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COVID-19 and ICT-Supported Remote Working: Opportunities for Rural Economies

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Abstract: The COVID-19 pandemic and resulting public health measures necessitated many workplaces to permit workers to work from home. The question is now asked can the temporary transition to enable workers to work from home become more permanent and how will this shape the spatial distribution of employment opportunities and, in turn, workforces. This paper focuses on the potential for ICT-supported working from home arrangements to reshape employment opportunities in rural settings. With limited local employment opportunities being a major driver of rural out-migration, enabling rural residents to access a broader range of employment through ICT may result in a longer term disruption to rural out-migration patterns. Despite the potential of ICT to support remote working, uptake in rural areas has been relatively low. This paper argues that the recent increase in use of ICT-supported working from home arrangements promoted by COVID-19 public health measures may erode two of the major barriers to participation in remote working—these being negative perceptions by the employer and employee about working from home and limited knowledge within workplaces about how to manage a partly or fully remote workforce. For rural populations it is plausible that the rapid transition to ICT-supported working from home arrangements will open up more diverse employment opportunities. However, it remains that for some rural areas and populations the urban-rural digital divide persists as a barrier to participation in ICT-supported remote working.



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1. Introduction

The economic stability and viability of rural regions is tied to, inter alia, employment patterns, with skills shortages a constraint to the output growth of many regions [1–3]. Skills shortages are a function of the narrow base of economic activities in rural areas, with prolonged patterns of rural to urban migration dominant in rural communities the world over. The dominant narrative of rural population decline has been well documented and theorized, with limited employment opportunity—including employment availability, diversity and career progression—underpinning labor outmigration from rural areas [4–7]. Given this understanding, strategies to support rural development have typically sought to address employment availability and lifestyle opportunities in rural areas [3,8–10]. That noted, extensive programs have also been developed to diversify rural economies in an effort to attract and retain skilled labor and further investment into rural communities [11,12]. However, with professional services and higher order medical, education and retail dominantly located in major urban regions because they need a minimum population base to be viability delivered, rural dwellers have had little option but to leave their communities to participate in these sectors.

However, advancements in ICT functionality, capacity and accessibility is rapidly reshaping how work is done and the structure of workplaces and workforces, with workers increasingly able to work in locations remote from the central workplace. For rural residents, these changes are driving greater opportunity to engage in diverse careers through

ICT-supported remote working. For rural businesses, developments in ICT-supported working is enabling them greater access to diverse skills and a broader market reach.

In 2020, the global COVID-19 pandemic necessitated a range of public health responses including some governments and businesses asking workers who were able to work from home to do so. Early studies on the transition of workers to ICT-supported remote working arrangements reveal that while there were differences between jurisdictions [13], broadly those employed in professional occupations [14] and younger workers [15] were more likely to have transitioned to ICT-supported remote working. Bahn et al. [16] found that the transition to ICT-supported remote working for those with caring responsibilities had disproportionately placed burdens on women, but suggested that longer-term the rapid transition to remote working may result in a wider acceptance of how flexible working arrangements can be used to support women to participate more fully in paid work. Tracing the rapid uptake of ICT-supported remote working and the responses of workers and employers, some analysts have argued that the disruption caused by COVID-19 to traditional workplace models will ensure these emergent ways of working are embedded into workplaces longer-term [17,18] with Gupta [19] commenting “the possible increase in remote work is massive” (p. 2).

