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Pathways From Research Into Public Decision Making: Intermediaries as the Third Community

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Abstract

Scholars and practitioners in public administration have often been referred to as the two communities, reflecting their differing incentives, constraints, and foci. In this paper, we examine the knowledge surrounding the use of empirical evidence in public decision making from both the academic and practice of policymaking literatures. After identifying points of convergence, we compare the important factors identified in each literature to four known cases of impact of empirical findings. We discuss how well each set of literature explains our cases and identify an important third community underidentified in the current conceptualizations of evidence translation—knowledge intermediaries.

> By their natures, those who study the science of what is probable will come into conflict with those who practise the art of what is possible.
>
> *Nature*, 3 November 2016

An enduring question in public management and governance is how do we enable our public institutions to more effectively leverage the corpus of knowledge to make public organizations more effective, efficient, and/or equitable? On the one hand, scholars toil away doing research that can inform policy producing volumes of findings each year. On the other hand, those in practice draw on various types of knowledge in making laws, regulations, rules, and policies. The overlap between these two knowledge bases is unclear, as is the responsiveness of one to the other. Further, the conduits for the transfer of knowledge between each group seem to be limited, rather than robust and reliable.

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In the public management literature, this tension has classically been framed as the "two communities" (Isett, Head, and VanLandingham 2016; Newman, Cherney, and Head 2016). The two communities framing describes policy scholars and policymakers as two distinct groups with incompatible timelines where policymakers need relevant information quickly, whereas researchers need longer time horizons to conduct research with rigor. The groups also have incompatible incentives where policymakers are motivated to make policy that will reflect well on them, and scholars are motivated to publish in high prestige journals and answer questions of scholarly, rather than practical, interest. Finally, and perhaps most fundamentally orthogonal, interests diverge with policymakers who want to solve problems for their contexts and jurisdiction, and with scholars who shy away from particularities and seek generalizable answers to questions that by definition transcend any one jurisdiction.

These differences between the two communities have been suggested to be paradigmatic and insurmountable. However, recent work has suggested otherwise (e.g., Head 2016; Newman, Cherney, and Head 2016). That, in fact, these communities want to be connected in meaningful ways. Explicit efforts to bridge the evidence creation and evidence use gaps have been

undertaken by a number of leading organizations in the United States such as the MacArthur, Pew, WT Grant, and Arnold Foundations, as well as the Centers for Disease Control and Prevention (Barbero et al. 2017; Crowley and Scott 2017; Tseng 2012; VanLandingham and Silloway 2016). Each of these initiatives has made concerted efforts to translate evidence for use in policymaking systems as well as to train policymakers to increase demand for such evidence.

Acknowledging the importance of practitioners and academics to each other's enterprises, and the motivations on both sides to engage, we examine the knowledge in these two communities with regard to empirical evidence uptake to determine the strengths of each, synthesize commensurate and complementary parts, and then provide insights into where the unified theories need improvement. We do this in three steps. First, we briefly highlight work on attention in policy cycles and public decision making. Next, we feature work from the practice of policymaking literature, which is particularly well developed in health/public health (Cairney, Oliver, and Wellstead 2016; National Academies of Sciences, Engineering, and Medicine 2017). We then explore the implications of these existing frameworks in relation to four case studies from a specific area of policymaking, national research funding policy. We contribute to the literature on evidence in public decision making through an explicit juxtaposition of existing frameworks on evidence use in policymaking with case histories—something that has rarely been done in the literature but has been called for (see Dobbins et al. 2009; Hanney et al. 2003; Innvaer et al. 2002; Lavis et al. 2004; Murthy et al. 2012; Oliver et al. 2014). We present a grounded approach to evidence use in policymaking, emphasizing a critical, but often overlooked area of inquiry—that of the role of intermediaries as an important connector in the evidence translation ecosystem.

