Wicked tendencies in policy problems: rethinking the distinction between social and technical problems

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ABSTRACT

Complex or intractable policy problems, often called ‘wicked’ problems, have been a feature of public policy research since the early 1970s. Observers have generally assumed that these wicked problems constitute a distinct category of policy problems, based on the notion that some problems – those characterised as substantially technical or scientific in nature – lend themselves to traditional linear problem-solving methods, whereas other problems that are social in nature tend to be wicked. By examining three cases where scientific knowledge is central to the debate – climate change, genetically modified foods and hydraulic fracturing – we argue that all policy problems can exhibit wicked tendencies, regardless of the amount of scientific information available to decision-makers. Therefore, the reliance on increased information in resolving wicked problems is unlikely to be sufficient or effective.

Introduction

A growing number of observers see a distinction between ordinary policy problems and another class of problems for which conventional strategies or techniques are not applicable. In their foundational 1973 article, Rittel and Webber referred to the latter as ‘wicked’ problems. Wicked problems, which have poorly defined boundaries, no obvious or apparent solution pathways, and are highly prone to cascades of unintended consequences, are often seen as immune to linear, rational or scientific methods of problem-solving (Kreuter, De Rosa, Howze, & Baldwin, 2004; Roberts, 2000; Turnpenny, Lorenzoni, & Jones, 2009).

One proposed method of dealing with wicked problems involves an increase in the knowledge available to decision-makers on a particular policy issue (Weber & Khademian, 2008). This is consistent with the movement for evidence-based policy, in which an increase in the quality and quantity of information used in the formulation and implementation of public policy is supposed to lead to more successful and sustainable social policy outcomes. Furthermore, there is an implicit assumption (or sometimes explicit – see Nelson, 1974 for example) in much of the scholarly work on wicked problems that policy problems
are substantially scientific or technical in nature are less likely to be wicked problems than issues that arise in areas of social policy. As explained further below, one interpretation of evidence-based policy is that it can make social policy problems more technical, and therefore more amenable to rational decision-making (hence, less wicked).

In this paper, we argue that this social/technical distinction in public policy is not as valid and useful as is often assumed. Highly technical scientific issues can exhibit many of the frequently cited properties of wicked problems, as demonstrated in recent examples such as climate change response, genetically modified foods and the use of hydraulic fracturing techniques for natural gas exploration. In these areas, the quality and quantity of information available to decision-makers has not helped to reduce the problem’s ‘wickedness’.

All problems of public policy are also inherently political problems, and therefore all policy problems have the potential, or even the tendency, to have some wicked characteristics. Consequently, instead of forming a distinct category of policy problems, the wickedness concept is better understood in terms of a spectrum. One reason that ‘evidence-based’ policy-making has not been effective in ‘taming’ wicked problems is that it is not possible to operationalise the distinction between social and technical policy problems in a way that is meaningful for policy-making, and so an increased collection and transfer of knowledge is unlikely to be an effective method of addressing wicked problems.

**Wicked problems**

Although the scholarship of wicked policy problems has benefited from a vigorous academic discourse since the 1970s, the concept is still somewhat fluid and a precise definition of what constitutes a wicked problem can be elusive. For the purposes of the following discussion, wicked problems will be understood as policy problems that seem to defy conventional strategies for developing public policy interventions designed to address them. This can be due to issues in defining the problem (Durant & Legge, 2006, p. 310), constantly changing problem constraints (Roberts, 2000, p. 1), or stakeholder disagreements (Kreuter et al., 2004, p. 443; van Bueren, Klijn, & Koppenjan, 2003, p. 194), among other factors.