As the potential and popularity of ICT-supported remote working expands, to enable rural populations and business to capitalize on this there is a pressing need to ensure that regional development and employment policy settings are informed by relevant and robust research on ICT-supported remote working. While COVID-19 has broadened familiarity with ICT-supported remote working, prior to COVID-19 this flexible working arrangement attracted considerable research attention, particular for its capacity to alleviate congestion concerns within major metropolitan areas. For policy makers, however, access to this valuable body of research can be difficult with much of it published in academic journals that are restricted by publisher firewalls. As such, this open-access paper focuses on synthesizing the key tenets of the research relevant to rural businesses and population as they look to support increased ICT-supported working arrangements in a post-COVID-19 pandemic environment. In doing so, this paper reflects on the recent and very rapid uptake of working from home arrangements as a response to the COVID 19 public health measures, and examines if the long lasting barriers to greater rural participation in ICT-supported remote working have been overcome. The review draws on, *inter alia*, studies examining remote working, telecommuting, the rural-digital divide, and rural development and focuses on addressing the following questions:

1. What are the recognized barriers to participation in ICT-supported remote working?
2. What is known about workplace policies for supporting ICT-supported remote working?
3. What are the implications of ICT-supported remote working for the wellbeing of workers and their households?

The paper is structured into four major parts. Following this introduction, an overview of the urban-rural divide in ICT is set out. This discussion provides a critical context for understanding the potential barriers to ICT-supported remote working in rural areas. Section three provides a summary of the major conclusions about the nature and function of ICT-supported remote working developed across the extant literature. The final section presents the discussion and conclusion, highlighting that while research on the implications of COVID 19 for workplaces is still emerging, through drawing on what is already known about the barriers to ICT-supported remote working, it is plausible to conclude that there will be a longer-term increase in participation in ICT-supported remote working by rural business and residents. It is also argued that the urban-rural digital divide will remain a barrier for some rural areas and populations and that policy initiatives to address this should focus on both infrastructure limitations as well as ICT knowledge of rural residents and businesses.

2. The Urban-Rural Digital Divide

A 'digital divide' in internet accessibility and internet use exists between urban and rural areas in many developed and developing countries [20]. A 2016 report on the digital divide in the USA found that 39 percent of the rural population lacked access to high speed broadband compared to only four percent of the urban population [21]. A 2015 study of the situation in Europe found that only 25 percent of the rural population had access to fast broadband [20]. In the UK, internet connectivity was reported to be higher than the average rates for Europe, however approximately 20 percent of the rural population had no broadband access at all [22]. A study of internet connectivity in the UK concluded that 'the more remote and sparsely populated a location, the more likely it is to experience slow or no broadband connectivity' (p. 584) [22]. With mobile broadband penetration now at 95% in OECD countries, there is a need to better understand the spatial distribution of this technology and the implications for access to high speed internet in rural areas [23].

Understanding the digital divide is made more complex by the rate at which technology is developing and shifting demand for this. While it is widely understood that 'high speed internet' or 'fast broadband' is important for supporting remote working and working from home arrangements, there is no universal meaning for the term 'high speed internet' or definition for the term 'fast broadband'. In 2016, the US Federal Communications Commission (FCC) defined a minimum standard for fixed terrestrial line broadband services as 25 megabits per second (Mbps) downstream and three Mbps upstream [21]. The FCC determined that it was reasonable to apply the speed benchmark of 25 Mbps/3Mbps to all fixed services but noted that, at the time the FCC report was written, there were no satellite broadband services that met the speed threshold. In 2015, the EU defined 'fast broadband' as downstream speeds of above 30 Mbps and 'ultra-fast' broadband as downstream speeds of above 100 Mbps [20] and did not distinguish between fixed line and mobile broadband. As technology further advances and 5G is rolled out, and the software and hardware demands also changes, definitions of acceptable standards will change.

While there is a recognized unevenness in access to high-speed internet between urban and rural areas and also within rural areas [24], the urban-rural divide in the uptake of internet use in the home is not simply a result of the limitations to the geographic penetration of infrastructure. Whitacre and Mills [24] found that, when controlling for differences in internet service availability, remaining differences between urban and rural areas were linked to socio-economic variables including income, education and sector of employment. They found that households with high income levels and high education levels were more likely to have broadband connection to their home. Additionally, those employed in a professional occupation were more likely than those employed in a trade to have a home broadband connection [24]. Of further interest was their finding that social norms and practices of places influenced in-home broadband connection. In a similar finding, Howick and Whalley [25], who examined broadband uptake in rural Scotland, concluded that a significant barrier to the uptake of internet to the home was that people did not see a need for an in-home internet connection.

