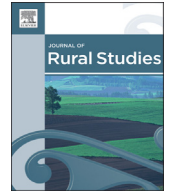


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Broadband for a sustainable digital future of rural communities: A reflexive interactive assessment

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ABSTRACT

Stakeholders face an ongoing challenge of assessing impacts of large-scale interventions, such as rural broadband infrastructure, which involve both social and technological change. In order to determine immediate benefits, intermediate outcomes and long-term societal impacts of broadband Internet, this paper integrates latest approaches to assess social and technological change, which are known respectively as 'reflexive learning' and 'reflexive governance'. This paper contextualises the integrated framework using case studies of broadband access and use among small businesses and community organisations from the first release areas of the heavily invested high-speed broadband network known as EORN (Eastern Ontario Regional Network) in Canada. EORN represents a major public-private partnership for rural telecommunications which began in 2009 and ended its first phase in 2014. Findings revealed location and sector specific benefits of broadband that rural small businesses and community organisations have realised from increased access to (including availability and affordability) as well as reliability of Internet connections. Also evident were early signs of transitions to more resilient and sustainable rural communities. Partly because of a new initiative, research evidence, however, was not sufficiently robust to determine system-level impacts or structural changes, such as closing rural-urban price gaps and reducing the price of rural broadband services.

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1. Introduction

The importance of evidence-based policy and practice where rural broadband infrastructure development and uptake are concerned has been an issue for many nations around the world, including Canada.¹ Whereas there are few demands to justify

return on investment or the impact of large-scale public infrastructure, such as water mains, bridges or roads, the long-term societal impacts of rural broadband infrastructure investments are questioned by policymakers. There are recurrent calls for more needs assessment and outcome analysis for digital development initiatives from a range of stakeholders, not the least of which are agricultural producers, rural residents and businesses themselves (Hambly et al., 2007; Longford et al., 2012). As elsewhere, rural Canada is in a dire need of building a resilient and sustainable system of production, responsible consumption and reliable public services (CRRF, 2015; Caldwell, 2015). This is, in part, due to the pressure upon scarce financial resources within the public sector. And with respect to broadband, the common misconception is that private telecommunication and Internet service providers will find competitive market advantages in the 'last mile' of rural connectivity. In fact, this is not the case, certainly not in relatively less populated rural or remote areas of Canada, the second largest country by area after Russia. In Canada, rural telecommunication services have been achieved through various broadband infrastructure investment models (Cherry, 2012). They include well-documented cases of First Nations owned and operated satellite-

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¹ The term broadband is defined in many different ways. Commonly it refers to high and ultra-high speed telecommunications infrastructure (Czernich et al., 2011). The first generation of broadband, particularly in rural areas of southern Ontario had fixed bandwidth targets of 1.5 Mbps (down only) which were marginally faster than dial-up Internet services. Federally established high-speed targets in Canada are now marginally higher (5 Mbps down/1 Mbps up) and highly contested by advocates of digital development. Ultra-high speed Internet speed targets are at least 100 times faster and the bandwidth (speed and capacity) of the network connection needs to be symmetrical). A definition of broadband needs to address additional criteria that reflects a network with standards based architecture which enables interoperability and makes it easy to support. The broadband network would be highly available and scaleable while offering symmetry and a differentiated system that supports multiple Classes of Service (CoS) and Quality of Service (QoS) for all applications that require it (see for example, the definition outlined by SWIFTnetwork.ca).

based broadband infrastructure (Bell et al., 2012), P3 (public and private partnerships) models, such as the Eastern Ontario Regional Network (EORN), the Alberta SuperNet and the recently funded consortium model of the SouthWestern Integrated Fibre Technology (SWIFT) network, hyper-local municipally owned and operated networks, such as Utilities Kingston's broadband services, and community-based networks, such as O-Net in Olds, Alberta (Longford et al., 2012).

