 1990s, scholars have studied teleworking practices in rural areas, but mostly

concluded that teleworking is predominantly an urban phenomenon. Hopes for teleworking in rural areas were high, which led to the promotion of ICT development such as telecottages² in rural areas (e.g., Di Martino & Wirth, 1990). Over time, however, it became apparent that the evidence of teleworking in rural areas is rather limited, which could also have resulted from the limited ICT infrastructure at the time (Grimes, 2000). In addition, awareness grew that workers most likely to perform telework from rural areas were privileged and high-skilled workers, and that their numbers remained rather low (Cornford et al., 1996). Other challenges to more widespread teleworking from rural areas included negative experiences of isolation for rural teleworkers (Di Martino & Wirth, 1990; Simpson et al., 2003) or the considerable differences in Internet bandwidths in rural areas compared with urban areas (Symons, 2000). The latter remains a major issue regarding digital rural development (e.g., Salemink et al., 2017). Compared with these earlier studies that focused primarily on more fixed or stationary teleworking (Hislop & Axtell, 2007), this article is based on a more dynamic understanding of using ICTs to enable work activities in multiple locations (Koroma et al., 2014). Furthermore, our focus is not on evaluating the potential of, or challenges to, teleworking or ICT infrastructure in rural areas, but rather on studying the urban–rural linkages that emerge due to multilocal work practices and the use of ICTs.

The specific focus on the interface of urban and rural implies that the rural economy is not isolated, but rather intertwined with urban economies through various types of flows such as flows of people, information, capital, goods, technology, etc. that connect urban and rural (Atterton, 2016; Davoudi & Stead, 2002; Tacoli, 1998). Given the increasing importance of ICTs (Weber & Freshwater, 2016), we see these as central mediating technologies that need to be incorporated in any analysis of urban–rural linkages. Insights about what kind of ICTs and communication applications specifically are able to connect urban and rural are missing.

Literature from the 1970s primarily questioned the dichotomy between urban and rural, providing a fruitful basis for research on urban–rural linkages (Funnell, 1988). Particularly in developing countries, work-related migration from the countryside to the city may arise out of necessity, as the poorer population migrates to benefit from urban economic prosperity (Lipton, 1977). Movement between urban and rural areas, however, can also be found today in industrialized countries, where daily work-related mobility from rural to urban takes place due to economic incentives for high skilled workers like better jobs and higher wages in urban centres, while the social centre of their life is located in the countryside (Bosworth & Venhorst, 2018). Such interregional commuting creates mobility-related linkages that lead to a restructuring of urban–rural relations (Shucksmith & Brown, 2016).

Furthermore, the literature on urban–rural linkages shows that the connection to the urban is relevant for economic actors such as entrepreneurs and enterprises who are located in the rural. Rural-to-urban linkages are important to these actors because they provide access to external knowledge sources beyond the regional rural context (Kalantaridis et al., 2019; Mayer et al., 2016). This implies that urban areas are still the centre of knowledge and suggests that economic actors in rural places do not reside in geographical isolation but are interwoven with other places despite their physical distance (Irwin et al., 2009; Kalantaridis et al., 2019).

In the 1990s, theses emerged that declared space and distance to be meaningless due to technological developments of the Internet and the increasing use of ICTs. The theses of the ‘death of geography’ (Bates, 1996) and the ‘death of distance’ (Cairncross, 1997) claimed that people and places become increasingly connected and geographical proximity matters less due to technological advances. These views also shed light on the connectivity of places across geographical distances, such as between urban and rural. However, the actual technology through which economic actors create urban–rural linkages is not well discussed in the literature. Yet, urban and rural areas have never been more connected than nowadays because of the widespread use of modern infrastructures: ‘Improvements in transport infrastructures and the rapid

adoption of ICT by retailers, service providers and most other businesses have greatly expanded the linkages between urban and rural regions' (Weber & Freshwater, 2016, p. 162). As a consequence, ICTs and particularly their Internet-based applications (e.g., digital communication, videoconferencing), as well as transportation (e.g., roads, rail lines) have the potential to shift economic activities to different locations if access to good broadband connection is available (Weber & Freshwater, 2016). These technological advancements and their widespread adoption – even pre-Covid-19 – illustrate the need to shift the focus of analysis from the impacts of linkages to the technology through which linkages are created and the individuals who create them. In particular, we do not know what specific digital devices and communication applications are used by economic actors who work between urban and rural locations.

Focusing on the use of ICT as a means to create urban–rural linkages also allows us to examine the ways in which ICTs enable proximity to other economic actors from any place and at any time (Graham & Anwar, 2019). This is important in the context of urban–rural linkages because proximity between economic actors can actively be created through linkages to, for example, customers in urban markets (Mayer et al., 2016). This implies that linkages not only connect urban and rural, but they can be used to create proximity. Therefore, proximity to geographically distant sources of knowledge and power sources can be a motivation for the creation of linkages.

How can economic actors from different locations create proximity to each other? So-called 'temporary clusters' create temporary proximity between actors, for example, at business events such as meetings, fairs and conventions, where also unplanned and unanticipated encounters develop by chance (Bathelt & Schuldt, 2008; Henn & Bathelt, 2015; Maskell et al., 2006). In this case, proximity only requires the transportation infrastructure to get the actors to the events. However, technological advances cast a critical light on the need for such geographical proximity (Torre, 2008; Torre & Rallet, 2005). New forms of proximity have developed through digital technologies that make physical encounters largely obsolete; this debate has intensified during the Covid-19 pandemic. ICTs as linking technology can be used to create proximity across geographical distances (Forman & van Zeebroeck, 2019) through digital written, audio and video communication (Torre & Rallet, 2005). Because this form of digital communication is not permanent and only created when using digital devices, it can be assumed to be of a temporary nature, as it takes place not in the physical geographical location but in the digital space. This view also raises the question of how ICTs enable proximity in time and space, when no specific location is necessary and proximity is independent of time.