One thing that most scholars of wicked problems agree on is that wicked problems are fundamentally distinct from other, ‘tame’, problems. Wicked problems are often defined in terms of particular characteristics that set them apart from other kinds of problems (e.g. Devaney & Spratt, 2009; Levin, Cashore, Bernstein, & Auld, 2012) in a tradition that goes back to Rittel and Webber’s (1973) original 10 ‘distinguishing properties’ of wicked problems. Many authors (see e.g. Batie, 2008, p. 1177; Blackman et al., 2006, p. 70; Wexler, 2009, p. 533) contrast wicked problems and tame problems in side-by-side comparisons that suggest that these two concepts might exist in a binary relationship with clearly defined boundaries. According to this point of view, wicked problems and tame problems are distinct constructs, and must not be confused.

Moreover, virtually all observers agree that wicked problems, being distinctive, require different approaches, attitudes and policy instruments from those required for tame problems. There is something special about wickedness, to the extent that the approaches traditionally used by policy-makers to address ordinary policy problems do not apply to wicked problems, nor will they help solve them (Rittel & Webber, 1973). Wicked problems occupy a different terrain in public policy, where conventional wisdom, linear thinking and even
scientific methods may be invalid (Coyne, 2005). According to this interpretation, it is therefore imperative that decision-makers be able to recognise wicked problems when they see them so that the appropriate tools and approaches can be used to address them.

However, there is an alternative interpretation of the relationship between wicked and tame problems. Roberts (2000, pp. 1–2), for example, divides policy problems into three categories, using stakeholder agreement as the metric for wickedness (when stakeholders cannot reach agreement on the definition of the problem or how to solve it, the problem should be considered wicked). Conklin (2006) argues that problems need not be considered all tame or all wicked – instead, they can have ‘degrees’ of wickedness. Farrell and Hooker (2013, pp. 2–3) argue that the binary approach is too simplistic, because problems are composed of multiple internal characteristics, all of which can exist along a scale from tame to wicked. Kreuter et al. (2004, p. 445) see the complexity of the problem, which exists as a spectrum, as the key measurement of the wickedness of a problem. For Head (2008), problems become wicked when complexity, uncertainty and divergence of stakeholder attitudes – criteria that all appear on a sliding scale rather than as either/or descriptors – approach their maximum values.

This sliding scale approach to understanding wickedness has a certain appeal. For one thing, not all of the criteria used to define wickedness are dichotomous. Stakeholders, who numerous authors identify as important actors in situations of wicked problems (Head & Alford, 2015; Hoppe, 2002; Sachs, Rühli, & Meier, 2010), can be aligned or unaligned by degrees, and their absolute numbers can vary. Other authors write about the uncertainty over a problem’s constraints as a key factor in diagnosing a wicked problem (Hunter, 2007; Weber & Khademian, 2008), and problem constraints can fluctuate slowly or rapidly, or at a variety of speeds in between. Challenges in defining the problem to be addressed – perhaps the most crucial defining characteristic of a wicked problem, according to Rittel and Webber’s original analysis – can be related to varying combinations of facts and values. More likely than not, then, wicked problems are the endpoint of a spectrum of policy problem difficulties, rather than the opposite of an imagined category of ordinary or tame problems (Farrell & Hooker, 2013). One might therefore refer to the wicked tendencies of all problems, rather than see wicked problems as a distinct and identifiable subset.

Nonetheless, in practice, cases of problems in public policy are frequently declared to be wicked, implying that wickedness is a state of affairs rather than a spectrum of difficulties. Sam (2009), for instance, argues that the development of sport policies constitute a wicked problem. For Hunter (2007), Australia’s policy towards its Indigenous communities is a wicked problem. Devaney and Spratt claim that protecting children from harm is a wicked problem, and set this issue in direct contrast with their assessment of what a tame problem might look like (2009, p. 639).