As internet and communications technology has developed and the internet has become increasingly used to provide essential and everyday services to rural dwellers (including banking, taxation, welfare, medical and education) [26], the urban-rural digital divide has been extended to include the nature and frequency of internet use [27]. In examining how rural dwellers use the internet, researchers have found that social, cultural and demographic factors considerably impact the nature and duration of in-home internet use [28,29]. Salemin et al. [29] found that while rural communities were most in need of improved digital connectivity to compensate for remoteness, they were the least connected. Nevertheless, researchers have found that enabling rural people, particularly those in isolated areas, to access services and communities of interest through the internet was positively associated with decisions to remain in their communities [28].

Despite the persistence of the urban-rural digital divide, it remains that over the last decade there has been a massive growth in high speed internet coverage and use in

rural areas in developed countries [20,23]. With more rural households now connected to the high speed internet than ever before, and research indicating that this connectivity is positively impacting peoples' decisions to remain in rural areas, it is timely to re-examine how improved ICT in rural areas could impact the nature of rural employment and labor attraction and retention.

3. The Emergence of Remote Working Using ICT

Working remotely from the workplace with the assistance of ICT to engage in the central workplace first emerged as a topic of academic inquiry in the 1970s. Such work arrangements were first investigated as telecommuting [30,31]. Telecommuting was presented as a method of working in which the employee does not commute to a traditional shared workplace. Telecommuters undertake their work within their own home or at some other remote workplace such as a public shared-office or co-working space. Telecommuters use telecommunications technologies to connect with work colleagues who are located at other places. Definitions of telecommuting typically include a requirement for telecommuters to log into a central workplace computer network [32]. This was positioned as an important factor that distinguished telecommuting arrangements from other employment arrangements that necessitated workers to travel to and from a central workplace (such as estate agents, sales representatives, tradespeople).

With the evolution and development of technology, there was a resulting shift in the nature of telecommuting and, more broadly, remote working. In particular, recent developments in the use of virtual private networks (VPN), cloud based computing, mobile applications and software as a service, meant that workers no longer need to log into a central workplace computer network. Recognizing this, in 2015, Allen et al. [33] defined telecommuting as, 'a work practice that involves members of an organization substituting a portion of their typical work hours (ranging from a few hours per week to nearly full-time) to work away from a central workplace—typically principally from home—using technology to interact with others as needed to conduct work tasks' (p. 44).

Studies on the use of ICT-supported remote working initially substantively focused on this mode of work as a mechanism for reducing the environmental and social impacts of long work commutes in America's rapidly expanding metropolitan areas [30,31]. It was argued that remote working through the support of ICT could enable a decentralized urban model, where firms established multiple small offices throughout metropolitan regions so workers could travel to the office closest to their home rather than a central location. Building on these initial ideas, Hiltz [34] and contemporaries focused on the implications of working remote from the central workplace for the community. Hiltz [34] presented the idea of an 'online community' suggesting that the rapidly developing internet technologies could result in traditional physical 'office' based workplace communities being replaced by remotely located 'online' workplaces.

However, since this period there have been a large number of studies conducted on a range of aspects for ICT-supported remote from home working. Some focus on the technology needs and suitability of software, others on measuring environmental impact and social implications for cities and suburbs. A search of the scholarly databases Science Direct, Taylor and Francis, Proquest and Scopus for articles on telecommuting and remote work identified many thousands of potentially relevant articles. This group of articles was then reviewed to identify those potentially relevant to the matter of labor attraction and retention. At this point, repeat articles were also removed from the group. Following this, articles focused on transport modelling and environmental impact modelling and those with a very narrow spatial focus were removed from the group. Finally, those that were not able to be accessed by the author through the author's institutional library or through reciprocal library borrowing were removed. This left 252 peer-reviewed studies across 136 journals being identified as thematically relevant to understanding the barriers to the uptake of ICT-supported remoteworking in rural areas. Substituting this search,

a search of *Goggle Scholar* and *Publish or Perish* for articles that considered COVID-19 and ICT-supported remote working revealed further articles that have informed this paper.