The possibility of creating urban–rural linkages and increasing the proximity between urban and rural through novel forms of digital communication thus calls the rural embeddedness of multilocal knowledge workers into question. Permanent migrants who move from an urban to a rural location can embed themselves in their destination community through their permanent settlement (Bosworth & Willett, 2011) and the establishment of social relationships (Anderson & Jirotka, 2015). We know that 'embeddedness is a process of becoming part of the structure' (Anderson & Jirotka, 2015, p. 483), but we do not know how multilocal knowledge workers embed themselves in the local structure of the rural, especially since they are only in the rural for a limited period of time due to their multilocal work style. Furthermore, the literature on the urban–rural shift demonstrates that the relocation of economic activities from urban to rural areas can be beneficial to rural areas. Among other factors, this is due to the increasing accessibility of many rural areas as a result of technological progress (Keeble & Tyler, 1995). Therefore, we are interested in examining to what extent multilocal knowledge workers who temporarily work in the rural are integrated in the rural local structure and how this affects their work activity.

This literature review suggests that urban–rural linkages arise from human practices. For example, multilocal workers actively use ICTs, which allows them to engage with individuals

and groups in geographically distant locations. Yet, multilocal work practices have not yet been sufficiently explored, particularly with regard to individual practices of the workers, and little is known about individual experiences, practices and strategies to create such urban–rural linkages in multilocal work arrangements.

MIXED-METHODS RESEARCH DESIGN

We used a mixed-methods approach that combines digital and analogue methods (e.g., Crabtree et al., 2015). By digital methods, we refer to methods that are computer-aided and thus collect digital data (log-files, digital footprints) with digital devices such as, for example, computers or smartphones (e.g., Leszczynski, 2018). Analogue methods are those that generate data through physical face-to-face interaction between researchers and study participants. Both digital and analogue methods can be of qualitative and quantitative nature.

In our study, the computer-aided digital methods (e.g., Leszczynski, 2018) involved the collection of quantitative digital work-tracking data from laptops and smartphones. The analogue methods included qualitative ethnographic walk-along observations and qualitative semi-structured interviews. Thus, valuable primary microdata of ICT use in urban and rural workplaces were generated and integrated in the mixed-methods approach as the data built the basis for our qualitative enquiry.

Research context

Our field research took place in Switzerland. We selected a sample of multilocal knowledge workers who work part of their time in the urban context and another part in a mountain region. Swiss mountain regions suffer from disadvantageous developments such as structural change, an ageing society and out-migration of young people to cities. However, digitalization seems to provide some potential (Bürgin & Mayer, 2020). Some mountain regions are proactively working on their ICT and work infrastructures and offer mobile workers the opportunity to engage in multilocal work practices (miaEngiadina, 2021; NüGlarus, 2020).

The technological development of broadband infrastructure plays a central role, although national differences vary (European Commission, 2020). Internet use grew rapidly in the 1990s, and in the early years a large proportion of users used dial-up connections that allowed Internet access via telephone network (OECD, 2014). Later, broadband was introduced with digital subscriber lines (DSL) technology (Philip et al., 2017). At the turn of the century, the still dominant but very slow dial-up connections were surpassed by broadband, with the introduction of asymmetric digital subscriber line (ADSL) leading to better broadband performance through the bundling of voice, video and data. Since then, fibreoptic broadband and DOCSIS 3.0 technology have become the new standard, with speeds often exceeding ADSL (OECD, 2014). Areas with lower population density, such as rural areas, still face gaps in coverage with fibreoptic networks. Alternatively, satellite technologies could serve those non-connected areas, but these account for only a small share of the broadband market (Philip et al., 2017). Furthermore, ultra-fast fixed broadband technologies, wireless technologies and mobile 3G/4G networks have been added in the past two decades. In addition, the increase in mobile broadband use has led to broadband provision, which is no longer exclusively tied to fixed networks (OECD, 2014). Although mobile broadband can fill the gaps of fixed broadband particularly in rural areas (Priefer, 2013), such areas are still underserved (Philip et al., 2017). In recent years there has also been a growing focus on 5G networks, which are even faster than their predecessors and thus offer new potential for overcoming the digital divide between urban and rural areas (e.g., Oughton & Frias, 2018).

In terms of broadband connectivity, Switzerland seems to be well positioned. It has one of the highest shares of jobs that can be done remotely, and flexible workplace models are

becoming increasingly popular (OECD, 2020; Weichbrodt et al., 2020). These emerging workplace flexibilities are facilitated by the advanced development of broadband infrastructure in non-urban areas. In 2019, Switzerland's overall fixed broadband coverage was 99.8% (EU-28 = 97.1%). Furthermore, 99.0% (EU-28 = 85.8%) of all Swiss households were connected to next generation access (NGA)³ broadband and 80.4% (EU-28 = 44.0%) to very high-capacity networks (VHCN).⁴ The overall rural fixed broadband coverage was 98.6% (EU-28 = 89.7%). The rural NGA coverage in Switzerland was 93.8% (EU-28 = 59.3%) and even 67.5% (EU-28 = 20.1%) of Swiss rural households had access to VHCN (European Commission, 2020). Thus, the high connectivity rate of Swiss rural areas provides an ideal setting to examine the use of ICTs in multilocal work arrangements, as access to broadband Internet is provided in urban as well as rural areas within the country.