The tendency to express wicked problems as the flip side of tame problems stems from the perceived binary division between scientific problems and social problems. Wicked problems have always been seen as existing within the domain of social policy rather than that of science and technology. Williams (2002, p. 104), for example, writes that wicked problems are ‘socially constructed’, and according to some, ‘the social complexity of wicked problems, rather than their technical complexity’ is what makes them difficult to address (Australian Public Service Commission, 2007, p. 4). Rittel and Webber (1973, p. 160) argue that ‘societal problems… are inherently different from the problems that scientists and perhaps some classes of engineers deal with… The problems that scientists and engineers
have usually focused upon are mostly “tame” or “benign” ones, whereas social problems ‘are inherently wicked’. Nelson (1974, p. 376) muses that it ‘may simply be enormously more difficult to design policies to equalize educational achievement or to eliminate prejudices, than to design spacecraft to go to the moon’.

In general, scientific or technical problems are associated with knowledge, whereas social problems are commonly associated with values. The ‘linear’ or ‘rational’ approach to addressing technical problems (Blackman et al., 2006, p. 70; Devaney & Spratt, 2009, p. 638; Kreuter et al., 2004, p. 442) cannot be used on wicked problems, which more appropriately ‘involve trade-offs among competing values’ (Durant & Legge, 2006, p. 310). Tame problems can be addressed by identifying and obtaining missing information, and then applying this missing information ‘algorithmically’ to produce potential solutions (Farrell & Hooker, 2013, p. 8); but information is less effective for wicked problems, where there are numerous diverging viewpoints emanating from actors who come and go over time (Weber & Khademian, 2008, p. 336). According to Wexler (2009, p. 533), the scarcity of available information, and difficulties in interpreting it, are defining characteristics of any given wicked problem. Tame (i.e. technical) problems offer true/false selection, and optimal choices can be made after obtaining the requisite information, whereas wicked (i.e. social) problems depend on good decision-making processes (Rittel & Webber, 1973, pp. 162–163), in which an understanding of competing values is more important than information.

One corollary of associating technical problems with knowledge and wicked problems with values is that if information can be made more central for a particular wicked problem (e.g. by reducing the relative importance of stakeholder values while improving the use of information in the policy arena), then a problem’s wickedness might be diminished. In other words, if it were possible to make a wicked problem more technical, possible ‘solutions’ might be obtainable. Roberts (2000, pp. 5–6) describes the potential impact of fuel cell technology as an instrument for addressing the wicked problem of greenhouse gas emissions arising from automobile exhaust. This challenge, which involves values-based perspectives about the personal use of motor vehicles, might be transformed into a more technological issue involving how to incorporate renewable energy fuel cells and their recharge facilities into the existing transportation infrastructure.

Furthermore, if wickedness is understood as a tendency rather than as a distinct category of problems, it becomes tempting to try to use information-based strategies in a preventative way to moderate trends towards wickedness in various policy arenas. For example, information about recidivism rates among different populations of former prisoners might help address the wicked problem of overflowing prisons (Warren, 2007). More information about student outcomes under various schooling arrangements might help a government reduce the wicked aspects in education policy (Slavin, 2002). Pilot projects testing new therapies for reducing drug dependence might help convert the wicked problem of drug addiction into a more technical problem which can more readily be addressed (Humphreys et al., 2004).

These strategies, which collectively aim to increase the collection of information and its transmission to policy decision-makers, are common approaches within the movement towards ‘evidence-based’ policy-making. Thus, one interpretation of the utility of evidence-based policy is that it might help ‘tame’ wicked policy problems through an increase in the availability of knowledge. However, as will be argued below, the ability of evidence-based policy-making to function in this way, namely, by facilitating the conversion of social issues into technical issues, is dubious at best.
Evidence-based policy-making

Politicians (e.g. O’Malley, 2014), administrators (e.g. European Commission, 2010) and academics (Cartwright, 2009; Head, 2016; Nutley & Webb, 2000; Pawson, 2005) have shown increasing interest in the use of ‘evidence’ to inform decision-making in public policy. The ostensible goal of evidence-based policy is to use verifiable research results to inform public sector decision-making, in order to better enable governments to achieve their public policy objectives.

