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The role of scientific knowledge in the public's perceptions of energy technology risks

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HIGHLIGHTS

- We examine influence of assessed and perceived knowledge on public risk perceptions.
- We model effect of knowledge type on publics' perceptions of three energy risks.
- All models show those with higher assessed knowledge see risks more like experts do.
- Perceived knowledge is less reliable predictor of public rating risk like experts.
- Greater scientific grasp of issues by public needed for accurate risk assessment.

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ABSTRACT

It is important for policy makers to have an accurate understanding of public attitudes toward pressing issues to help inform their decision making. Researchers consistently find that the public's receipt of and correct processing of scientific information and knowledge are essential for its problem solving. Different levels of understanding of specific energy technologies may produce different risk assessments across technologies within this issue domain. How this differential risk assessment occurs and the role that scientific information may play in it is not yet well known. This project seeks to determine the role that perceived and objective scientific knowledge may play in the public's risk assessments of different energy technologies. Our findings suggest that scientific knowledge does temper public risk evaluations of different energy technologies, therefore linking more clearly the connection between science knowledge, scientific trust, and issue problem identification.

1. Introduction

Information is a critical component of the problem solving process (Delli Carpini and Keeter, 1996; Hmelo-Silver, 2004). This is particularly true when the problem is complex. As society becomes more technologically complex, this complexity is reflected in the problems and issues facing government officials. Consequently, expert-based information can be instrumental to policy making (Amara et al., 2004; Grundmann and Stehr, 2012). It is also clear that political factors play an important role in the policy making process, and public perceptions have the ability to encourage and/or discourage political action. However, despite the public's role in this process, it is not always clear how the public develops these views.

Given the relationship between information and problem solving, the Knowledge Deficit Model (KDM) emphasizes that scientists and experts understand specific issues better than the public and this allows them to better evaluate the risk associated with a situation (Hansen et al., 2003; Kellstedt et al., 2008; Stoutenborough and Vedlitz, 2014). This is ultimately why expert testimony is often sought during problem solving processes. KDM argues that the public does not have the same knowledge or information that is available to experts, and this decreases the likelihood that they will view the issue in the same manner as the experts. According to KDM, the solution to this is to shrink the knowledge gap between the public and experts, which should result in greater attitudinal and policy congruence.

Unfortunately, previous examinations of KDM have found that even with some amount of applicable knowledge, the public

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frequently differs in its assessment of risk. These differences often result in either the overestimation (Hansen et al., 2003) or underestimation (Kellstedt et al., 2008) of risk. This has caused many to question whether knowledge is a useful predictor of these attitudes (Bulkeley, 2000).

A recent examination of KDM calls into question the very meaning of knowledge. Stoutenborough and Vedlitz (2014) argue that alternative constructions of knowledge may exist when an issue is complex and that previous examinations of KDM may have measured the incorrect construction of that knowledge. In short, they argue that there is a difference between a scientific construction of knowledge and the construction commonly held within the public. Their examination found evidence that there are distinct and different constructions of knowledge and that these constructions result in different perceptions of risk.

The implications of this on the policy process could be large, particularly if the issue is one where political actors feel public support is necessary. If scientific knowledge is the gold standard for problem solving and the public lacks sufficient scientific knowledge to view an issue in a manner congruent with scientists, then it is critical that we understand how the public processes and uses scientific knowledge in its risk calculations. Moreover, risk perceptions directly influence an individual's support for specific policy proposals (Stoutenborough, 2015a; 2015b; Stoutenborough et al., 2013; Stoutenborough et al., 2014) and aggregate policy positions (Lubell et al., 2006; Lubell et al., 2007; Stoutenborough et al., 2014). Has the world become so complex that even those who want to understand these issues simply cannot do so? If Stoutenborough and Vedlitz (2014) are correct, can we measure scientific knowledge in a manner that yields results consistent with what KDM expects?

2. The role of knowledge

The importance of knowledge and information within the problem solving process cannot be understated. Simon ([1947] 1965) pioneered the assumption of bounded rationality, which recognizes that individuals do not operate with perfect information. This is particularly true when there are uncertainties and complexities associated with an issue (Ostrom, E., 2007). An individual is only able to process a limited amount of information at any given time, and while theoretically unlimited in size, long-term memory takes longer to store than short-term memory. Factor in the costs of obtaining information, and this creates a situation that encourages problem solving with, at best, incomplete, or at worst, incorrect, information.