Sample

For this exploratory study, we recruited a small sample of multilocal knowledge workers who fulfilled the following criteria: (1) they have their main workplace in an urban area (at an employers' premise, in the home office or in combination); (2) they work for at least one work-week (five workdays) every three months⁵ (thus every season of the year) in a Swiss mountain region;⁶ (3) they use laptops and smartphones in their daily communication activities; and (4) they agree to share their individual digital communication tracking data with the research team.

We recruited a total of six participants (Table 1). The recruitment of study participants proved to be challenging as no registers of multilocal knowledge workers exist. We contacted co-working spaces (at the time of recruitment, $n = 12$) in the Swiss mountain areas, recruiting two participants. We recruited one participant through a post in the Facebook group of the association of Digital Nomads Switzerland. Two more participants were recruited through an organization in Switzerland that promotes location-independent work practices called the Work Smart Initiative. A final participant was recruited through the private contacts of a member of the research team.

Initially, we aimed for a sample size of at least 10 participants. Our initial recruitment phase secured 14 potential participants, but eight of these left the project due to time constraints and/or privacy concerns. However, during data collection and analysis we found this sample size advantageous as the empirical fieldwork became more manageable: (1) the application of our mixed-methods approach led to a high quantity of data that had to be processed and coordinated; and (2) a greater effort from the participants themselves was required in comparison with comparable studies. Using this approach, we were able to generate a high quantity of data and process it meticulously, which would have been difficult with a larger sample size generating an even larger amount of data. Thus, the data are not fully generalizable but provide exploratory insights into a possible pattern in the creation of urban–rural linkages through ICTs from pioneers who engaged in multilocal work arrangements even before the Covid-19 pandemic.

Data collection and processing

Data collection consisted of two consecutive phases that involved different methods. In the first phase, digital methods were applied to collect quantitative digital communication tracking data of applications on laptops and smartphones for five days each in the urban and the rural workplaces. These data were statistically analysed and, based on these statistics, the questions for the interview guide of the semi-structured interviews were created. In the second phase, we conducted qualitative ethnographic walk-along observations in combination with semi-structured interviews during the participants' journey from the urban to the rural workplace. The methods and their connections will now be explained in more detail (Figure 1).

Table 1. Sample of multilocal knowledge workers (names anonymized with pseudonyms).

Pseudonym	Profession	Employment status	Primary location of employment	Urban workplace	Rural workplace	Average multilocality frequency	Rural embeddedness
Susan	Virtual assistant	Freelance entrepreneur	Urban	Home office	Private	1–2 days per week	Family
Robert	Product manager digital public services	Corporate employee	Urban	Employer's premise	Private, seldom co-working space	2 days per week in urban	Family
Matthew	Information technology (IT) specialist	Freelance entrepreneur	Urban and rural	Home office, employer's premise	Private, co-working space	1 week every 2 months	Family
Nancy	Innovation manager	Corporate employee	Urban and rural	Home office, employer's premise	Private, co-working space	Two to three times per month for 3–4 days each	Family
Daniel	Data and artificial intelligence (AI) solution specialist/lecturer	Corporate employee	Urban	Home office, employer's premise, co-working space	Private	Every weekend	Family
Joseph	Specialist for human resources and organizational development	Corporate employee	Urban	Employer's premise	Private	At least 10–15 times per year	None

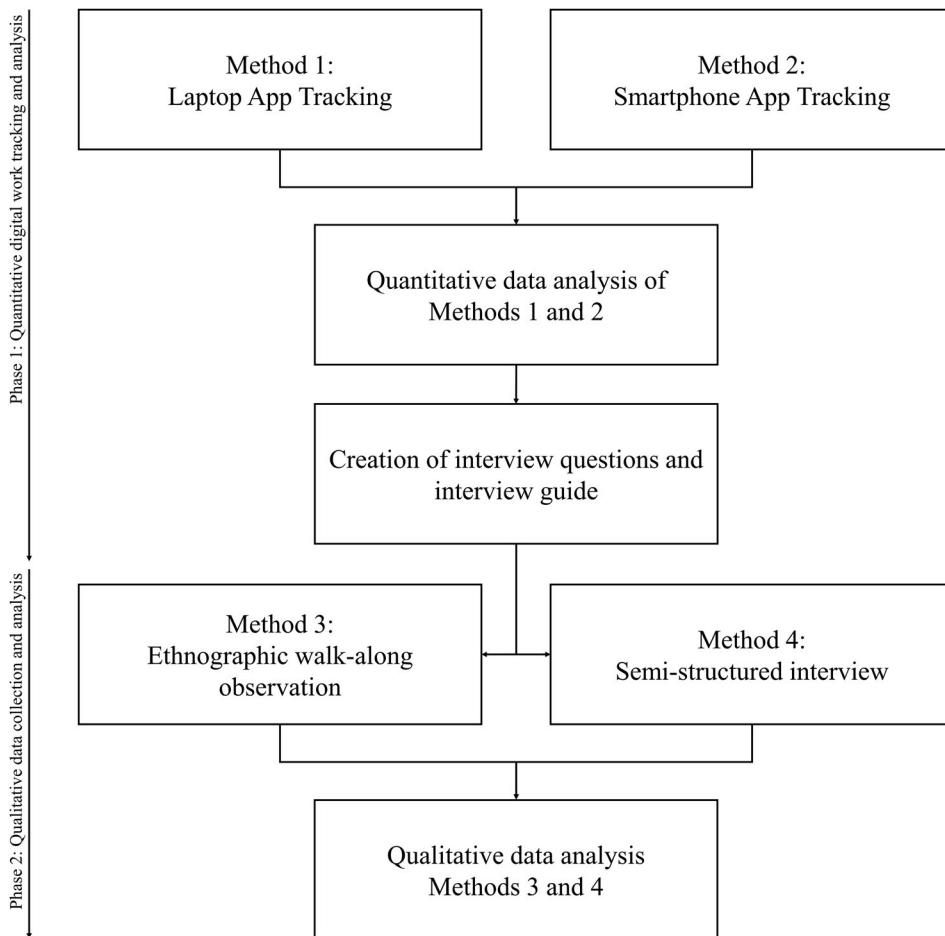


Figure 1. Mixed-methods approach separated in two phases of data collection.

