Scottish Geographical Journal

ISSN: 1470-2541 (Print) 1751-665X (Online) Journal homepage: https://www.tandfonline.com/loi/rsgj20

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To cite this article: Elisabeth Roberts, John Farrington & Sarah Skerratt (2015) Evaluating New Digital Technologies Through a Framework of Resilience, Scottish Geographical Journal, 131:3-4, 253-264, DOI: 10.1080/14702541.2015.1068947

To link to this article: https://doi.org/10.1080/14702541.2015.1068947

Published online: 16 Oct 2015.

Scottish Geographical Journal, 2015
Vol. 131, Nos. 3–4, 253–264, http://dx.doi.org/10.1080/14702541.2015.1068947

Evaluating New Digital Technologies Through a Framework of Resilience

ELISABETH ROBERTS[a*], JOHN FARRINGTON[b] & SARAH SKERRATT[c]

[a]*Department of Geography and Environmental Management, University of the West of England, Frenchay Campus, Bristol BS16 1QY, UK;* [b]*Geography Department, University of Aberdeen, St. Mary's, Elphinstone Road, Aberdeen AB24 3UF, UK;* [c]*Scotland's Rural College (SRUC), King's Buildings, Edinburgh EH9 3JG, UK*

(*Received 11 May 2015; accepted 30 June 2015*)

ABSTRACT *This paper explores how an evaluative framework of resilience might be utilised to assess the impact of new digital technologies. This paper outlines key themes and indicators from recent literature on community-level and rural resilience and incorporates insights from work on digital inclusion and rural information and communication technologies to build a framework of rural community resilience. It then highlights a successful case study carried out by the Digital Engagement and Resilience project and describes some of the methodological challenges that can be encountered in cross-cutting evaluative work in a digital economy context. Finally, it contextualises this work in the current policy climate of rural digital agendas to stress the growing need for holistic and critical approaches to 'resilience'.*

KEY WORDS: resilience, digital inclusion, rural broadband, ICTs

Introduction

'Resilience' as a concept is increasingly deployed in rural development policy and research engaged with ruralities and communities (Department for Culture, Media and Sport UK Government 2010). The Digital Engagement and Resilience (DEAR) project at the dot.rural Digital Economy Research Hub, University of Aberdeen, worked with a conceptual framework of resilience to evaluate the use of new digital technologies and the impacts of superfast broadband deployment within rural communities.[1] In the context of persistent digital divides between urban, peripheral and rural areas, and the rolling out of UK government 'digital by default' strategies (Farrington *et al.* 2013; Thornham 2013), it is increasingly important to examine the 'social geographies of resilience' (Franklin *et al.* 2011) in terms of digital access, adoption and inclusion. Across rural development and digital policy, information and communication technologies (ICTs) are expected to fill gaps in, supplement and enhance rural services and are sometimes viewed as a panacea to social problems experienced in rural locales. With the Internet representing the 'death of distance'

Correspondence Address: Elisabeth Roberts, Department of Geography and Environmental Management, University of the West of England, Frenchay Campus, Bristol BS16 1QY, UK. Email: liz3.roberts@uwe.ac.uk

(Warren 2007), ICTs are cast as tools that will reduce isolation for rural inhabitants, create cohesion and opportunities, aid transparent, participatory governance and support health and transport services. The reality of this, as experienced, is debated in current research (Clayton & Macdonald 2013; White 2013).

The DEAR project aimed to look at Hub themes and individual research projects to gain better understanding of attitudes towards, and use of, digital technologies as being deployed by Hub projects and to explore links between communities' interaction with innovative, broadband-enabled technologies and enhanced community resilience. These links were explored in our case study with the Satellite Infrastructure for Rural Access (SIRA) project, outlined below. Our approach sought to develop understanding of how the social and technical aspects of technology use interact, identifying patterns and 'meta-lessons' for community resilience-building. We hoped that the holistic approach provided by the resilience framework – as a general heuristic (Wilson 2012) – might better reflect the lived experience of interconnected rural challenges. These aims were based on the premise that it is important to understand the conditions that enable uptake and use, and the impact that technologies have on people's lives at the level of individual experience. For example, the capacity of a rural community to take up a new, Internet-enabled, health-related technology will be dependent on a number of factors, including: existing Broadband infrastructure; current health service provision and related infrastructure such as transport; the regional economy and policies at various scales; levels of digital engagement and existing willingness/desire of individuals to participate (in the technology scheme and in community/health activities).

