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Prioritising indicators of cumulative socio-economic impacts to characterise rapid development of onshore gas resources

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ABSTRACT

Rapid development of coal seam gas (CSG) extraction in Australia has been accompanied by significant socioeconomic impacts. Measures of these impacts, which are needed for planning and policy processes, can be captured in terms of indicators. The utility and practicality of using indicators in this way is explored here. This literature review establishes lessons for selecting a salient, credible and manageable suite of indicators that could be monitored to assess the cumulative social and economic impacts of CSG development in Queensland's Western Downs Regional Council local government area. This analysis suggests the process of establishing indicators is itself an exercise in inclusive dialogue and learning that must be focused on adaptation to the local context. It will benefit from collaboration among multiple stakeholders as well as technocratic input; and from applying an integrative, multi-dimensional framework capable of capturing local and regional scales and both quantitative and qualitative perspectives. Making such an inclusive, iterative, multi-faceted process manageable with limited resources necessitates a process of prioritising.

1. Introduction

In recent years, development of onshore natural gas, in the form of coal seam gas, in Australia has stimulated a wide array of interconnected economic, social and environmental impacts that have attracted unprecedented public attention. As a result, a series of planning and regulatory challenges have emerged. The perceptions of residents in affected localities intersect with the aspirations of gas companies and their contractors and the public-interest concerns of local, state, and federal government. Thus, in a modern, capitalist democracy, governance of resource industry development necessitates understanding and addressing a highly complex set of problems, marked by competing interests and incomplete knowledge of consequences. These challenges are sometimes termed 'wicked problems' (Rittel and Webber, 1973; Head, 2008a). Such wicked problems are difficult for planners, citizens, and others to understand much less arrive at effective and agreed strategies to address the issues.

Attacking such challenges can involve enlisting varied stakeholders in a common pursuit. We have identified such a pursuit – the selection of indicators of cumulative socioeconomic impacts of the rapid resource development that an affected region is experiencing. Insights into selecting sustainability indicators are gleaned from the literature to enable characterising an approach suited to this context. We are aiming for an indicator set that will help to identify possible cumulative, long-term impacts on regional socio-economic conditions and assets. In the indicator selection process, we seek to use an action-learning approach to build working relationships among diverse stakeholders from the community, government, and industry and cultivate common understandings of the complexities in the planning choices that they face.

A better understanding of the full range of resource development impacts has been sought in a recent stream of research (Franks et al., 2012; Barclay et al., 2012; Pattenden et al., 2011; Franks et al., 2008, 2009, 2010a; Brereton and Parmenter, 2007, 2008). Within this field, interest is growing in tools and processes for assessing these impacts (Hilson and Basu, 2003; Azapagic, 2004; Duinker and Greig, 2007; Li et al., 2008). This interest draws upon a substantial effort formulating indicators of sustainable development (*e.g.*, United Nations, 2007; MacDonald et al., 2012; Pintér et al., 2005).

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Despite all of this work, a lack of consensus on approaches and unanswered questions about the development, selection and application of indicators remains (Ramos and Pires, 2013). The range of options means that effective assessment and management of impacts of resource developments are not yet possible with any specific indicator set; the process of selecting and prioritising indicators, rather, represents a situated learning opportunity (Lave and Wenger, 1991). The indicators selected also serve as "a tool for stimulating and focusing discussions on regional and national goals and priorities; monitoring and understanding community trends and outcomes; and for opening broader debates about the meaning and measurement of 'progress'" in a specific situation or context (Cox et al., 2010, p. 73). The situation that we are studying presents significant methodological challenges due to the scale and speed of development by multiple coal seam gas (CSG) companies in the State of Queensland's rural Western Downs region. That is compounded by exogenous influences including a gradual decline in population, frequent drought, and recent amalgamation of local governments.

Our strategy for addressing the wicked problems that result is described in this article. Here, we report on insights from the first stage of a project designed to support a common understanding of cumulative socioeconomic impacts of coal seam gas development. (Other research is examining environmental impacts.) Such understanding is meant to inform subsequent decision making across multiple sectors towards achievement of sustained socioeconomic benefits for the region.