Communication activities on the laptop were tracked using the open-source time tracker ActivityWatch, which collects the names of focused applications, focused window titles in a timeline of events, active user input and inactive periods (away from keyboard (afk) events). The participants run the application during their digital work tracking days. After the digital work tracking days were completed, the data were exported manually by the participants and handed to us. We assisted the participants to ensure that the exports were done correctly. To provide data security, we offered the participants to handover the data in a physical meeting. However, all participants sent us their data files via email or cloud services. The total amount of laptop tracking data for the six participants was approximately 50 MB of JSON files.

The digital communication tracking data of laptops was processed using Jupyter notebooks. The communication data on laptops was filtered by digital work tracking days and assigned to the corresponding urban or rural location. After filtering the data by dates of interest, the total number of window events was approximately 100,000 with approximately 4,400 afk events. Next, we created pattern-matching rules to categorize all raw events into privacy-preserving categories. Based on this procedure, the data were categorized according to the variety of applications used by the participants, and communication applications were separated from the other data. In doing so, the data were cleaned of artefacts from the data collection method,

and highly sensitive data (e.g., window titles) were removed from the analysis. The cleaned data were then classified among six identified types of communication activities (email, hybrid communication, social media, audio/video communication, communication management and text messaging), and descriptive statistics (arithmetic mean, median, standard deviation (SD) and standard error (SE) of the average) were created.

Simultaneously, smartphones were also tracked to collect logs of mobile communication activities (Birenboim & Shoval, 2017). Because Apple iPhones (the device used by all participants) do not grant third parties access to application usage data, the participants had to manually take screenshots of their battery usage data (the durations of usage of applications is displayed within 24 h on a per 1 min basis) and hand them to us. Here as well we offered the participants to collect their screenshots through a physical handover, but they all sent their data via email or cloud services. The total amount of smartphone tracking data was approximately 40 KB (around 1,200 data points) across all six participants.

The smartphone tracking data were processed using Microsoft Excel tables and also Jupyter notebooks. First, the smartphone battery screenshots were manually transcribed by us into a digital editable format such as a Microsoft Excel table. Second, the data were categorized in the same fashion as the communication tracking data of laptops, unusable artefacts were cleaned, and the data were imported into Python. Here, too, we created pattern-matching rules in order to categorize the raw events of the data into privacy-preserving categories. Based on that, the digital communication tracking data were extracted to generate descriptive statistics (arithmetic mean, median, SD and SE of the average).

In the second phase, qualitative analogue methods were applied. First, we conducted ethnographic walk-along observations (Rose et al., 2010) and recorded our notes by hand. The walk-alongs allowed us to gain familiarity with the study participants and to observe their multilocal work practices and workplaces. We accompanied each participant once during their travel from their urban to their rural workplace (by car or train). Through this practice, we obtained a better understanding of the participants' multilocal work behaviour in the multilocal setting between urban and rural areas. Second, we conducted qualitative semi-structured interviews during the walk-alongs to deepen the findings from the first phase and the walk-along. We used a semi-structured form of interviews in which we also showed the participants their own digital communication tracking data and asked precise questions based on the data. Together with the notes from the ethnographic walk-along observations, the interviews were imported into MAXQDA12 for transcription, coding procedure and qualitative content analysis (Mayring, 2015).

Throughout the research process, ethical considerations were applied with utmost care (Anderson & Jirotnka, 2015; Madge, 2007; Tiidenberg, 2018). Informed consent was granted by written and signed letters of consent between the research team and each individual participant. Confidentiality of the data was granted through secure data storage on the university's server infrastructure and maintaining the secrecy of participants' identities.

RESULTS

Creation of urban–rural linkages

In contrast to the literature, which highlights the differences in the effects of digitalization between urban and rural areas (Saleminck et al., 2017), we found that our study participants could work from any rural place as long as digital infrastructure was available, enabling them to create linkages from the rural to the urban. This finding is based on the almost identical digital communication activities between urban and rural (Tables 2 and 3) and upon qualitative interview data.

Table 2. Communication activities on laptops during digital work tracking days in urban and rural workplaces.

Type of communication	Total	%	Daily average	Median	SD	SE of the average
<i>Urban</i>						
Email	43:01:13	62.87%	01:13:20	01:05:45	00:38:16	00:15:37
Hybrid communication	15:50:19	23.15%	00:27:16	00:24:34	00:24:01	00:09:48
Social media	05:34:11	8.14%	00:09:58	00:03:09	00:14:18	00:05:50
Audio/video communication	01:57:45	2.87%	00:03:16	00:02:11	00:04:18	00:01:45
Communication management	01:27:15	2.13%	00:02:49	00:00:00	00:06:15	00:02:33
Text messaging	00:34:52	0.85%	00:00:58	00:00:00	00:02:22	00:00:58
Combined average	68:25:38	100%	01:57:39	02:10:04	00:37:24	00:15:16
<i>Rural</i>						
Email	45:18:04	65.07%	01:23:50	01:18:34	00:44:28	00:18:09
Hybrid communication	15:28:58	22.24%	00:26:00	00:25:54	00:15:31	00:06:20
Social media	06:56:09	9.96%	00:11:49	00:01:33	00:24:18	00:09:55
Audio/video communication	00:28:25	0.68%	00:00:45	00:00:08	00:01:21	00:00:33
Communication management	01:17:05	1.85%	00:02:09	00:00:00	00:04:53	00:01:59
Text messaging	00:08:29	0.20%	00:00:10	00:00:00	00:00:25	00:00:10
Combined average	69:37:13	100%	02:04:47	02:02:50	00:56:43	00:23:09

Note: 'Hybrid communication' includes audio, video and text.