POLICY AND PRACTICE THEORIES

The canonical policy literature is vast. Thus, this review is purposefully brief to provide only a broad sketch. We are strategically brief with regard to the academic literature assuming readers are fairly familiar with the frameworks presented here. We go into somewhat more depth with the practice literature, assuming that readers have less familiarity with these materials. At the end of this section, we look at the overlap between the literatures.

We bound our focus in two important ways. First, we limit the discussion to process. We are curious to know what dynamics and inputs shape the use of evidence. Thus, we do not look at the literature that focuses on the outcomes of policymaking—which is both early in its development and is quite limited in its scope. Second, we focus mostly on how professionals in agencies make decisions using evidence, not the legislative domain. While related, these are quite different processes and it is not feasible to focus on both in one paper.

The Academic Community

Two main areas of the policy science literature are germane to our discussion: agenda setting and decision making. While other areas of the social science literature speak to the issues relevant here, like diffusion of innovation (c.f. Rogers 2003) and policy entrepreneurs (c.f. Mintrom 2000), these literatures inform our work, rather being central to it. Thus, we limit our attention to these two theories.

Agenda Setting

Literature in both business and political science agrees that policy does not get made if decision makers are not aware of the problem and are not motivated to do something about it (Cobb, Ross, and Ross 1976; Downs 1972; Dutton 1997; Dutton et al. 1997). Thus, issues need to rise to the attention of public decision makers and there must be sufficient motivation—either through magnitude of the problem or public pressures—to address it. Downs' (1972) and Hilgartner and Bosk's (1988) classic articles illustrate that all issues have a natural rhythm of interest, while other classic work finds that related, but smaller issues can be bundled together so that their chances of being heard are greater (Sabatier and Jenkins-Smith 1993). Issues can rise to the attention of public decision makers through either incrementalism or a focusing event (Baumgartner and Jones 1993).

Public outcry and political pressure can push items onto the public agenda. And these constituent pressures can be particularly heavy at more local levels of policymaking (Trautman 2016). Though, in more technical areas of policymaking public campaigns or social movements are typically, but not always absent. This lack of public outcry does not, however, mean that coalitions around these kinds of policies do not exist. Rather, the coalitions are substantively focused and are comprised of technical experts (Sabatier and Jenkins-Smith 1993) such as technical agencies, the R&D community from the private sector, and research-oriented universities. These groups can come together to create pressure for change in policy concerning technical and substantive areas.

Decision Making

Once issues are on the agenda, public decision makers need to act upon them. The extent to which these decisions are based upon empirical evidence is variable.

While technical problems are often solved through technical expertise within policy solutions, very few policy problems are purely technical. Thus, public decision makers base their decisions on a variety of factors.

Public decision makers face both internal and external pressures when making decisions (Heikkila and Isett 2004). Internally, decision makers must conform to the norms and standards within government and their jurisdictions, specifically. This can include the acceptability of the problem definition, its solutions, current operating realities, as well as the political dynamics of the organization and the decision-making context (Allison 1969; Cyert and March 1963). Exogenous pressures can come from the rules about how government and agencies can operate. This can include authority and jurisdictional issues. In addition to these institutional factors, constituent voice is important in public decisions and plays a nontrivial role in whether and how public problems are solved (Isett, Head, and VanLandingham 2016; Trautman 2016).

The Practice Community

Public decision makers must make the best available decisions for their problems. This "best available" is a nod to Simon's (1997) idea of satisficing where decision makers have to balance pressures, engage in search processes to find relevant information, identify feasible solutions, even if partial, and determine credibility (Cyert and March 1963). The key is that if credible evidence exists but is not findable or understandable, then it is not in contention to be used (Dodson, Geary, and Brownson 2015; Huber 2016; Pierson and Schaefer Riley 2013).

In this section, we examine frameworks that speak directly to the phenomenon of how to get evidence used in policymaking—specifically from the agency head perspective. We leverage one specific literature here that is extremely well developed—policymaking in public health (National Academies of Sciences, Engineering, and Medicine 2017). We selected the health policymaking literature because of the depth and breadth of materials published within this domain. It has been noted as the best developed literature from a grounded perspective by the National Academies. The articles selected for this section were either written by policymakers reflecting on their operational perspectives on their daily work, or researchers explicitly capturing the experience of policymakers in grounded explorations. Given that the constraints of operating within agencies are likely similar regardless of substantive domain, there is no reason to believe that the processes discussed here are fundamentally different in other government domains.