Across the above broadband infrastructure investment models, assessment of immediate outputs, intermediate outcomes and long-term societal impacts has inevitably been discussed. However, many argue that discussions are biased towards causal links between immediate outputs and long-term impacts without necessarily engaging in procedural reflexivity on intermediate outcomes, such as change in behavior and relationships (Earl and Carden, 2002; Smutylo, 2001). Recognising this gap in assessment methods, municipalities are increasingly seeking a standard approach to assessment of rural broadband infrastructure that involves both social and technological change interventions (WOWC, 2014). This paper aims to address this challenge by using a hybrid assessment approach that integrates literature on social change assessment and technological change assessment with a focus on latest developments in respective fields, 'reflexive learning' and 'reflexive governance'. Reflexive learning involves first-order reflexivity through self-confrontation which often creates awareness about circular causality between problems and solutions. This approach of circular causality, for example, would inform that the problem of a digital exclusion cannot be solved from within the regime of market competition that created it. Second-order reflexivity is about breaking the circular causality of the first-order reflexivity through a substantive reflexivity on a higher level of structuration (Bos and Grin, 2008). For example, this would mean if the problems of digital exclusion are to be overcome, the incumbent regime would engage in substantive reflexivity, such as assuring welfare gain from broadband infrastructure investments, fair distribution of welfare, and respect of rights to get connected in the digital world (Trachtenberg and Focht, 2005). To explore these ideas further, the specific objectives of the paper are as follows: first, to examine various approaches to assess social change and technological change, as they pertain to rural broadband, in order to develop a hybrid method which this paper refers to as 'reflexive interactive assessment.' Second, we apply this hybrid assessment method to case studies in which immediate benefits of Internet access and use are identified and considered in relation to procedural reflexivity on medium-term changes towards appropriate stakeholder representation and fair consideration of rural broadband issues, and substantive reflexivity on long-term societal transitions towards low-carbon production and consumption systems.

The next Section reviews the concepts of social change assessment and technological change assessment, respectively culminating with a discussion on reflexive learning and reflexive governance. In Section 3, the focus is on the methodology of our proposed hybrid reflexive interactive approach developed for assessing complex socio-technical interventions where risk and uncertainty are ubiquitous. Next, Section 4 examines broadband development and uptake by small businesses and community organisations in EORN's four first release areas. This is followed by a discussion of the key findings in Section 5: first, why does the hybrid reflexive interactive assessment lead to a better understanding of socio-technical change as compared to conventional assessment methods in particular and social study of science and technology in general and; second, how does broadband Internet impact the success of rural small businesses and community organisations? The final Section concludes the paper with the

identification of key recommendations, including a need for longitudinal data for the proposed reflexive interactive assessment in Eastern Ontario and other rural areas of Canada and around the world.

2. Literature review

Broadband infrastructure investments are both social as well as technological interventions (Middleton and Ellison, 2008; EORN, 2015). To start with, social change assessment involves input–output causal analysis, outcome analysis and impact assessment with two variations: first, program theory-based assessment methods and their various modifications (Davies, 2004; Douthwaite et al., 2003; Springer-Heinze et al., 2003); and second, reflexive 'theory in practice' approaches (Argyris and Schön, 1974; Bolton, 2010; van Mierlo et al., 2010). Similarly, the available literature on technological change assessment involves expert-based impact assessment and multilevel analysis, the latter to generate evidence base for reflexive governance of science (Joss and Bellucci, 2002). Multilevel analysis falls under the gambit of reflexive modernization which argues that it is time to consider the anticipatory principles of new modernity to address the limitations of the incumbent modernisation regime (Beck, 1992; Beck et al., 2003; Stirling, 2006). We now provide a brief review of these two bodies of literature to understand their relevance to assess social and technological change in large-scale regional and rural broadband infrastructure investments.

2.1. Social change assessment

Program theory as it pertains to social change assessment consists of two interrelated components: theory of change and theory of action (Funnell and Rogers, 2011). A theory of change refers to the central mechanism by which change emerges. There can be different theories of change at different stages of interventions, such as theory about obtaining inputs, implementation of activities, immediate benefits, intermediate outcomes and long-term societal impacts. Thus, a theory of action entails an implementation plan that explains activities that will be undertaken. In recent decades, there has been a proliferation of program logic models which are closely associated with the 'theory of action' measurement of tangible outputs and intangible outcomes. Logical framework approach and results-based management are two specific examples of classical program logic models to assess social change interventions (Kusek and Rist, 2004). Essentially, program-logic models measure progress against objectives and report on a set of pre-determined indicators that are known and may be achieved under a set of assumptions. These models entail two types of logic: first, establishing a causal chain of results from translating inputs and resources into immediate outputs, intermediate outcomes and long-term impacts; and second, identifying indicators or metrics that help verify the extent to which the results are achieved.

Critics argue that dependence on predetermined indicators and assumptions hampers the relevance of program logic models to address procedural aspects of participatory program implementation and unanticipated changes in wider social, cultural, economic, environmental or political contexts (Earl and Carden, 2002; Patton, 2011; Smutylo, 2001). For example, specific indicators, such as Internet speed (typically download speeds) are argued to be reductive and ill-advised as a single measure of broadband access and use in Canada (Middleton and Ellison, 2008). Hence, program logic models often encounter 'attribution error' which is defined as attributing results to a particular actor or factor when multiple actors and contingent factors are jointly responsible for a success. In the same example of measuring broadband access in Canada, one

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