Utilising a resilience framework to explore rural digital divides and ICT adoption offers a unique and critical approach that identifies the resources and vulnerabilities a community has and the effects that interlocking digital and physical (dis)connection or (dis)engagement has on rural living. This is particularly important in light of recent research that critiques UK government Superfast broadband roll-out strategies for their implicit assumption that providing access will automatically equate with use (Badasyan *et al*. 2011; Helsper 2012; Mervyn *et al.* 2014).

Current UK broadband Internet access policy focuses on government subsidies to private providers to roll out Superfast broadband infrastructure (House of Commons Committee of Public Accounts 2013). Despite recent investments in the UK's rural programme, Broadband Delivery UK (BDUK), innovative solutions to connectivity are increasingly necessary to improve the connectivity of the 'final few' (*BBC News*; House of Commons Committee of Public Accounts 2013). The UK government has since committed an additional £10 million fund for pilot schemes that explore alternative broadband technologies in rural areas (*The Telegraph* 2014). European Union-led Rural Development programmes, which aim to create opportunities for economic growth and job creation (EC 2010), are predicated on universal access to high speed, reliable Internet connectivity. Rural areas with deficient Broadband infrastructure are excluded from these opportunities and from the broader benefits the Internet brings including, for example, access to online services, entertainment and participation (social interaction, political engagement, and information).

Based on a number of key themes and indicators emerging from an extensive literature review covering the themes of community resilience, digital divides, digital inclusion and rural ICTs, we developed our conceptual framework of community resilience with the intention of being able to identify patterns in engagement with digital technologies and rural community resilience. From these patterns, we hoped to be able to make policy recommendations for increasing rural community resilience through digital strategies.

Frameworks for Resilience

As well as attracting considerable interest from human geographers and other social scientists interested in urban, economic and organisational resilience (Evans 2011), and rural- or community-level resilience (Skerratt & Steiner 2013; Wilson 2012), the concept of resilience is increasingly being mobilised in rural and community development policy. Malleable in its definition and application, resilience is understood as the capacity of individuals and communities to bounce back or 'bounce forward' from external shocks such as natural disasters or slow onset changes such as economic or public service decline. It is applied broadly as a framework to understand how communities respond and adapt to environmental and societal changes (Adger 2006 cited in Wilson 2012). Resilience is understood as the capacity of individuals and communities to proactively adapt to constant change through pathways to build capacity and develop resources within and beyond the community (Magis 2010; Skerratt 2012).

Increasingly, the place-specificity and social, historical, and political contexts of communities are also being brought into consideration when defining community resilience (Cote & Nightingale 2012), as it is recognised that resilience is not a characteristic inherent in individuals or communities but is culturally informed and defined.

Resilience is receiving increasing attention within rural geographies as scholars reflect on contemporary economic uncertainty and ecological crisis. Scott (2013) argues that resilience provides an opportunity to 're-frame' rural debates which includes reframing endogenous rural development strategies as activities that encompass local and extra-local resources. Rural places are analysed 'in relation to an interdependent set of socio-spatial, economic, institutional and environmental systems' (Scott 2013, p. 604). Likewise, Wilson (2012) stresses the interconnectedness and importance of balancing social, economic and environmental factors, whilst McManus *et al.* (2012) call for a holistic view of rural decline, arguing that the reality of rural lived experience is a combination of these factors (this perspective is exemplified in the example presented earlier of the interdependencies of new healthcare technology adoption). A shift towards more environmentally sensitive rural lifestyles and consumption patterns is ultimately called for (Wilson 2012; Scott 2013).