To identify articles for inclusion we used the Cochrane approach for systematic reviews. We used a snowball approach beginning with two influential articles in the field (Greenhalgh et al. 2004 and Jewell and Bero 2008), and identified 32 articles with forward and backward citation mapping using both PubMed and Google Scholar through December 2017. Articles were screened for a focus specifically on evidence translation in public decision making. We then read each article looking for convergence and created a synthesis that presents the most common elements across each of the 32 articles. From this review, three groupings of factors relevant to use of evidence in policymaking qualitatively emerged: relevance, content and credibility, and access/comprehension.

Relevance

The main concern of policymakers is not whether or not evidence exists—although that is an important concern, but the extent to which the evidence can speak directly to the policy problem at hand. While couched in many different ways, this is the topic that most clearly emerged in the practice of policymaking literature.

"Location, location, location" is the mantra in real estate, and likely in policymaking too. Geography matters for relevance to a policymaker. Statements about a general need or a pervasive phenomenon do not distinguish themselves to decision makers from the information noise that surrounds their daily context (Hanney et al. 2003). Instead, information needs to be specific to policymakers' local jurisdiction and based on data about the people they serve (Brownson et al. 2016; Fielding and Frieden 2004; Hanney et al. 2003; Laugesen and Isett 2013; Murthy et al. 2012; van de Goor et al. 2017). Policymakers also want to see how they compare to their peers (Stamatakis, McBride, and Brownson 2010; Stone 1989)—action in jurisdictions that they think are similar to theirs or competitors can compel decision makers to act, to avoid seeming like laggards. The connection between causal ideas and responsibility to act (Isett, Laugesen, and Cloud 2015; Stone 1989), and a moral obligation to fix an identified problem (Gamble and Stone 2006) for their constituents is crucial, both objectively and comparatively.

In many cases, the geographical relevance is communicated by numbers. While scholars like to think that they know good evidence when they see it, the criteria that public servants use are somewhat different and more nuanced. There are three categories of numbers highlighted in the current literature as crucial to policy decisions. First are descriptions of a problem that highlight disparities in the population (Stamatakis, McBride, and Brownson 2010). How are distinct populations differentially benefitting from or disadvantaged by the status quo? Second, projections are important. In particular, the number of cases that

could be prevented by a given intervention (Hanney et al. 2003), the cost of policy inaction and how these costs are distributed (Stone 1989), and the distribution of the benefits of the intervention (Hanney et al. 2003; Jewell and Bero 2008; Stamatakis, McBride, and Brownson 2010) are of interest to public decision makers. Finally, in scientific circles, the randomized controlled trial and a low *p*-value are the gold standard of quality results. However, public decision makers actually want to know how good the evidence is that something will affect outcomes in a meaningful way (Atkins, Siegel, and Slutsky 2005)—that is effect size, not statistical significance. The difference is that the intervention *does* what it is intended to do (effectiveness), not that it *can* (efficacy).

Geography and the kinds of numbers policymakers use highlight a critical contingency for evidence use: information needs to be targeted. This means that the scope of the information provided is explicit and to the point of the decision at hand, shaven of all secondary and tangential information, and is inserted into the process when it potentially can be useful (Brownson, Fielding, and Maylahn 2009; Burris et al. 2010; Coffman et al. 2009; Hanney et al. 2003; Lavis et al. 2008).