However, despite the intuitive attractiveness of basing public policy decisions on established evidence, not everyone has been supportive of this idea. Since the mid-1990s, when the UK Labour Government under Tony Blair began to use the phrase ‘what counts is what works’ to describe its motivation for policy decision-making (Davies, Nutley, & Smith, 2000; Legrand, 2012, p. 336; Sanderson, 2003, p. 332), the possibility and desirability of evidence-based policy have been doubted by some (e.g. Adams, 2004) and have been ardently rejected by others (e.g. Parsons, 2002). Critics of evidence-based policy often argue that bodies of evidence are inherently subjective and value-laden, and therefore any decisions that purport to be based on evidence are more likely to be the result of biased conclusions that should not be taken as universally accepted truths (Hammersley, 2005). When biases have been successfully disguised as truths, they can be used to suppress dissenting voices or to maintain a status quo that unfairly disadvantages some at the expense of others (Maddison, 2012; Marston & Watts, 2003). According to this point of view, an appeal to evidence-based policy is therefore an appeal to technocratic decision-making, in which policy is arrived at by means of a hierarchy of technical methodologies rather than through the democratic balancing of societal interests that results from informed debate (Biesta, 2007, p. 5; Monaghan, 2010).

Nonetheless, as mentioned above, the notion that public policy should be informed by research evidence continues to enjoy substantial support among politicians, administrators and academics. It is widely agreed that information about the likely outcomes of specific government interventions should contribute more to policy choices than ideologies, traditions and other unsupported reasoning. Even so, numerous observers acknowledge that the elements used to make policy are not science-based mechanisms, but are made up of political processes that rely on negotiation, bargaining, compromise, competition and other activities that involve the participation of multiple stakeholders and competing interests (Freiberg & Carson, 2010, pp. 155–156; Hertin et al., 2009, p. 1196). A compromise position has emerged from this debate that describes policy-making as inherently political, but still open to the influence of information from outside sources; proponents of this perspective suggest that ‘evidence-informed’ might be a more appropriate term to describe policy-making than ‘evidence-based’ (Davies et al., 2000, p. 353; Head, 2013, 2016; Packwood, 2002, p. 270).

In any case, evidence-based policy-making, at its core, is about the throughput of relevant information (Howlett, 2009, pp. 157–158). Supporters claim that not enough information is passed on to decision-makers, and that policy outcomes could be improved if decision-makers had better access to better information and were more likely to absorb this information (Stoker & Evans, 2016). Critics claim there are natural impediments to the flow and usage of information, namely the processes of political bargaining and the values orientations that are inherent in policy-making, and that such impediments cannot be overcome (e.g. Cairney, 2016). Critics of evidence-based policy also believe that prioritising information...
over practical human judgement would be an inferior method of deciding how to allocate resources in a democratic society (Biesta, 2007). All sides of the debate see the core issues of evidence-based policy-making as being related to the flow of information to the authorities responsible for making decisions relevant to public policy.

With respect to wicked problems, evidence-based policy-making can therefore be interpreted as an attempt to use information to temper the wickedness of policy problems by reducing the dependence of decision-makers on the values held by stakeholders (Kreuter et al., 2004, p. 445; Sanderson, 2006, p. 125). Evidence-based policy for education (Slavin, 2002), criminal justice (Aos, Miller, & Drake, 2007) or public health (Brownson, Chriqui, & Stamatakis, 2009), for instance, all rely on the assumption that access to better knowledge – about the outcomes of specific interventions, or about the process in which policy is made, or about the nature of the problem itself – will lead to greater consensus on how to improve policy outcomes, whether in education, crime reduction or improving nutrition. By reducing the impact of diverging stakeholder values, evidence-based policy seeks to make policy problems appear to be more technical and less social or political (Adams, 2004, p. 40; Bhatta, 2002, pp. 98–99; Sanderson, 2002, p. 6).