User-generated data are error-prone. Not all participants sent complete data.

Values are averages of participants' averages.

The participants' quantitative data give preliminary insights into the patterns of digital communication activities in the urban and rural workplaces. The six study participants' communication activities on the laptop differ only slightly between urban and rural workplaces on both laptops and smartphones. The difference in the total duration of communication activities on the laptop between urban and rural (07:08 min more on average in the rural) is mainly due to the use of more email (10:30 min on average) during workdays in the rural (Table 2). The other types of communication activities were approximately equally used on laptops in both locations, with a difference of less than 3 min between urban and rural. Similar findings are drawn from the communication activities on smartphones (Table 3). Although statistical analysis generally shows slightly higher use of communication activities (03:37 min on average) in the rural compared with the urban, this difference is also very low and not significant. Other types of communication activities also do not differ more than approximately 3 min between both locations. One larger difference was found in the median of the combined average, which was 27:15 min higher in the rural versus the urban, indicating individual differences between the participants.

Based on this analysis, there were no overall statistically significant differences⁷ in the creation of linkages through digital communication activities detected between urban and rural. However, more in-depth knowledge of the digital communication activities was generated during the interviews. We showed the participants the descriptive statistics of their quantitative digital communication tracking data to let them comment on it, and asked specific follow-up questions. This practice led to individual reactions by the participants. Nancy, for example, reacted to her laptop-tracking data with surprise, stating, 'man, this is not much for me on the computer'. Furthermore, while showing her the smartphone tracking data, she was surprised

Table 3. Communication activities on smartphones during digital work tracking days in urban and rural workplaces.

Type of communication	Total	%	Daily average	Median	SD	SE of the average
<i>Urban</i>						
Audio/video communication	18:31:00	41.72%	00:40:37	00:29:00	00:37:10	00:16:37
Hybrid communication	15:15:00	34.36%	00:33:30	00:30:00	00:20:56	00:09:22
Social media	05:22:00	12.09%	00:12:13	00:13:10	00:07:53	00:03:31
Email	04:07:00	9.28%	00:08:54	00:07:30	00:04:55	00:02:12
Text messaging	01:08:00	2.55%	00:02:16	00:02:00	00:02:21	00:01:03
Communication management	00:00:00	0.00%	00:00:00	00:00:00	00:00:00	00:00:00
Combined average	44:23:00	100%	01:37:32	01:25:00	00:49:36	00:22:11
<i>Rural</i>						
Audio/video communication	17:29:00	38.50%	00:40:00	00:51:12	00:28:51	00:12:54
Hybrid communication	17:23:00	38.28%	00:35:52	00:34:30	00:26:10	00:11:42
Social media	06:21:00	13.98%	00:15:22	00:09:00	00:13:55	00:06:13
Email	03:14:00	7.12%	00:07:50	00:03:00	00:09:27	00:04:13
Text messaging	00:56:00	2.06%	00:01:59	00:01:30	00:02:12	00:00:59
Communication management	00:02:00	0.07%	00:00:04	00:00:00	00:00:08	00:00:03
Combined average	45:25:00	100%	01:41:09	01:52:15	01:04:03	00:28:39

Note: 'Hybrid communication' includes audio, video and text.

User-generated data are error-prone. Not all participants sent complete data.

Values are averages of participants' averages.

by the amount of time spent on the device, stating, 'oh my god'. Robert, for example, reacted to the higher use of social media applications in the urban with 'yes, this is interesting. [...] yes, yes, but I think that is not entirely coincidental'. When Susan was shown the high amount of time spent at the computer, she laughed and called herself a 'total workaholic'. She reacted to the higher use of browser-based applications with 'exciting, yes. I hadn't been aware of that yet'. Daniel reacted with 'it's interesting. But it's cool', while looking at the table, recognizing that his worktime on the laptop is similar between the urban and the rural workplace. Joseph was surprised while reviewing his table, noting the higher use of the Outlook email application in the rural: 'I find the Outlook a bit interesting. That it really is more in the mountains'.

To create urban–rural linkages, fast and stable digital infrastructure must be available to access the Internet, which was clearly shown in the interview data and walk-alongs. One participant, Robert, is a product manager for digital public services and has a leading position. He lives in a mountain area and travels every week to the urban for two workdays (including overnight stay) as his work requires his physical presence at the urban workplace for half of the week. Robert, an example of a frequent multilocal worker, clearly pointed out the importance and necessity of stable and fast Internet connection in the rural for working and being connected with co-workers:

This is a must. Undoubtedly, you need a good [...] good internet connection. Otherwise, you're gone.

[...] That's really important a good connection to do desktop sharing or drawing on the screen directly with the partner or something. That helps a lot, yes. That means this is a must.

While Robert is working in the rural, he uses communication applications such as WhatsApp, Skype or phone calls more frequently to create linkages to co-workers and clients in the urban, where he usually meets them in person. Interestingly, Robert stated that communication applications such as Skype for Business and specific tools such as screensharing also decrease the relevance of physical meetings in person, as information and knowledge can easily be shared over distance via ICTs. This is a practice he used pre-Covid-19, as our fieldwork ended about four months before the first lockdown in Switzerland.

The digital infrastructure is also important to the creation of linkages from the urban to the rural. This is illustrated by innovation manager Nancy, who works for different firms and needs to be reachable for her co-workers and/or supervisors: 'The reachability is just funny enough the same everywhere. You also have to be extremely reachable here [in the mountains]. [...] So that means that I am always available everywhere when they are on the phone'.