The relevance of the information to a policymaker's scope of authority and budget can be a facilitating factor for use. It is a mistake to think that just because evidence points to a problem (or a solution) that something can be done to address it. Hanney and colleagues (2003) point out that sometimes a system just is not able to absorb the findings. Either the system has little to no resources to address the concern or no technical solution exists. In fact, few examples illustrate that using evidence to illustrate a "new" problem exists is effective at all. Identifying a new problem means that a new program needs to be developed. New programs have high upfront costs and long-term benefits, yielding a low-powered incentive (Fielding and Briss 2006; Frant 1996). Despite reluctance to initiate a new program, evidence is more likely to be used to start a new program rather than replacing an existing one (Fielding and Briss 2006)—adding to the status quo rather than changing it (Cyert and March 1963; Downs 1967).

Public decision makers are more likely to use evidence if it comports with their operating realities. Recommendations need to be feasible and consistent with decision makers' jurisdictions, resources, authority, and scope of operations (Brownson, Fielding, and Maylahn 2009; Lavis et al. 2003). Solutions that fall outside established authorities cannot be implemented and might be illegal. Reversibility is also important for public servants. Decision makers might require room to back away from publicly stated positions when implementation or context changes (Jewell and Bero 2008; Zaltman, Duncan, and Holbek 1984). Path dependency stemming from a potential decision could lead to risk aversion and maintaining the status quo rather than engaging in needed change.

Content and Credibility

Once it is established that the evidence circulating in the policy stream is relevant, then what the information contains, and who has said it becomes important.

Effective public evidence needs both qualitative and quantitative components (Jewell and Bero 2008). On the qualitative side, stories provide an emotional hook and an intuitive appeal (Brownson, Chriqui, and Stamatakis 2009; Troy and Kietzman 2016). Stamatakis, McBride, and Brownson (2010) point out that "protagonists [of a story] should reflect an important constituency that could benefit from the proposed policy change.". In particular, stories are especially important when the benefits to a group are difficult to monetize such as with safety or quality of life (Brownson, Fielding, and Maylahn 2009; Stamatakis, McBride, and Brownson 2010).

Arguably, scholarship is not needed to generate stories for policy arguments—individuals are best at relaying their personal stories directly. The strength of scholarship as it is typically conceptualized, lies in providing quantitative evidence and arguments that can be difficult to generate from other sources. Social scientists are skilled in providing cost-benefit analyses, descriptive statistics, and impact analyses. They may, however, be less aware of or interested in the other types of numbers influential with public decision makers that were noted above. It is important that the numbers presented also provide a narrative, just as with qualitative data.

Credibility is a second component of evidence content. Strictly speaking, credibility "involves the scientific adequacy of the technical evidence and arguments" (Cash et al. 2003, 8086). However, policy audiences without the requisite specialist expertise to make a technical judgment, instead tend to assess the credibility through face validity of the messenger, or the research team (Brownson, Chriqui, and Stamatakis 2009; Dodson, Geary, and Brownson 2015; Lavis et al. 2003, 2008). Professional or known government organizations are often considered credible sources (Lavis et al. 2003) as are researchers from respected universities. Showcasing the credibility of the analysis as well as the researcher is central to evidence uptake.

Having highly credible material that appropriately balances qualitative and quantitative narratives is fundamental. However, crafting those elements so that they are responsive to the policymakers' needs is crucial. Cash et al. (2003) established that ongoing

interaction is central to providing salient, credible, legitimate information. Effective feedback mechanisms to establish salience can be as simple as a conversation to inquire about perceived shortcomings. Projects that involve interaction only at the beginning risk providing solutions to yesterday's problems (not salient), or outdated knowledge (not credible) and excluded parties often question the legitimacy of information resulting from the ensuing conversations (Dobbins et al. 2009; Lavis et al. 2003).

Access/Comprehension

The practice of policymaking literature clearly illustrates the importance of the idea that how you say something is almost, if not more, important than what you say.

The literature is clear on the need for high-quality and unambiguous communication. This is an area many scholars shy away from, feeling the data should speak for itself (Pisano 2016). Given that busy decision makers have limited time and cognitive resources to filter through all of the material they need to make decisions, they must rely on both heuristics (about source and content) and the summaries provided to them by others (Cyert and March 1963; Dagenais, Laurendeau, and Briand-Lamarche 2015; Ostrom 1998). While academics often point to the systematic review as a gold standard, these kinds of documents have also been shown to have barriers to uptake (Tricco et al. 2016)—so the nature and presentation of the summaries of evidence are important (Dodson, Geary, and Brownson 2015).