3.1. Who Participates in ICT-Supported Remote Working?

Studies reporting on COVID-19 and ICT-supported remote working have revealed that the rapid transition to remote working has been greatest amongst those working in the professions. This finding confirms findings from earlier work on the barriers to ICT-supported remote working, with this type of workplace arrangement found to be more suitable for some occupations than others [35]. While the transitions to work arrangements and workplaces from COVID-19 are still evolving, it is possible to learn more about who participates in ICT-supported remote working and why through drawing the expansive body of extant scholarship on this topic.

Considerable research attention has been given to identifying the factors that underpin the decisions of employers and employees to participate (or not) in ICT-supported remote working. In a 2003 summary of selected telecommuting studies, the U.S. Department of Transportation Research and Innovative Technology Administration identified that, in enabling workers to engage in telecommuting, employers could receive the benefits including: increased productivity; reduced costs for the provision of workspaces; lessening of difficulties in covering 'difficult' shifts; greater retention of valued employees; greater access to a wider labor pool; lower sick leave utilization, and; improved motivation of employees. It was identified that engagement in telecommuting could result in financial savings resulting from reduced travel and other work related expenses (such as uniforms) [36]. Other benefits included: increased proximity to family and community; autonomy and increased control over work conditions and schedules, and; improved quality of life.

One of the more notable studies to report on why employees and employers engage in ICT-supported remote working, Igbaria and Guimaraes' [37] compared telecommuters and non-telecommuters involved in sales at a large firm based in a major US metropolitan area. Igbaria and Guimaraes [37] found that those working remotely were more certain about the tasks they were required to complete, and faced less role conflict and role ambiguity than those working in the central workplace. Remote workers also reported they were happier with their supervisors and had a greater level of commitment to their organization than those working in the central workplace. However, there were some potential concerns for those involved in remote arrangements with these workers indicating a lower level of satisfaction with peers and with promotion. Subsequent research by Kurland and Cooper [38] and Wilton et al. [39] found that ICT-supported remote workers faced isolation from 'day to day' discussions and events in the workplace and this could result in employee dissatisfaction and lower retention.

Given the focus of the extant scholarship on metropolitan areas, ICT-supported remote working has been investigated and positioned as a travel demand management (TDM) strategy for metropolitan areas. Overcoming the multiple and complex social, economic and environmental impacts of traffic congestion has been positioned as of critical importance to the viability of metropolitan regions [40,41]. Within the body of work investigating ICT-supported remote working as a TDM strategy, researchers have highlighted the personal benefits for workers when they are not subject to daily commutes [42]. Allen et al. [33] found that while reduction of daily commutes is beneficial to workers, this relationship could be quite complex stating "the extent of telecommuting has been positively associated with organizational commitment and negatively associated with intent to leave the organization, such that more extensive telecommuting has been associated with greater commitment to the organization and lower turnover intentions" (p. 45). While those in rural areas may not have to face congested travel routes, the lower density settlement patterns of these areas can mean that workers must travel large distances each day to access suitable employment. In these cases, ICT-supported remote working arrangements could greatly reduce the need for travel. Drawing on the experiences of workers based in metropolitan areas, reducing

travel time could increase rural-based workers satisfaction with work—a key factor in improving employee retention.

People enter into ICT-supported remote working arrangements for one or more of these reasons: to access work that is more meaningful; to improve their work–life balance, or; to reduce their commuting time. Importantly though, those entering such arrangements also seek to maintain or improve their financial position. From the scholarship it is possible to construct a broad understanding about the characteristics of those who engaged in ICT-supported remote working. However, it must be noted that much of this research has been undertaken in North America, which limits the generalizability of the information. Baily and Kurland [43] found that macro studies based on participation data were not reliable for identifying demographic characteristics of ICT-supported remote workers, as these macro studies did not pick up different forms of remote work. Their review of smaller case study based research outputs concluded there was considerable diversity in the demographics of this workforce and this reflected different occupations and workplace policies.