Internet-enabled digital technologies are viewed as a crucial resource in creating these alternative pathways for rural communities. Whilst rural communities are embedded in multi-scale technological systems, they also experience patchy connectivity, including what are referred to as 'not spots' and can receive considerably lower speeds and quality of broadband Internet than urban areas (Skerratt 2010; Farrington *et al.* 2013; Philip *et al.* 2015). Rural geographers have highlighted rural–urban divides (Puel *et al.* 2007; Basu & Chakraborty 2011) and community aspects of rural connectivity and ICTs (Warren 2007; Skerratt 2010) whilst elsewhere the 'embeddedness of ICT use in the geography of people's daily lives' (Gilbert *et al.* 2008, p. 912; Couclelis 2009) has been stressed. Given the materiality and unevenness of these digital geographies (Zook & Graham 2007; Spinney *et al.* 2012; Kinsley 2014), there is considerable scope, then, to think through the spatial implications of digital inclusion, adoption and tools in terms of rural resilience.

Wilson's (2012) framework of community resilience includes questions related to Internet connectivity within a list of indicators of economic capital, McManus *et al.* (2012) name technological development as an exogenous change that communities must adapt to. Work

by Grace and Sen (2012) points to the importance of 'convivial' technologies in their study on the role of public libraries for community resilience. This research notwithstanding, resilience research to date does not have a strong technology component.

Researchers have taken a variety of approaches to measuring and evaluating resilience. A growing challenge is to capture the interacting scales of regional, community and individual resilience. Reviewing literature on community resilience, digital divides, digital inclusion, rural ICTs and rural sustainability identified a number of key themes and relationships that paint a complex picture of the discourses of rural communities' digitally enabled resilience. This review led to the development of a framework of resilience, designed to evaluate the impact of new digital technologies on rural areas and the knock-on effects they might have, for example, on people's capacity to interact and build social capital or their ability to use other digital services and build digital literacy. The resilience framework has three main categories, namely individual resilience, community resilience and digital engagement. The resilience framework also incorporates sensitivity to cultural norms in processes of resilience and considers how norms can be established both through socially embedded hierarchies of power and, discursively, through ongoing, unquestioned practices.

Individual Resilience

Individual and community levels of resilience are mutually supportive in ways that resilience researchers are still working to unpick. Individual resilience has been predominantly studied within psychology and healthcare settings. It is dependent on a number of factors including the events and circumstances of a person's life-course, their interaction in formal and informal networks at a range of scales, education and employment opportunities, socio-demographic status and their access to, and the availability of, resources. All these factors influence an individual's capacity to adapt (Berkes & Ross 2012). Well-being is increased by participation in a cohesive and vibrant community (Poortinga 2012). High reported levels of health and general well-being (in the form of economic and social capital) are associated with greater levels of efficacy to effect change (Bush & Baum 2001). Community resilience can be enhanced by a key individual who is well networked, skilled and resourceful (MacKinnon & Derickson 2012).

Community Resilience

For the purposes of developing frameworks of resilience, a pragmatic definition of 'community' is utilised here and in the DEAR project as a whole, which, following Wilson (2012), understands communities of place to be geographically bounded entities but which also acknowledges that communities-of-place also exist as communities of practice, of interest, professional communities and online communities. Community resilience is often broken down into various components indicative of community capitals or assets, including, for example, economic, cultural, natural and social capital (Callaghan & Colton 2008). Social capital is considered to be important for social inclusion, well-being, trust, reciprocity and collective capacity (Cote & Nightingale 2012). Place uniqueness and attractiveness can also influence people's willingness to participate in local economies and governance; localisation is the degree to which people invest in their community, including shopping, volunteering, working there (Graugaard 2012). However, rural communities need, simultaneously, to be diverse and outward-facing. Diversity is believed to increase

the resilience of communities through removing dependency on one industry or person (Wilson 2012). For example, multifunctional rural regions are more resilient than those reliant solely upon agriculture (Wilson 2012; Scott 2013). Social learning and fostering local knowledge and endogenous skills and information are also valuable processes in developing resilience. Each of these components is variously thought to contribute to a community's willingness to participate locally and develop collective capacity.