The presumption that social problems can be made technical through more effective communication of information is a major shortcoming in the rhetoric associated with the evidence-based policy movement. As numerous authors have noted (Head, 2013, Pawson, 2002; Sanderson, 2002), political dynamics are a fundamental part of the democratic policy-making process and cannot be neutralised by a dose of evidence, no matter how relevant or powerful. Traditionally, theories of policy change rely on political forces rather than on rationalist mechanisms to explain how changes come about (e.g. Baumgartner & Jones, 1991; Cohen, March, & Olsen, 1972; Lindblom, 1959; Nutley & Webb, 2000, pp. 25–29). And as Lowi (1972) and Pierson (1993) have demonstrated, the link between policy and politics is reciprocal and inextricable.

This is not to say that evidence cannot be used to inform policy decision-making or that it should not be used in that way, as some have argued (e.g. Biesta, 2007; Neylan, 2008). Rather, if information is to contribute to the formulation and implementation of public policy, the users of that information must acknowledge the limits of the rationalist enterprise. Evidence can be used to illuminate policy choices that are then weighed and debated by relevant stakeholders and policy-makers (Sanderson, 2002, pp. 4–5), but in a democracy, evidence cannot make those policy choices on the deliberators’ behalf (Head, 2010, p. 80).

By extension, then, it is not possible to convert wicked social problems into tame technical problems, because there are no purely tame or technical policy problems. All policy problems are ultimately political problems, no matter how important the technical knowledge components may be; and therefore there is no significant distinction between ‘social’ and ‘technical’ for purposes of public policy. Therefore, a focus on data collection and knowledge translation (e.g. Stoker & Evans, 2016) is unlikely to be an effective method of addressing wicked problems.

The following sections outline three examples of supposedly technical or scientific problems that have resulted in policy decisions that are largely fuelled by political dynamics and value orientations rather than by research evidence. All three examples also illustrate how the collection and transmission of information cannot, by itself, readily reduce or pre-empt a policy problem’s wicked dimensions.
Climate change

Climate change is an increasingly important subject of interest within the scientific community. Bibliometric studies, for instance, have shown a large growth in the number of scientific publications on topics related to anthropogenic climate change throughout the 1990s and 2000s, as well as an increasing prominence relative to other related environmental areas (Janssen, Schoon, Ke, & Börner, 2006; Wang, Pan, Ke, Wang, & Wei, 2014). This exponential increase in scholarship (and in general political interest) in this area has resulted in a public policy arena that has been virtually inundated with information about climate change and policy responses.

Furthermore, scholars of climate change science have nearly reached a consensus on the facts concerning the trends and causes of the climate change problem, which means that the broad technical parameters of the problem are generally accepted. The scientific community is essentially united on the bigger picture items: climate change is happening, it is happening more rapidly than it has in the past, and the activities of humans, especially with regard to the release of greenhouse gases into the atmosphere, have created this problem (Cook et al., 2013; Doran & Zimmerman, 2009; IPCC, 2015; Oreskes, 2004). Dissenting scientific opinions continue to be voiced (e.g. Spencer, 2012), including from some high profile scientists like the physicist Freeman Dyson (Biello, 2009), but these voices are vastly overshadowed by the scientific majority. According to a quantitative analysis of the professional credentials of academics writing on the subject of climate change, the expertise and prominence of consensus-supporting climate researchers ‘vastly overshadows that of the climate change skeptics and contrarians’, thereby enhancing the credibility of the consensus point of view (Anderegg, Prall, Harold, & Schneider, 2010).

Despite this near-agreement among climate experts and most other scientists, the information on the subject of climate change produced by the scientific community has had only modest influence on policy decision-making, both at national and international levels. The first round of international collaboration on climate change mitigation, the Kyoto Protocol, has largely been seen as weak and incomplete (Kutney, 2014; Prins & Rayner, 2007; Rosen, 2015), as have later attempts to produce a superior arrangement (Banerjee, 2012). Smaller scale agreements, such as the Western Climate Initiative organised by a group of Canadian provinces and US states, have been confronted by significant challenges (Klinsky, 2013). Around the world, national governments have had very little success combating global climate change, either individually or internationally: regardless of the prominence of the issue, global temperatures, atmospheric carbon dioxide concentrations and sea levels have continued to rise, while polar sea ice continues to decline at accelerating rates (VijayaVenkataRamana, Iniyan, & Goic, 2012, pp. 880–881).