Incomplete information improves the chances of an individual making a mistake during problem solving because one may choose improper strategies (Ostrom, V., 2007). For an individual to develop hypotheses to solve a problem, one must understand the problem (Hmelo-Silver, 2004). From a policymaking perspective, imperfect information increases the likelihood of adopting policies that will not properly address the problem and may be associated with negative externalities. Indeed, several important theories of the policy process emphasize the importance of information (Ostrom, E., 2007; Baumgartner and Jones, 1993; Sabatier and Weible, 2007).

Knowledge influences the policy making process in other ways as well. Delli Carpini and Keeter (1996) argue that the quality of the public debate and the resultant reforms are often dictated by the public's understanding of the issue. The public's lack of understanding of many issues negatively affects the ability of the government to represent the will of the people (Iyengar, 1987; Lowi, 1979; Schumpeter, 1942). Yet, evidence suggests that decision makers will still side with the public over scientists and experts, even when it is probable the public does not understand the issue (Stoutenborough and Vedlitz, 2012).

Some issues, though, are so important that sound policy making is essential for the continued survival and/or prosperity of humans. When this is the case, an accurate understanding of the issue is essential (Churchland and Sejnowski, 1992). While one can debate the necessity of energy for the survival of the human race, there can be no debating its necessity for continued prosperity.

How can we adequately solve our problems if scientific understanding of certain issues is required for an individual to resolve that problem properly, yet the public is largely ignorant on many complex issues, and policymakers require some semblance of public support to pursue certain policies? It has been argued that the public's lack of understanding on many issues largely explains the differences between experts and the general public (Hansen et al., 2003; Kellstedt et al., 2008; Stoutenborough and Vedlitz, 2014; Bord et al., 2000). Experts are expected to understand an issue better than the public, which is why their council is often requested during policymaking and rulemaking processes. KDM assumes that if the knowledge gap between the experts and the public is reduced, the public is more likely to view issues in the same manner as the experts.

However, because many studies have failed to find support for the assumptions of KDM, many researchers have charged KDM as being too simplistic and failing to capture the dynamics between public perceptions and those held by experts (Bulkeley, 2000). Some argue that factors other than knowledge, such as values, social processes, and institutional factors, provide a better explanation for public perceptions on policy issues (Burgess et al., 1998; Wynne, 2006, 1996, 1992, 1991).

Nevertheless, few would debate that certain issues require some level of expertise to solve. Many psychological studies of risk perceptions presume that the influence of knowledge-related concepts like probability, magnitude of harm, uncertainty, and catastrophic potential are stronger causal factors than alternative explanations (Fischhoff et al., 1978; Mumpower et al., 2013; Slovic, 2000). While not always referred to in these terms, indicators of these concepts are commonly found to be predictors of risk (Earle et al., 2007; Morgan et al., 2002; Tversky and Kahneman, 1992). To evaluate risk properly, one must have an understanding of the issue. For example, an individual's values or institutional factors are unlikely to influence views about the risk of burning oneself by touching a hot stove, but one's knowledge and experience should.

One of the issues that requires some level of expertise to solve is climate change. When analyzing KDM using several knowledge constructions of global climate change, Stoutenborough and Vedlitz (2014) found that the public likely relies upon alternative constructions of knowledge. They argue that previous examinations of KDM may suffer from measurement error, which resulted in measuring the wrong construction of knowledge. If scientific knowledge is the standard we should strive to achieve, as KDM suggests, then measurements of any other construction of knowledge could result in an inaccurate test of KDM. This may explain the inconsistent results found in previous examinations.

Similar to climate change knowledge, there is reason to suspect that the public may be relying upon alternative constructions of knowledge about energy issues. The public obtains most of its information about energy issues from the media. Therefore, the public's understanding of energy issues is probably similarly superficial because media coverage does not always facilitate the development of sound basic knowledge (Gomez-Granell and Cervera-March 1993). Part of the problem is that journalists are taught that more complex issues need to be presented at a sixth to ninth grade reading level (Covello and Sandman, 2001), which can oversimplify the information. Indeed, some scientists acknowledge that to attract media coverage, it may be necessary to "offer