3.2. What Are the Recognised Barriers to Participation in ICT-Supported Remote Working?

A revealing field of inquiry in considering the barriers to the uptake of ICT-supported remote working has been that which examines the costs and benefits of ICT-supported remote working for businesses [44], with uncertainties about the costs and benefits recognized as a major barrier to business uptake. Quantifying both the benefits and costs to business has been recognized as methodologically challenging as it requires the use of assumptions about the number of days workers engage in ICT-supported remote working. As workers have diverse working arrangements, with some working part days from home and part days from the office, while others work almost full time from home (or an alternate workspace nearer to their home) assumptions about participation are inherently difficult. Therefore, studies quantifying the financial costs and savings associated with ICT-supported remote work are typically based on averaged participation rates. Examples of this approach are Lister and Harnish's national scale analyses for the UK [45], USA [46] and Canada [47]. While they varied their assumptions for each country, they identified that ICT-supported remote workers were more productive workers than those based in a central workplace as they had fewer interruptions, had more effective time management, typically worked longer hours and, for those with flexible hours, opted to work when they were most productive. Overall, they identified that when workers engaged in ICT-supported remote working they had a 20 per cent increase in productivity.

Researchers have found that ICT-supported remote work does not always result in increased worker productivity. Neufeld and Fang [48] identified a causal relationship between a worker's satisfaction with ICT-supported remote working arrangements and their productivity. In their study of a large Canadian multinational company, 84 per cent of those who expressed a positive attitude about ICT-supported remote working were highly productive. Contrastingly, 92 per cent of those who expressed a negative attitude about ICT-supported remote working had low productivity. Again, and importantly, much of the work published on ICT-supported remote working draws on singular or geographically constrained case studies. This has resulted in a body of work where the diversity in the experiences of workers (and employers) has been well documented and the many situational and contextual factors affecting the benefits for employers and workers have been illustrated [39,49–51].

Extending on the work examining the situational and contextual factors that impact experiences of ICT-supported remote working, a study by Anderson et al. [52] shifted the focus to consider how workers' individual differences, such as personality traits, affected their experiences. They developed their inquiry from earlier studies [53,54] and found that individual differences influenced how people interacted with contextual factors. They reiterated the findings of earlier works that identified that these contextual factors moderated the outcomes such as wellbeing and worker productivity. They also illuminated

that while ICT-supported remote working could deliver benefits to workers and employers, there were no global conditions or factors that could ensure that ICT-supported remote working arrangements delivered productivity gains or other costs savings. This line of inquiry has not yet been extended to rural settings.

As noted in the previous section, ICT-supported remote working arrangements are not suitable for all occupations or employment situations. Again turning attention to the question who can participate in remote working, van den Broek and Keating [55] investigated how government policy settings affected workers' and employers' engagement with ICT-supported remote working. Using a comparative analysis approach drawing on the cases of the UK and Australia, van den Broek and Keating identified that policy instruments affected who could participate—confirming that remote working was not an option for all employees or employers. Some policy instruments were 'privileged-based' while others were 'rights based' and these instruments restricted access for employees in unskilled areas of the economy. Privileged-based referred to situations where opportunities to work remotely tended to be confined to employees who possessed greater bargaining power and occupational status. van den Broek and Keating [55] argued that for ICT-supported remote working to become a legitimate employee expectation and, in turn, for participation to grow, policy instruments needed to be based on rights, rather than privileges.