Cognitive inaccessibility is an important issue and one that is not well understood by scholars. Studies illustrate that quantitative analyses are inaccessible to most public decision makers (Brownson, Chriqui, and Stamatakis 2009). These individuals are often trained to do other things than sort and interpret data. At least one study has shown that public decision makers do not effectively distinguish between cause and correlation (Jewell and Bero 2008). And while there is some face validity to the idea that training public servants in data interpretation will address capacity deficits (Redman et al. 2015; VanLandingham and Silloway 2016), there is limited evidence on the extent to which this works (Murthy et al. 2012).

Thus, the ability to summarize and distill information in a transparent and credible way is key to getting the attention of decision makers without contributing to overload (Burris et al. 2010; Cyert and March 1963; Hanney et al. 2003; Murthy et al. 2012). Information presented in a straightforward way (without jargon) that is easy to understand can be absorbed more quickly—and then possibly used (Burris et al. 2010; Coffman et al. 2009; Gamble and Stone 2006). "Well designed translational materials and strategies that reflect an understanding of the constraints that policymakers face certainly have a greater chance of carrying the day than do research reports that are physically and cognitively inaccessible to policymakers"(Burris et al. 2010, 197).

While transparent summary is critical, communication of empirical findings needs to go beyond just the statement of facts. Instead, the benefits of policy adoption should be visible and unambiguously presented (Atkins, Siegel, and Slutsky 2005; Gamble and Stone 2006). Also, for policy areas where outcomes are long term, Fielding and Briss (2006) suggest including intermediate measures of benefits to provide a shorter time to payoff for policymakers forced to work on short policy cycles. This aids in framing the problems and benefits in a manner that can be understood and evaluated quickly by busy decision makers.

Areas of Overlap

The academic and practice policymaking literatures have distinct contributions and strengths. But they describe the same phenomena. Therefore, it is not unreasonable to expect that the two literatures may have some overlap. Indeed, we do find some points of convergence (see figure 1).

In a comparison of the agenda setting and practice literatures, we see two points of convergence. The agenda setting literature makes clear two points: decision makers must be aware that a problem exists and they must have motivation to address it, motivations can be related to the magnitude of the problem at hand. These points are echoed in the practice literature with the focus on geography. This literature illustrates that decision makers have an expressed obligation to act once they know that a problem exists in their jurisdiction.

Within the decision-making literature, there are also two points of overlap with the practice literature. The first point of overlap is with regard to decisions being made within authority and jurisdiction limitations. This comports with the practice literature's ideas of evidence being presented with the operating realities of the decision maker in mind. The second point of overlap is related to credibility. Both literatures stress the importance of the evidence presented being credible with regard to both method and reporting of results.

There is no overlap with the process literature and the third factor emphasized in the practice of policymaking literature, access/comprehension. While these components are sometimes addressed in the evaluation and data visualization literatures (Isett and Hicks 2018), they are not seen within the process literature on policymaking. The emergent literature on evidence use outcomes also touches upon some of these aspects,