Despite an abundance of technical and scientific information, policy problems in the area of climate change continue to exhibit strong wicked tendencies. While the technical problem – that the earth's annual average temperature is rising so rapidly that ecosystems cannot naturally adjust to the change – may be agreed upon by scientific experts and some national governments, the central policy problem remains poorly defined. Instead, a number of related policy issues have been identified, such as the detrimental effects of climate change on agricultural industries (Nelson et al., 2009), the impact of climate change on the general economy (Mendelsohn & Neumann, 1999), and the effect of climate change on island nation populations (Barnett & Campbell, 2010).
These climate-related policy problems all display wicked tendencies. Climate change has become such an urgent and high-stakes policy issue that trial and error is not politically possible, and the externalities resulting from policy decisions are far-reaching and cascading. The boundaries of the problem are especially unclear, as many observers struggle over whether to place responsibility for action on climate change at the local, national or international level (Huitema et al., 2016). In this case, abundant and rigorous generation of knowledge has failed to turn the wicked social problem of climate change into a technical problem to be resolved through science (Tangney, 2016).

Genetically modified foods

Scientific interest in genetically modified (GM) foods expanded rapidly after GM technologies emerged in the early 1970s (McHughen & Smyth, 2008, p. 3). With the uptake of GM crops in many countries, a vast industry has appeared, accounting for 134 million hectares of farmland globally by 2009 (Prati, Pietrantoni, & Zani, 2012, p. 163). In 2011, 16 million farms around the world planted genetically modified crops (Jacobsen, Sørensen, Pedersen, & Weiner, 2013, p. 652). In recent years in the US, 90% of soybeans and 65% of cotton, by acre, were genetically modified (Kuzma, Najmaie, & Larson, 2009, p. 547). In Western Canada, where most of Canada’s canola is grown, 95% of canola crops were of GM varieties by 2007 (Knispel & McLachlan, 2010, p. 13).

As with climate change, policy problems in the area of genetically modified foods exhibit a high degree of wickedness. In particular, the ‘problem’ has never been adequately defined. Is policy meant to focus on the potential for human health hazards from genetic modification of food? Or on consequences for the environment, or for agricultural industries? Or is GM food really a trade issue? As with many wicked problems, solutions and problems in this area are often conflated, and the bulk of the policy debate centres around the issue of labelling food that contains genetically modified ingredients, without much articulation of why this information might be useful to the public.

Despite much scientific and technical information being generated and circulated to policy-makers internationally, interpretations of the evidence have been varied and policy on genetically modified foods has differed across national boundaries. In the US, genetic modification is abundant, but labelling of genetic modification of consumer food products is not enforced (Dannenberg, Scatasta, & Sturm, 2011). However, in the European Union, stricter regulation is in place and a regime of labelling has been applied (Zhuang & Yu, 2013). These differences have arisen even though governments in the US and Europe have had access to the same scientific information for purposes of policy creation.

Furthermore, policy decisions related to genetically modified foods have often run counter to what scientific evidence has recommended. In the US, regulators have ignored claims from environmental experts that some genetic modifications could have adverse effects on the agricultural industry and other aspects of the environment. For instance, crops that have been modified to produce naturally occurring pesticides may be breeding pesticide-resistant insects, and this practice has often been left unchecked (Bratspies, 2002). Conversely, in the European Union, imports of genetically modified foods were effectively restricted in the years 1999–2010 (Viju, Yeung, & Kerr, 2012), contrary to the advice of European scientists who concluded that these products posed no serious health risks to consumers (Marchant, Sylvester, & Abbott, 2009, p. 725). This indicates an absence of the kind of linear or rational–logical problem-solving that is supposedly characteristic of ‘tame’ technical
policy problems. Again, access to an abundant supply of information has not succeeded in reducing the wickedness of the problem.