Susan is a virtual assistant and constantly in contact with her clients, regardless of where she is working. She enjoys the flexibility to visit her parents in the mountains on a weekly basis and can still be in constant contact with her customers due to good Internet connection. However, Susan used ICTs for approximately twice as much time in the rural compared with the urban, explaining that she needs to connect with her clients for clarifications or decisions, as she 'often just want to get an OK from them'.

Email connects multilocal knowledge workers to co-workers, supervisors and clients in the urban. This linkage was created slightly more during workdays in the rural. Information technology (IT) specialist and programmer Matthew uses email to transfer new orders or tasks to co-workers in the urban. Email is the most important communication tool to 'somehow also remind people to do something and then also to finalize something. And email is actually super suitable. When you use a chat, then it's too general.' A similar finding was true for Nancy, who mentioned that since physical meetings are not possible in the rural, she coordinates tasks and informs her co-workers and supervisors in the urban through email or phone calls to initiate processes or to work on open tasks.

Furthermore, data and artificial intelligence (AI) specialist Daniel is a multilocal worker not only within Switzerland but also, at times, intercontinentally. Daniel prefers the application Microsoft Teams to stay connected with co-workers and supervisors, which unites text messaging, audio and video conferencing, and file sharing.

Joseph is a specialist for human resources and organizational development. His digital communication activity differed markedly from the other participants. Joseph consciously tries to keep the creation of linkages to the urban as low as possible during the workdays in the rural:

I really try to do as much face-to-face as possible before [going to the mountains]. And if it is, then it is really still quickly to explain something. Or I pick up the phone if I have the feeling it's more efficient than doing a mail now.

The examples show that communication activities using ICTs can create linkages between workers even over large geographical distances as long as a good and stable Internet connection is available. Therefore, the rural can serve as an adequate work environment for multilocal knowledge workers given that it meets their technological requirements and there are hardly any restrictions on the way they work. Consequently, the creation of linkages from rural to urban, and vice versa, increasingly connects the rural to the urban through ICTs.

Temporary proximity through ICTs

We found two forms of proximity that were created by multilocal knowledge workers during workdays in the rural: actively created proximity and passive proximity in terms of receptiveness. In doing so, multilocal knowledge workers can overcome distance through the creation of

proximity via the use of ICTs even though they are geographically distant from the firm's office located in the urban. At the urban workplace, proximity is created through physical meetings with co-workers, clients and/or supervisors. As this is not possible in the rural, proximity is created 'on demand'.

The first form of proximity is of an active nature. There is general concern among our participants that during workdays in the rural there is less knowledge exchange with co-workers and/or supervisors taking place, and input for work must be actively sought. Consequently, proximity to the urban is needed to access information and knowledge. The multilocal knowledge workers actively create temporary proximity through rural to urban digital communication activities, which is nicely illustrated by Robert:

You have to do that more actively when you work remotely. [...] And not always, but sometimes it's just a bit of chat somewhere start with someone. [...] So, people notice that you're also working and then suddenly some questions come up and so on. [...] With some coworkers I have more chat for smaller things. A little bit like small talk.

While working in the rural, Joseph communicates with his supervisor in the urban in a short and purposeful manner. Although he tries to clarify open questions before travelling to the rural workplace, sometimes he must actively create proximity to the source of power. In this regard, Joseph explained that he communicates with his supervisor when he needs decision-making power or to double-check his working steps:

She wants to see certain decisions before I make them. I also appreciate her know-how, where I quickly say 'hey, what do you think about this?' [...] Picking up decisions in the sense of 'yes, do we want to go in this direction as a team, or what do you think of that?' These are things like that. Just briefly before you take the next hurdle.

Similar is true for Nancy, who also creates proximity to her supervisors in the urban, but her situation differs slightly from the example above. Nancy is less dependent on her supervisors' decision-making power. She explained that she and her supervisors seek proximity in more informal ways: 'It has both, we are looking for a bit of proximity and friendship. My supervisors and I. An exchange. Also information that is sometimes on the meta level. Not such key information, but still important information.'

Susan is a freelance entrepreneur and is not dependent on supervisors' decisions. The decision-makers are her clients, with whom she also actively searches for exchange or information and therefore creates proximity using phone calls and WhatsApp. However, this contact is more informal and also can stem from loneliness during her workdays: 'You know it yourself, if you can't exchange somehow, you are like empty.'

The second form of proximity is of a passive nature: multilocal knowledge workers do not actively seek out information as in the active form of proximity, but they show that they can be contacted. The connection between urban and rural through ICTs is maintained by showing the willingness to be receptive for proximity for co-workers, supervisors and/or clients from the urban.

The aim is to maintain the connection to the urban. In this regard, Nancy explained that 'of course, I have to maintain the connection to the people I am in contact with'. She demonstrates her availability by being online and is therefore receptive for proximity created by her co-workers and supervisors at any time and at any place, as 'always everywhere when they call, I am available'.

Data and AI solution specialist Daniel uses communication applications on his smartphone less while working in the rural. Nevertheless, creating linkages through ICTs is a strategy for

creating passive proximity via online availability to his co-workers in the urban, if they need him, and to maintain the proximity to the urban power centre:

Yes, it is then simply [...] that is more so a bit also to mark presence. In the sense of: 'Hey, I'm not [...] I'm not just offline', or 'I'm here'. And then you have to write a quick 'mässi' [message] again: 'Hey, I'm working on this and that and I have this', or 'if you need something, I'm available', and so on. That people still know the people are available. [...] That's more a bit of the political ... let's say political approach.