Digital Engagement

Any attempt to evaluate the capacity of new digital technologies to increase community resilience requires a baseline which establishes current/pre-study levels of digital engagement. Digital engagement is dependent on a variety of factors including the speed and reliability of local Internet connectivity, ICT access and use, users' digital literacy as well as perceptions of, and attitudes towards, new digital technologies. Greater recognition is now being given to cultural, social and institutional barriers to Internet access and the adoption of digital technologies. Digital inclusion strategies recognise that those who could potentially benefit most from digital technologies and online services are often those already socially excluded and lacking the resources, capacity or awareness to be able to utilise them (Helsper 2012). Warren (2007) noted that new digital technologies are introduced within existing technology infrastructures which means that the digitally literate are better able to adapt to new technologies, and the digitally excluded may always be catching-up. Access to broadband Internet, digital devices and Internet-enabled services is argued to increase individual quality of life, well-being, levels of participation, increasing inclusion and choice, and has positive social and economic impacts (Department for Culture, Media and Sport UK Government 2010). The Carnegie UK Trust and the Plunkett Foundation (2012) suggested that broadband initiatives could be explored in terms of how they might empower, skill-up, identify resources and build collective capacity. Digital engagement in this context might also be understood as digital resourcefulness.

Cultural Norms and Power Relations Within Communities

Community resilience does not happen in isolation within a community but is influenced by actions and policies at individual, regional, national, and even international, scales. Within communities, power circulates through social relations in often-invisible ways. Resilience is not experienced in the same way and/or to the same extent by all members of a community. It is thus not uniform or neutral but reflects the interests of different actors with sometimes competing motivations, meaning we must always be careful to ask 'resilience of what and for whom?' (Cote & Nightingale 2012). Frameworks of Digital Engagement and Resilience must question normative assumptions about the role of technology and how power circulates around both discourses of and actual uses of new digital technology. For example, in rural broadband policy, technocratic solutions for rural areas persist, whereby access to Broadband Internet is equated with use. Within the concept of digital engagement, it is therefore necessary to think about leadership roles, who the key actors in the community are, and whose interests they appear to be serving. Political discourses of localism, popular in academic and lay contexts, stress the 'responsibilisation' of the community. Resilience studies need to examine bottom-up and top-down pathways for communities to influence their future. Communities are heterogeneous, encompassing competing

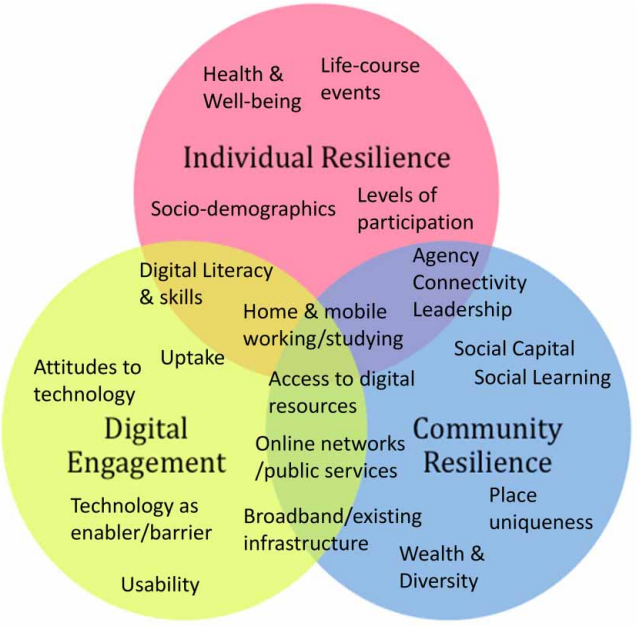

Figure 1 Framework of Digital Engagement and Resilience: interacting spheres

groups, individuals and values, and as a result, different levels of resilience (and vulnerabilities) may be evident at different times and within the context of different issues or challenges facing a given community at any one point in time (Wilson 2012; Franklin *et al.* 2011). Therefore, building resilient communities involves a complex and iterative process of interactions between multiple pathways at a range of scales (Skerratt & Steiner 2013).