Considering barriers to ICT-supported remote working in rural areas, a steadfast theme in rural development literature highlights the implications of limited or unreliable telecommunications and power supply. Rural regions have lower levels of internet service and reliability than metropolitan regions [56–58]. The urban-rural digital divide has attracted the attention of local level governments, national governments, and international governance organizations, with national governments and international governance organizations developing programs for improving internet access and ICT resources and skills in rural areas. For example, Roberts et al. [58] identified that since 2006 there were at least 24 policy documents addressing the urban-rural digital divide that were relevant to the UK (this included EU policies). Many policies have sought to improve access to ICT through infrastructure investment, such as in the USA the Connect America Fund which supported the installation of broadband in un-serviced rural areas in the USA. However, as noted earlier in this paper, the urban-rural digital divide is not entirely associated with access to appropriate internet service, but is also related to individuals' patterns of adoption and engagement [59,60].

The digital divide has hindered the viability of ICT-supported remote working for rural businesses and workers. However, as the coverage of, and accessibility to, high speed internet has improved and governments and businesses have rolled out training and education programs to rural populations to support their use of the internet for everyday activities (such as banking and accessing education) [60] the prospect for greater participation in ICT-supported remote working in rural areas has improved.

3.3. What Is Known about Workplace Policies for Supporting ICT-Supported Remote Working?

ICT-supported remote working has been positioned as a strategy for businesses to reduce overheads, improve productivity and attract and retain skilled workers. However, researchers have found that ICT-supported remote working is not an effective option for all employers or employees. Recognizing that the success of ICT-supported remote working arrangements varied between organizations and employers, researchers focused attention on identifying the role of workplace policies on experiences for both the employer and employee. Katz [61] highlighted that for ICT-supported remote working to deliver benefits for both the company and the employer, the company needed a well-developed strategy for supporting remote working, for managing remote work and for ensuring worker productivity. McCready et al. [62] commented "there are differences in managing remote workers, which although are not different in essence, require a different concentration of management skills. In particular, a more deliberate approach is necessary to develop

relationships and teams” (p. 16). However, as internet technology and commuter practices have evolved, so to have workplace policies and management practices, enhancing the opportunities for effective communication for remote workers and managers. Given this, further research is now required to examine how contemporary communication technologies, formats and practices are impacting employer and employee management behaviors and satisfaction with ICT-supported remote working arrangements.

Researchers have positioned addressing real and perceived worker isolation as one of the more difficult issues facing employers offering ICT-supported remote working arrangements. Worker isolation was first identified as a major barrier to participation in the early 1990s [43], and Yap and Tng [63], Holloway [64] and Bae and Kim [65] identified a gender dimension to the sense of isolation. Cooper and Kurland [66] reviewed strategies that managers adopted for addressing potential (and real) professional isolation issues for ICT-supported remote workers. They identified that many companies that engaged in remote working recognized the potential for workers to feel and become professionally isolated. For managers this issue needed to be considered when fostering team synergy and replicating informal learning opportunities [66].

Examining workplace policies for supporting ICT-supported remote working, Beham et al. [67] found that the uptake of remote work arrangements was often influenced by the attitudes of managers. Interestingly, a study by Duxbury and Neufeld [68] found that ICT-supported remote working arrangements had little impact on intra-organizational communication, with difficulties in communication more closely related to the behaviors of the worker and manager. While not reviewed for this paper, it is noted that there is an extensive literature on organizational and management culture and, while not specifically focused on ICT-supported remote working, this literature may provide critical insights into how workplace policies support ICT-supported remote working arrangements.

Expanding on research about the importance of workplace policy and support, Wilton et al. [39] considered how social norms within workplaces affected willingness to participate in ICT-supported remote working. They found that, while for some, workplace interaction and culture had a subtle (or no) impact on their decision regarding remote working, for others they actively sought advice and approval from colleagues before deciding to transition to remote working. From this body of work, it can be concluded that employers wishing to enhance participation in remote work should be mindful of the potential impact of such flexible work arrangements on social relationship and norms within the workplace.