In addition to these two forms of proximity, we also found a practice to deliberately prevent proximity. In this regard, laptops and smartphones are put aside to strategically disconnect from co-workers, supervisors and/or clients in the urban to be more focused for work, as mentioned by Daniel. Furthermore, mountain sports-loving participants such as Susan, Nancy and Joseph highlighted a more extreme type of disconnection by not taking the smartphone with them during leisure activities in the rural. On the one hand, they gain the power over their activities to create proximity whenever they need them. On the other hand, they also gain power over proximity coming from the urban reaching them while they are in the rural by not providing receptiveness for those ICT linkages with their co-workers, supervisors and/or clients.

Rural embeddedness

The increasing popularity of multilocal work arrangements between urban and rural raises the question of the rural embeddedness of multilocal knowledge workers coming from urban areas. We found (1) that the linkages created from urban to rural are mainly on a personal and/or family level, through which the multilocal knowledge workers become embedded in the local structure even if they are not physically present in the rural; and (2) this embeddedness in the rural has limited effects on the economic activity (Anderson & Jirotka, 2015), except when the study participants worked for a company located in a rural area or they actively seek for the expertise of family members living in the rural area.

Linkages from urban to rural are rarely created for work. Only Matthew und Nancy, who both work part-time for a firm located in a mountain region, created work-related linkages from urban to rural. They permanently maintain the connection regardless of whether they are currently working in urban or rural using, for example, email applications, Microsoft Teams or Slack. Consequently, both of them are embedded in the rural even if they are not permanently on site.

For the other study participants, the urban to rural linkages are mainly of a personal nature and not directly work related, because they are not involved in specific work activities in the rural, as their important work contacts are located in the urban area. In this regard, Robert explained that in the urban 'are more such contacts that I have informally or formally. And that is logically a bit more than in the mountains, yes.'

While in the urban workplace, the study participants created linkages to the rural to communicate with family members or friends. With the exception of Joseph, all the study participants maintained personal contact with people in the rural. These linkages are created daily or once to several times a week using text messages via WhatsApp direct messages, WhatsApp groups or phone calls. This is nicely illustrated by Nancy's statement:

Well, some of them are really people that I got to know simply from being in the same villages a lot now. And really at the village square and other young families, those I write maybe let's say weekly, or I ask them 'hey, when will you be there? I'll be there then and then'. Or 'do you have time then to maybe

quickly, when I bring my child, keep an eye on my daughter?'. Or 'I'll watch your children, you can leave them with me. I'm here'.

Nevertheless, their personal contacts in the rural can have a positive impact on work, insofar as the study participants have active exchange with rural contacts who have a different perspective on issues. This is illustrated by the example of Daniel, who views his family in the rural area as a 'test laboratory' in which he can receive feedback on his work from people who are not familiar with it. Daniel considers this a great advantage, because 'if they understand it, I'm sure my customers will understand it too'.

Susan similarly benefits from contact with her parents who live in the rural and support her work by giving feedback and technological assistance. For example, she tests the comprehensibility of graphics by asking her mother for feedback. She also benefits from her father's movie editing and proofreading skills: 'I benefit from him extremely. Indeed, he helps me. He sometimes proofreads for me, edits my videos for me'. However, other than the contacts with her parents, Susan does not benefit from other rural contacts for her work.

In contrast to the examples of Daniel and Susan, Joseph does not actively connect with other people living in the rural area where his second home is located. He mentioned that contacts with neighbours come by chance when he is in the rural during his leisure time. The example of Joseph shows that it is also possible that a multilocal knowledge worker can own a secondary residence in the rural, but only show scarce embeddedness in the rural local structure, from which no benefit for work can be drawn:

Yes, with some you talk a little more and with some a little less. But basically, you get along very, very well with all of them. [...] You sometimes look 'hey, are you ordering wood for the winter?' for example. Or now there have been a few young people with whom you go out for a beer or where you can improve your French. Something like that. But no, it's really nothing for work now.

However, we found that most study participants are embedded in the local social structure of the rural work destination due to strong family ties and relationships. Although most participants in the study are well-embedded socially, they rarely derive an economic advantage. While their already-held personal contacts and social networks help them, new economic opportunities with actors or firms in the rural did not emerge. These patterns show that a stronger embedding of the work in the rural local structure is not necessary for multilocal knowledge workers' economic outcomes, as linkages from rural to urban maintain the embeddedness of work in the urban.

DISCUSSION AND CONCLUSIONS

The aim of this paper was to analyse the ways in which multilocal knowledge workers create urban–rural linkages, how they use proximity to the rural respectively urban and to what extent they are embedded in the rural. As an exploratory study, it provides novel insights and starting points for future research in terms of methodology and conceptualizations of urban–rural linkages in the digital age.

Multilocal knowledge workers create urban–rural linkages through ICTs to maintain the connection to the workplace in the urban and to their family or social connections in the rural. Earlier works on urban–rural linkages suggested that people's mobility patterns and ICT increasingly connect urban and rural economies and societies with each other (Bosworth & Venhorst, 2018; Licher & Brown, 2011; Weber & Freshwater, 2016). Our study suggests a more nuanced understanding of urban–rural linkages in the digital age. The examination of the technology itself through which linkages are effectively created (ICTs) illustrates that

urban and rural are not just simply linked, nor are they linked all the time. Linkages should be understood as dynamic and flexible, particularly because ICTs can be used in strategic ways. Thus, linkages must be understood as strategic means that can be created independent of place and time and ‘on demand’ due to digitalization. Furthermore, we emphasize that urban–rural linkages created through the use of ICTs are dependent on humans’ individual strategies and interaction with digital technologies to engage with other individuals and groups in distant geographical locations, also between urban and rural areas. Therefore, our study adds to existing studies of urban–rural linkages through transportation (e.g., Bosworth & Venhorst, 2018) or access to extra-regional knowledge (e.g., Kalantaridis et al., 2019; Mayer et al., 2016), and incorporates considerations of modern work practices and increasingly popular ICT-based multilocal work practices. The latter must be taken into account, particularly in a post-Covid-19 context.