Figure 1 illustrates how we have bought the key themes and indicators together across these different literatures to create a framework of Digital Engagement and Resilience. It focuses on the interactions between digital engagement (a focus on users – usability, uptake, technology as barrier/enabler and thus contributor to individual or community capacities), community resilience (interest in baseline factors including social capital, leadership and resources, and individual resilience (including participation in community and socio-demographics), with interrelations identified through, for example, the way that digital technologies alter modes of working, studying, entertainment and communicating, whilst their capacity to do this might be reliant on digital skills and access to digital resources. Digital engagement is also influenced by norms about technology, captured through attitudes to technology and what role technology should play in society (e.g. enabler). Through the next sections of this paper, we outline our attempts to implement and test the framework which met with mixed success.

The DEAR Project and Dot.Rural Case Studies

Using the framework illustrated in Figure 1, the DEAR project undertook cross-cutting research within the RCUK dot.rural Digital Economy Hub at the University of Aberdeen.

The DEAR project team worked with selected projects from the four societal themes (Healthcare; Accessibility and Mobilities; Enterprise and Culture; and Natural Resource Conservation) that framed individual research projects funded by Hub. Many of these projects were developing new digital technologies designed to address specific challenges facing rural communities. The DEAR project was able to work closely with some projects to test the framework, build understanding of resilience in specific contexts and evaluate the scope of the new digital technology being developed by projects to build resilience in 'real-world' contexts. It was not possible to work with all Hub projects (e.g. some were not at a suitable stage in their development to interact closely with DEAR; others were unable to share primary data with the DEAR project because that would have breached ethical approval conditions). Interacting with Hub projects was thus not a straightforward task. Next we outline the methodologic problematics we encountered and how we worked around them.

An important part of the DEAR project was to develop Hub project case studies to test the resilience framework through an iterative process. We first conducted scoping studies of all Hub projects in which information about the design and deployment of digital technologies associated with these projects was collated. Where the ethical approval for individual projects allowed, project data (including qualitative and quantitative data generated from research diaries, web analytics, interviews and surveys) were analysed by the DEAR team. Key themes to emerge of direct relevance to resilience included the importance of the appropriateness (to levels of ability, to contexts of use, to rural Internet speeds) and usability (e.g. the user interface) of the digital technology associated with individual Hub projects, as well as project participants' existing levels of online and offline participation. The digital technologies deployed within Hub projects were viewed as enablers for opportunities within communities of practice and of place, with potential to contribute to local-level resilience. Users' current digital engagement – their literacy, confidence and trust – was an important factor in the role that new technologies could contribute to this participation. A limitation encountered in the scoping research was the fact that generating information about patterns of engagement with digital technologies was not an explicit aim of many Hub projects. The level of detail the scoping research could go into about patterns of digital engagement was thus constrained.

The DEAR project relied on access to data and cooperation from the researchers working across Hub projects which all had different disciplinary focus, timeframes and levels of intended technology deployment. Therefore, we had to adapt our approach – within the over-arching resilience analytical framework – to reflect the needs and realities of assessing resilience across Hub projects. Our original aim was to carry out a systematic survey with stakeholders and users to establish relationships between digital engagement, Hub technology adoption and community resilience. Due to difficulties in accessing users and project partners, we adapted our conceptualisation of resilience (this adapted approach is outlined in Roberts *et al*. forthcoming). The capacity of research projects to carry out successful user engagement and impact activities had implications for our evaluation project. The DEAR project navigated challenges involving: the negotiation of evaluation methodologies and gaining buy-in across different projects with different aims, disciplinary perspectives, ambitions and timeframes; communicating resilience, a complex and multi-component concept with disciplinary baggage, to researchers with different disciplinary agendas; acquiring access to users when projects themselves struggled to acquire and evaluate feedback; accessing primary data and bringing discrete and highly differential secondary data together in a

systematic framework; and treating projects as case studies which required careful collaborative working. A further consideration relates to an issue with cross-cutting research regarding the extent to which individuals and projects feel that they can and should share their data: intellectual property is a sensitive issue to be negotiated in evaluative, cross-cutting research.