**Hydraulic fracturing**

Hydraulic fracturing is a technique used in the oil and natural gas industries to extract these commodities from deposits such as shale, in which the gas or oil is trapped in small pockets rather than existing as a large reservoir. Liquid, usually water with chemical additives and sand, is forced down into the deposit at high pressure, causing the shale to crack and release the gas or oil, which is then pumped to the surface.

From an engineering perspective, hydraulic fracturing can represent a highly cost-effective solution to the long-standing problem of how to retrieve oil and gas from deposits that are deep and scattered. In the US, for example, the technique has enabled the industry to expand its estimates of total recoverable natural gas by 35% between 2006 and 2009 (Gregory, Vidic, & Dzombak, 2011, p. 181). In Canada, hydraulic fracturing is estimated to increase the potential of natural gas extraction by at least 33% (National Energy Board, 2009, p. 22). In an era of high demand for energy, the gas industry is keen to expand and has strong political support.

However, hydraulic fracturing is not merely a technical solution to an engineering problem. It has also become a highly divisive political issue. A prominent groundswell of opposition has developed, based on a range of perceived risk factors (Boudet et al., 2014; Davis, 2012). Opponents of hydraulic fracturing, which many refer to as ‘fracking’, have contended that the technique may cause earthquakes (Warner & Shapiro, 2013, p. 8), may result in the injection of unsafe quantities of methane gas into drinking water (Osborn, Vengosh, Warner, & Jackson, 2011) and may allow harmful substances to be released into the environment, which causes health problems in humans and animals (McDermott-Levy, Kaktins, & Sattler, 2013).

The debate has had major political ramifications, with the economic arguments for industry expansion being countered by various proponents of the precautionary principle. The Canadian province of Quebec, one of only two provinces that does not produce any oil or gas (the other being the tiny Prince Edward Island), has placed a pre-emptive moratorium on shale gas exploration (Chong & Simikian, 2014, pp. 4–5), despite the decline in the mineral extraction industry in that province and the consequential reduction in revenues to the government caused by this slump (Cousineau, 2013). The debate over whether or not to develop Quebec’s shale deposits has been highly public (and highly political), with the popular former premier Lucien Bouchard having been enlisted as the spokesperson for the natural gas industry. Similarly, moratoriums on further development of the ‘fracking’ industry in agricultural regions have been imposed by some of the state governments in Australia (Horne, 2015; Tan, George, & Comino, 2015). In this policy example, as in the cases of climate change and genetically modified food, the availability of technical, science-based information has failed to reduce the wickedness of the policy problem at hand.

**Discussion and conclusion**

The three policy examples discussed above are ostensibly anchored in scientific or engineering problems, but they have all been subject to political dynamics associated with wicked problems. For example, in each of the cases, actions are followed by unintended
consequences, such as trade disputes between the US and Europe over genetically modified food, and the financial distress to both economies that these disputes may have caused. In addition, in each of the three cases, impasses in implementation have occurred, such as the moratorium on natural gas exploration in parts of Canada and Australia. None of these outcomes are characteristic of tame, technical or essentially scientific problems.

In each of the three cases examined here, the scientific nature of the issue and the abundance of technical information that is readily available to policy decision-makers have not reduced the tendency of these policy problems to be wicked problems, nor have they made policy decision-making in this area more rational or linear. For example, policy decisions affecting climate change are still highly motivated by political and industry considerations. In the United States, for instance, conservative opponents of climate change mitigation activity have succeeded in popularising the view that anthropogenic climate change is an unconfirmed hypothesis or is under debate, and this has undermined support for climate action (Boykoff, 2007, p. 486; Bryner, 2008; McCright & Dunlap, 2003). In Australia, partisan disputes led to the failure of the Carbon Pollution Reduction Scheme (Crowley, 2012).