3.4. What Are the Implications of ICT-Supported Remote Working for the Wellbeing of Workers and Their Households?

It is widely accepted amongst ICT-supported remote workers that flexibility in working arrangements can help improve worker wellbeing. Researchers have shown this is particularly the case for workers with caring responsibilities or those who otherwise have competing demands on their time. Engaging in ICT-supported remote working can also result in improved wellbeing to other members of the worker’s household [69]. For workers who participate in ICT-supported remote working, even on a part time basis, they can gain greater control over their work—family boundaries [69]. Troup and Rose [50] found that this form of flexible work provided an effective option for workers to integrate work and personal lives, but cautioned that there was not a ‘one size fits all’ arrangement. Extending this point, Felstead [70] found that workers who experienced good outcomes for their wellbeing and household wellbeing implemented strategies for managing isolation from co-workers and interruptions from family and friends. However, for some workers, undertaking much of their work at home resulted in challenges in effectively separating work tasks from home tasks [64]. This issue was more common with women, with Holloway [64] commenting that women “often find that working from home sees them doing even more of the unpaid domestic work than they previously did” (p. 36) and that “despite the apparent advantages of telework, particularly for women with childcare responsibilities, the implementation of telework in a busy family home is problematic” (p. 42).

Moore [71] examined the potential impact of homeworking on home and family life and found that people who worked from home were no less stressed than those working from a central office. This finding was true for both males and females. Moore considered the impact of the nature of employment arrangements on wellbeing through measuring and comparing workers' stress in different employment arrangements. Forty per cent of participants in Moore's study found aspects of working from home stressful. Interestingly, this experience of stress was not differentiated by occupation but those with young children in the household did experience greater levels of stress levels. One participant in Moore's study commented, "one of the frustrations is I think, you feel you're not doing anything particularly well" (p. 8) [71].

4. Discussion and Conclusions: ICT-Supported Remote Working and the Implications for Rural Economies Post COVID-19

COVID-19 has disrupted working arrangements across the world. For many, particularly those in professional occupations [15], COVID-19 related public health measures have necessitated them to work from their home for a period of time. Many employers and employees who had previously not engaged in remote working arrangements—despite there being no or little technological barrier to doing so—have been able to transition to remote working [72]. Preliminary research, while jurisdictionally and sectorally limited in its coverage, indicates that in particular circumstances worker productivity has increased and workplace costs have decreased [73]. However, for the positives brought by the rapid shift to working from home, some researchers have highlighted that for some, particularly those with young children in the household, working from home has had a negative impact on their work and wellbeing [74]. Reuschke and Felstead [75] also suggest that in response to the COVID-19 pandemic there has been a spatial unevenness in the uptake of working from home. They argued that the observed unevenness (also see [76]) can be partially explained by the severity of COVID-19 in particular locations, variability in the occupational structure of workforces and difference in socio-economic status. Furthermore, when considering differences between counties, they highlighted the importance of policy settings in influencing the preparedness of employers and employees to engage in flexible work arrangements [75]. These preliminary findings do align with those from the established scholarship which highlights that for ITC-supported working from home to be beneficial to the employer and employee careful consideration needs to be given to workplace policies for supporting workers, the nature of work tasks and the individual's personal circumstances and work environment preferences. While time will tell how what the lasting legacy will be from the COVID-19 stimulated transition to ICT-supported working from home, the extant scholarship does provide robust and useful information for rural and regional policy makers seeking to support the longer-term expansion of ICT-supported working from home arrangements in their area.

ICT-supported remote working arrangements are usually negotiated between the employee and manager and there is notable diversity in how people participate in ICT-supported remote working and the reported benefits to employers and employees. Across the literature examining ICT-supported remote working broad insights about worker and employer behavior and experiences relevant to non-metropolitan contexts include:

- Engagement in ICT-supported remote work can enable workers to improve their work–life balance. This, in turn, relates to worker satisfaction, performance and retention.
- Engagement in ICT-supported remote work enables workers to access work they otherwise could not due to the distance they would have to travel between their home and place of work.
- Employers have demonstrated that by engaging in ICT-supported remote work they are able to extend the geographic pool of labor and overcome supply side labor shortage issues.