Having outlined some of the difficulties we experienced and highlighted some of the initial promising insights from scoping studies, we now move to focus on a case study that worked as a good test for thinking conceptually and from an evaluative perspective about DEAR.

Working with the SIRA project

DEAR was able to build a successful working relationship with one of the projects in the Hub Culture and Enterprise theme due to synergy in aims and theoretical interest and because the project had reached a stage whereby user-driven data could be shared with DEAR at the point in DEAR's evolution when that type of interaction with an empirical project was required. The SIRA project was examining the digital needs of rural creative practitioners with a view to testing and developing an innovative system for enhancing the capacity of satellite Internet provision in rural areas that lack access to adequate fixed telecommunications infrastructure. The DEAR project was particularly interested in understanding the barriers and enablers associated with poor digital connectivity at the level of the community concerned and for individuals within that community, in this case rural creative practitioners. The outcomes of the collaboration resulted in a greater understanding not only of individuals' levels of digital ability, actual use of the Internet and bandwidth needs, but also the very real personal and professional desires for digital capacity and the frustrations of creative practitioners working in rural locales (see Roberts & Townsend 2015b for further evaluation). We were also able to examine the adaptability and resourcefulness of individuals and communities through this work, specifically developing knowledge of the ways in which digital and cultural capitals enhance rural resilience. We found that rural creative practitioners both contribute to economic resilience (through living and spending in the area, hiring local people and cultural tourism) and to other, less tangible, aspects of community life such as offering their skills (artistic, business or general) to their local communities on a voluntary basis, boosting local community capacity, skills and place-value (see Roberts & Townsend 2015a). Looking at resilience from the perspective of one employment sector, the need for a holistic approach to resilience research was stressed through showing not only how broadband speeds impact upon work practices but the knock-on effects on the community. Awareness of different types of power relations present in rural communities was raised: tension was noted between the visions for resilience held by the creative practitioners (who were sometimes incomers) and those held within the community more broadly.

The relations between digital engagement and digital capacities, individual agency and leadership, as well as the changing connectivity and working practices involved in Internet-enabled technology use were evident in this case study. At this stage in the SIRA project, the data being collected were pre-installation of the Hub developed technology. This meant that the focus of the data was on the barriers created by lack of technology rather than the impacts of the Hub technology. The view in the rural areas studied was that such areas deserved the same access and speeds as everyone else. Place uniqueness

and diversity were key themes in this case study of rural creative practice. From this work, and the findings of the wider project, we were able to situate the research in the broader policy landscape and make recommendations for further research and policy formation.

The Policy Landscape: Furthering a Joined-up Approach

The final section of this paper seeks to contextualise rural digital economy resilience research within the context of UK policy agendas. Our work highlighted that there is a normative positioning in digital policy, which assumes under-explored links (e.g. between economic and social resilience, and between digital and social inclusion – UNESCO 2010; European Commission 2010). When the policy documentation was set alongside our community resilience framework, the need for a more integrated, embedded approach was highlighted (see Roberts *et al*. forthcoming).

In the UK, the rural digital divide, whilst lessening in terms of access, is likely to increase in terms of both speed and quality due to the Government's commitment to the roll out of Superfast Broadband Internet (Commission for Rural Communities 2009). The Rural Broadband Community Fund (BDUK) is one way through which local authorities and communities can take responsibility for developing infrastructure to ensure and improve their access to broadband Internet and to prevent increasing digital exclusion. The technical infrastructure in rural areas is, despite ongoing infrastructure upgrades, predicted to continue to lag behind urban areas and, in consequence, many rural areas face an ongoing game of catch-up as technologies develop apace and are diffused more rapidly in urban areas (Warren 2007). Alongside policies for Superfast Broadband (predominantly) is a commitment to Digital by Default provision of UK government services delivery which seeks to encourage a 'virtuous cycle' of digital inclusion by ensuring people to use the Internet for tasks such as council tax claims and booking a driving test online (www.gov.uk). It is argued that people in rural communities have the most to lose by not being digitally connected, especially as it is funding cuts to rural service provision that potentially can have the most dramatic impacts because of the distance to alternatives.