We review here a range of indicator sets with a view to extracting lessons applicable to the development of appropriate and reliable indicators of the socioeconomic impacts of CSG exploration and production in the Western Downs. Our consideration of indicator properties, criteria for their selection and processes of developing them cannot be concluded with a set of indicators that is best in any general sense. Rather, we conclude with notions about steps needed to contextualise sustainability indicators to address cumulative impacts in resource regions. The specific example that we are using is a mainly agricultural region in a first-world democracy that is facing multiple, multi-billion dollar, resource development projects that have been commenced in the short span of a few years, where each project has a dispersed footprint near rural towns.

Others have conducted reviews of indicators (*e.g.*, Ramos and Pires, 2013; Singh et al., 2012), with Parris and Kates (2003, p. 559), for example, concluding that "there are no indicator sets that are universally accepted, backed by compelling theory, rigorous data collection and analysis, and influential in policy." To assist those addressing contested settings, where – as in our case – indicator development has not been invited, we report what can be seen as a 'learning pathway', a way to demonstrate to varied stakeholders the value in selecting common indicators.

Our account here starts with a brief overview of the challenges of measuring cumulative impacts, frameworks for organising indicator sets and the varied purposes that indicator sets may serve. We then identify some of the processes for developing them and delineate criteria for their selection. In these respects, we undertake a 'Goldilocks' assessment ('not too hot, not too cold, just right'), commenting on which processes and criteria best suit our context. For this context, we conclude that identification and monitoring of indicators should not remain just an element in a social impact management plan; essentially an exercise in compliance with a company's operating conditions mandated by government. We suggest that indicator selection should be undertaken as a responsive management strategy, an approach aligned with the 'governance' school of indicator development (Ramos and Pires, 2013). This governance approach is underlined by one realisation from this survey of indicator sets. That is, there are many possible factors that indicators can be tracking, in fact, too many. That means that those who are involved in developing indicators must set priorities about which factors and which impacts are the most important to track according to which values. As a result, the identification of suitable indicators is an exercise in governance in itself.

2. Use of indicators to address cumulative socio-economic impacts

2.1. The complexity of cumulative impacts

For the CSG fields in Queensland, the term 'cumulative impacts' has come to refer to the combined effects of the exploration, extraction, and pipeline projects of the four major CSG companies. A working definition of 'cumulative impacts' offered by Franks, Brereton, and Moran (2010a), Franks, Brereton, Moran, Sarker, and Cohen (2010b, p. 300) is: "the successive, incremental and combined impacts of one, or more, activities on society, the economy and the environment." However, this definition is deceptively simple as key characteristics of cumulative impacts – whether positive, neutral, detrimental, or mixed – complicate the process of aggregating effects of multiple activities and projects. For instance, cumulative impacts can be non-linear; e.g., apparently small, incremental changes in water levels in bores could pass a tipping point and have a disproportionate impact on human health and livelihoods, rendering certain areas of officially designated 'strategic cropping land' uneconomical due to a lack of water.

Cumulative impacts accrue across time and space, and there can be spatial and temporal separation of the source of change and the experience of the impact. Capturing the state of an indicator at a particular time and place provides at best only a partial picture. Indicators with a time dimension and potential application at multiple scales (e.g., local and regional) will be needed as well as ones that reveal trends and point to thresholds.

Time is a factor in the nature and degree of cumulative impact beyond just accumulation of impacts, as timing and scheduling of changes can be significant. For example, there is often a time lag between the arrival of a gas company's drilling crews in a town and the erection of suitable housing, which results in steep rises in local rents and sale prices. Combine that with a lack of capacity to respond rapidly in rural areas – whether because governments are slow to approve land release or applications for building construction, or because of a lack of available labour for the local building industry – and negative impacts on supply and affordability of accommodation can be exacerbated.

The interacting effects on society, the economy, and the environment are often connected in convoluted ways that make it hard to gauge net effects. Additionally, in aggregating these influences, one needs to account for exogenous forces, that is, activities occurring outside the CSG projects. For example, the profitability of export crops is influenced by changes in prices of fuel, fertiliser and other inputs as well as by the weather and the exchange rate for the Australian dollar. However, the latter is affected, in turn, by an influx of international investments to develop liquid natural gas (LNG) exports. Such feedback and interaction processes illustrate the complex interplay that constitutes cumulative impacts and the importance of selecting indicators that represent overall impacts experienced by the receiving social or environmental system rather than discrete changes.

When looking for indicators of cumulative impacts, one also needs to decide whether to focus on indicators of the changes that cause impacts (activity indicators), indicators of the impacts or pressures experienced, or indicators of the changing condition of