In the area of genetically modified food, although there is an abundance of scientific research output available to policy-makers, public policy is ultimately determined by contending political dynamics rather than by rigorous research activity. While an analysis of the differences between American and European styles of policy-making is beyond the scope of this discussion, these national differences have been found by some to be the determining factors in the divergent regulatory regimes associated with genetically modified food in the US and Europe (e.g. Durant & Legge, 2006).

Similarly, despite a highly technical basis, with the potential for easy and timely scientific answers to technical questions, the issue of hydraulic fracturing also exhibits many characteristics of a wicked policy problem. By boosting the yields of fossil fuel extraction, there is considerable potential for this process to improve economic gains for companies and for the governments that collect taxes and royalties from these companies. If there are public health or environmental hazards attributable to the hydraulic fracturing process, it should be possible to determine scientifically the extent of these hazards. However, policy in this area often proceeds more like what would be expected of a wicked social problem than a ‘tame’ technical problem, as values are more influential than facts, and problem boundaries and definitions are not properly articulated.

The limitations of the evidence-based policy movement are now well understood. Parkhurst (2016), Pawson (2005) and others have noted that appeals to evidence-based policy-making are doomed unless they are used in conjunction with a deeper understanding of political dynamics and embedded biases. The additional point we make is that the notion that there is a precise distinction between technical and social problems for the purposes of making public policy is a myth. Policy problems with a scientific basis, such as the three cases discussed above, cannot be reduced to tame, technical puzzles through the generation of new data, no matter how accurate, abundant or well-supported that information may be. Ultimately, there is no sharp divide between wicked and tame problems; all policy problems have wicked tendencies.

Evidence-based analysis, therefore, cannot in itself be a cure for wicked problems, and evidence in general should not be touted as the way to resolve the wicked aspects of policy problems. As the case studies examined above demonstrate, increasing or improving the generation of information or the collection of data and its transmission to policy-makers...
is not an effective way to deal with the wicked aspects of a policy issue. If all policy problems exhibit wicked tendencies, then the emphasis should be placed on untangling the political dynamics and values-based discourse in that particular policy area if progress is to be achieved. Research on its own will not suffice; it will have to be used more effectively by policy-makers as well, and some form of institutional change is likely required to allow this to happen (Parkhurst, 2017).

In addition, the instrumental use of evidence is not the only method through which information can have an effect on public policy. Carol Weiss’ classic essay (1979) on research utilisation outlines what she calls the ‘knowledge-driven’ and ‘problem-solving’ models of research use – both of which are instrumental uses of evidence (Head, 2010, p. 86). However, Weiss also describes an ‘enlightenment’ model, in which new knowledge slowly gains ground by altering public attitudes and political culture, as it filters through the many individuals and connections involved in the political process of decision-making. This is obviously a less immediate – and less glamorous – way for evidence to be included in the policy process, but it may be the strongest means in the long run for the impacts of evidence-based policy analysis.

In summary, regardless of how evidence is used to influence policy decision-making, a focus on data collection and knowledge translation alone cannot be an effective method for taming wicked problems. Because wickedness is not a separate and distinct category of policy problems, but rather an inherent tendency in all policy problems, the policy problems faced by decision-makers are social in nature and therefore possess wicked tendencies. Attempts to improve the quality of policy debate through better use of best available evidence remain important, but strategies to tame the wickedness of a policy problem that rely solely on collection and transmission of information – without due emphasis on institutional change and long-term enlightenment activities – are likely to fail. This may be why, despite the widespread interest in evidence-based policy, there has been little actual change in the role that evidence plays in policy decision-making (Banks, 2009, p. 23).

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No potential conflict of interest was reported by the authors.

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