Our framework illustrates that the UK policy focus on provision (of access to superfast broadband) is crucial, but that it is not sufficiently linked to inclusion/participation strategies, which our preliminary scoping of Hub projects as case studies showed was a significant factor in the extent to which individuals found technologies to be 'enabling'. Factors from across the three circles in the resilience framework diagramme (Figure 1) interact. Future policy interventions should be more cognisant of these interactions and associated knock-on effects.

The community resilience framework supports increasing recognition that the social, cultural and institutional barriers to participation influence, and remain after, digital access, and that an approach that views these as interconnected is necessary. An integrated policy approach with resilient communities at its core would ensure communities were given the necessary resources and support to enable them to successfully manage the responsibility passed to them through localism policies (Roberts and Anderson forthcoming). This part of the DEAR work supported findings by others that resilience is a useful way to re-think notions of 'empowerment' and 'participation' that often appear uncritically in policy documents and, less often, in academic work, as somehow 'spontaneous, self-regulating, inclusive and organic' (Skerratt & Steiner 2013, p. 321). The DEAR project work seeks a more critical engagement with these discourses.

DEAR was able to make targeted claims in relation to policy. It evidenced how rural creative practitioners are using digital technology and how they negotiate low broadband Internet connectivity through adaptive strategies. Currently, it is acknowledged in academic and policy literature that rural broadband increases the 'reach' of rural businesses but the everyday reality of digital provision and practice in remote areas, or the extent to which they are using it to extend their reach, is not explored in detail. The actual (sometimes low-tech) uses of digital tools and social media by practitioners in low connectivity areas can better direct future policy seeking to promote rural economies. Limited broadband access is a major barrier to (creative) businesses continued working in remote communities and the 'spillover' that this has, such as other types of participation and capacity building. Through such 'resilience case studies', DEAR has been able to highlight this gap in policy and practice and make recommendations such as the potential for considering creative practitioners as suitable 'digital intermediaries' for building digital skills in rural communities, and even offering training opportunities.

Conclusion

Resilience frameworks have the potential to evaluate the challenges as well as the successes of digital economy research in order to identify 'meta-lessons' for developing digital technologies for increased community resilience. This type of work, which explores the resilience of communities to adopt new technologies and the resilience of project-developed technologies 'in the wild', is an important part of digital economy research. The DEAR project has conducted case studies, which have allowed user feedback from technologies to be understood in the context of rural Broadband access, digital literacy and skills and everyday rural community life. It has provided comprehensive policy contexts to Hub projects and themes. Together, these work packages start to build a picture of impacts for rural communities.

Although we have successfully been able to identify relationships between digital engagement in rural communities and individual and community resilience, we have not had the depth of data or long-term timeframe needed to explore feedback loops and pathways for digitally enabled resilience. Nevertheless, our work has added to the understanding of the relationships between individual digital technology users, community use of digital technology and resilience. We worked with an integrated framework for gaining understanding about rural digital divides, digital inclusion and the capacity of new digital technology as 'resilience resources' and enabling or prohibiting pathways to resilience. More broadly, we have responded to questions about whether there might be such a thing as digital capital, how digital capacity might be built in rural areas and what role digital resources have in processes and pathways for rural resilience?

Note

[1] Superfast broadband is defined by the UK government as broadband connections that allow download speeds of 24 mbps and over to be received. Ofcom and the EU define it as speeds in excess of 30 mbps. Superfast broadband is achieved primarily by laying new fibre optic cable that will reach 95% of the population by 2017 (Department for Culture, Media and Sport UK Government 2010). A large part of the remaining 5% of the UK population live in remote rural areas, where low population densities mean there is limited consumer demand which hinders the economic incentive for large telecommunications companies to 'roll out' the necessary infrastructure. In some cases, geographical barriers make extending the infrastructure impossible.

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