In addition, our findings illustrate that a sufficient ICT infrastructure must be available to create urban–rural linkages, so that knowledge-intensive economic activities can also spread into the rural environment (Weber & Freshwater, 2016). Our study thus also connects with previous academic work on teleworking in rural areas by emphasizing the relevance of high-bandwidth Internet infrastructure (Symons, 2000), which is a basic requirement for multilocal work practices of high-skilled workers and their ability to (temporarily) work in rural areas (Cornford et al., 1996). Therefore, we point out that specific preconditions, such as a stable and fast broadband connection, must be present. Given these preconditions, there are hardly any differences in digital communication activities in work practices between urban and rural. This suggests that multilocal knowledge workers do not experience any disadvantage with regard to their work in rural areas. However, this finding may be related to the study participants’ workstyle at multiple locations, not only between urban and rural areas, but also within the urban context itself between home office, co-working spaces and/or at the employers’ premises. Communication practices between home office in the urban and the workplace in the rural may therefore be congruent. Future research could investigate this in more depth, especially in light of the Covid-19 pandemic.

Through analysing the linking technology, we detected nuances in the ways proximity between the urban and the rural is created. Proximity is actively created, passively maintained or strategically avoided. Focusing on the work practices of multilocal knowledge workers and on the ways they use ICTs to create temporary proximity (Torre, 2008; Torre & Rallet, 2005) allows for a more nuanced perspective on the proximity concept and in particular on the means through which proximity is created. In our study, temporary proximity is created through ICTs and not through physical events. Nevertheless, the creation of temporary proximity through the use of ICTs should also be critically questioned. For example, due to the dependence on ICTs during workdays in mountain areas, there are few opportunities for unplanned face-to-face encounters (Bathelt & Schultdt, 2008; Henn & Bathelt, 2015; Maskell et al., 2006). These kinds of encounters seem to be primarily tied to the urban workplace. It should also be noted that the study participants strategically go to the mountain areas and, therefore, deliberately avoid encounters by chance. Thus, encounters are strategically transferred to digital space, consciously planned and not developing by chance in multilocal work practices.

The study shows that multilocal knowledge workers are embedded in the local social structure but not in the local economic structure of the rural (Anderson & Jirotka, 2015; Bosworth & Willett, 2011). In the case of our study participants, embeddedness in the local structure of the rural is mainly family related and not job related. Embeddedness in the local economic structure of the rural could not be determined, as linkages from the rural to the urban can be created through ICTs. Furthermore, an increase of economic work activities within the rural context was not detected due to the temporary nature of the urban–rural shift (Keeble & Tyler, 1995) of multilocal knowledge workers. Therefore, in today’s context of more flexible and

multilocal work in the digital age, embeddedness should be reconsidered as the temporary duration of the stay in the rural does not lead to increased economic work activity within the rural context. This is because digitalization enables the creation of urban–rural linkages and therefore allows for distant connections to actors in the urban. Consequently, digitalization and novel multilocal work practices shed light on the (probably) decreasing importance of embeddedness in the rural for work.

This study is limited by its sample and the Swiss national context in which rural and peripheral areas are well connected and broadband infrastructure and access is of high quality. However, while findings of our study do not necessarily apply to all national contexts, they illustrate in-depth insights regarding new multilocal work practices between digitally well-connected urban and rural areas. The study provides an analysis of urban–rural linkages and extends the repertory of methods in economic geography (Bathelt & Li, 2020) and rural studies (Strijker et al., 2020). Future research could build on our findings by analysing other technologies and practices that create urban–rural linkages such as cargo or delivery services. Furthermore, future studies could also focus on multilocal work practices between urban and rural regarding social worlds such as family issues, or the merging of work and private life in multiple workplaces. Subsequent studies could also examine the creation and effects of urban–rural linkages of home office during the Covid-19 pandemic.

NOTES

¹ In this article, we understand rural areas as regions outside the major urban agglomerations. Therefore, and fitting to the Swiss context, we use rural and mountain areas as synonyms (Mayer & Baumgartner, 2014). Rural areas are attributed to economic challenges such as a less favourable economic environment, dependency on natural resources, specific social environment, less qualified human capital, fewer and less dense settlements, and/or lacking accessibility concerning transportation and ICT (Baumgartner et al., 2013). When considering rural areas, we refer to mountain areas as including larger and smaller mountain settlements in Switzerland.

² Telecottages are central buildings in rural areas that provide access to ICTs for the local rural community for education, business and leisure (Di Martino & Wirth, 1990).

³ NGA coverage includes fixed-line broadband access technologies that can achieve 30 Mbps download speeds (European Commission, 2020).

⁴ VHCN coverage includes fixed-line broadband access technologies that can achieve gigabit download speeds (European Commission, 2020).

⁵ This period was chosen to exclude daily commuters and people who work in the periphery by chance (e.g., holiday workers).

⁶ This criterion significantly restricted the sample and, therefore, complicated the recruitment phase because the study participants explicitly had to work in mountain areas temporarily. Other rural areas in the lowlands or in agglomerations were not included.

⁷ The statistical findings only refer to our study sample of six participants and cannot be generalized to a broader population. These statistical data from the first phase served as the basis for the consecutive ethnographic walk-along observations and qualitative interviews.

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DATA AVAILABILITY

The anonymized data that support the findings of this study are available from the corresponding author, RB, on reasonable request. The data are not publicly available due to their high sensitivity and for ethical reasons.

DISCLOSURE STATEMENT

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