- For employers, ICT-supported remote working can result in reduced costs associated with central office space provision, lower costs of recruitment and staff turnover, and enable increased worker productivity.
- For both employers and workers, worker isolation can be an issue. There are a number of research papers that report on different workplace (employer instigated) and home (worker instigated) strategies to address and manage worker isolation.

It is understood that as the functionality and affordability of ICT for remote working continues to improve, the opportunity for engagement in ICT-supported remote working will also continue to expand—geographically and sectorally.

Considering the potential legacy of the rapid transition to ICT-supported working from home, it is plausible that, given the increased pool of businesses and workers now familiar with remote working, rural businesses could have access to a more geographically disbursed workforce. This is important as a major challenge for rural communities and businesses has been attracting and retaining an appropriately skilled labor force. The reasons why rural businesses can face difficulties in attracting and retaining labor are complex, yet have typically been associated with the nature of the work as well as various place-based factors [8,77]. The place-based factors that have been identified as barriers to rural labor attraction and retention include limited diversity in employment opportunities, limited opportunities for career advancement and limited opportunities for social and economic advancement within rural communities [78,79]. Addressing place-based barriers, ICT-supported remote working may provide rural businesses with an avenue to employ workers who are permanently based in places that offer employees their desired lifestyles with employees only having to travel to the rural community occasionally, or indeed never. ICT-supported remote working could also provide an opportunity for rural based residents to participate in employment and work communities that is 'located' outside of their home community, thereby enabling rural communities to retain critical human capital.

To support the expansion of ICT-supported remote working in rural areas, it is critical to understand why workers and employees become engaged in this flexible work arrangement. Workers become engaged in ICT-supported remote working for a range of reasons, including a better work–life balance, to better manage caring responsibilities, to access work that would otherwise be unavailable to them due to geographic distance and, to save on travel and parking costs. Researchers have also found that the reasons that propel individuals to become involved in ICT-supported remote working could affect satisfaction with remote work. Likewise, the nature of employment and relationships with managers also affected satisfaction and, in turn, likelihood to remain engaged and productive.

Prior to the COVID-19 pandemic, considerable research attention had been given to assessing the costs and benefits of ICT-supported remote working arrangements for employers. A unifying theme across this research is that remote working can result in improvements in worker productivity, but this depends on the nature of management arrangements and the employees' own capacity to manage work–life demands. It has been recognized there is a need for further information about best practice arrangements for remote working, particularly those that can accommodate the different types of arrangements and technologies used to support these arrangements. For rural settings, improved information about best practice arrangements could be particularly useful given the recent innovations in ICT and the potential opportunities this provides to rural areas and businesses that previously were not able to engage in ICT-supported remote working.

Within policies that promote ICT-supported remote working arrangements for rural areas, remote work has typically been positioned as a solution for either rural populations seeking to access employment in metropolitan areas or rural businesses seeking to engage workers who are based in metropolitan areas. Very little empirical work has been published within the peer reviewed scholarship that examines the social, economic or geographical dynamics of these arrangements. While identified as potentially very important to the sustainability and growth of rural areas, the published accounts of the performance of such arrangements are limited. Along the same vein, very little is known about how ICT can

enable metropolitan based workers to access rural situated work or to participate in rural industries. With scholars having identified growth in the geographical spread of counter-urbanization (particularly in developed countries) [78] it is possible that ICT developments have been an important factor influencing the intensity and direction of these migration flows. While the extant scholarship on ICT-supported remote working does provide considerable insight into the benefits, costs and complexities of remote working there remains a need to examine how ICT-supported remote work operates in rural spaces and the implications of the remaining urban-rural digital divide to the potential to transform rural employment and economies. While these matters remain, the COVID-19 pandemic and the resulting rapid move of many workers to ICT-supported remote working has considerably increased employer and employee familiarity with remote working and, in doing so, has shifted forward prospects for substantive growth in remote and flexible work for rural resident and businesses.

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