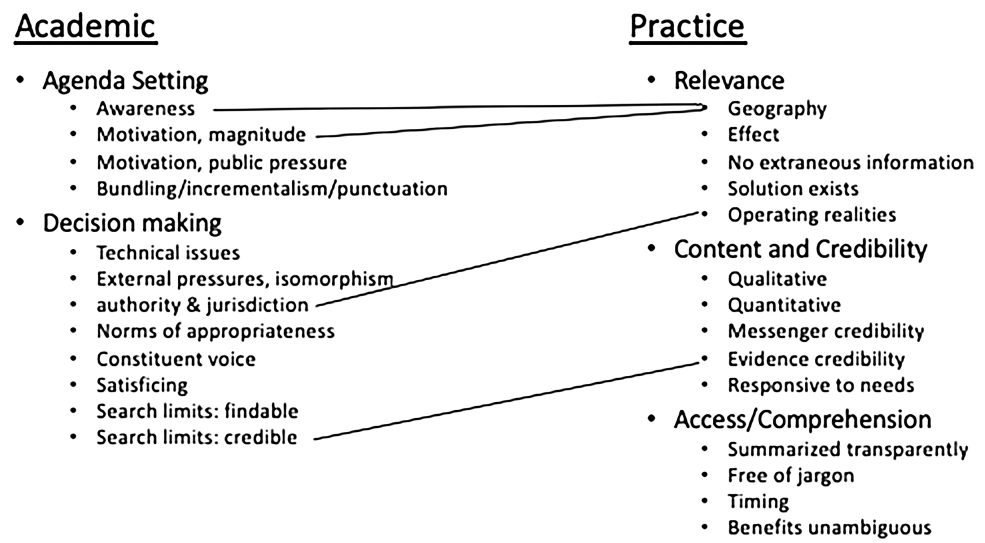

Figure 1. Overlap among academic and practice literatures.

however, at this time, the factors related to clear communication and message crafting have not been explored in the canonical policy literature as an antecedent to evidence uptake.

RESEARCH FUNDING POLICY CASES

The cases chosen for this paper were selected purposively and exemplify work with high academic credibility, most were highly cited in the scholarly literature, as well the work had demonstrable policy impact. Finding cases of successful policy impact from social science research is difficult and here we relied on experience. One of the authors has been an observer of science policy for many years and thus is in a position to identify cases with high impact within this domain. Selecting cases within one substantive domain helps to provide some consistency with regard to institutional context, so that variation can be attributed with more certainty to the analytical framework. We examine four cases focusing on funding of research across three countries.

Case 1: Mansfield's rate of return (United States)

The first case of policy impact comes from the work of economist Edwin Mansfield of the University of Pennsylvania. As in most policy arenas, those arguing for the value of publicly funded research do not lack for anecdotes—the internet, the laser, MRI etc. are all examples of successes of public research dollars that have created tangible public value. Quantitative evidence however is scarce, and the time lags between research and application provide an extra challenge to gathering it. Mansfield was the first to empirically estimate the social rate of return to public research spending which he calculated to be 28% (Mansfield 1991, 1998). In an environment lacking quantitative evidence supporting the value of research, Mansfield's work proved valuable to intermediaries, namely government agencies and advocacy organizations seeking to support the case for research funding in Congress including the Congressional Budget Office and the Task Force on the Future of American Innovation.

Mansfield's paper focused on a single, clear number, surrounding it with caveats, but nevertheless stating in the conclusions:

> A very tentative estimate of the social rate of return from academic research during 1975–78 is 28 percent, a figure that is based on crude (but seemingly conservative) calculations and that is presented only for exploratory and discussion purposes. (Mansfield 1991, 11)

Users of Mansfield's results repeatedly referred to the 28% figure.

Mansfield calculated a social rate of return from research to wider society, a typically economic view "from nowhere." However, the data were gathered from a survey of US firms, so in fact the result concerned the return from US research to American society. The return reported in the paper was from corporate research that used publicly funded research, establishing both the greater good and the benefits to firms who are an important constituency in justifications for public research spending. The intermediate measure of benefit to firms provides a view to benefits without asking policymakers to wait for the more diffuse and longer-term societal benefits.

Prof. Mansfield was encouraged to produce this study by the Policy Studies Unit in the National Science Foundation (NSF), who funded the work, and it was published in a respected specialty journal, *Research*

Policy. The Congressional Budget Office (CBO) was tasked with examining the work and reported that it was credible as a validation of the guiding vision in US science policy and referenced it in justifications of Federal investment in research (Alsalam et al. 1998; Webre 1993). The 28% number was used to argue for the value of research funding by President Bush, agencies, advocacy groups, and in Congressional testimony (Drake 2007; Powell 2006; *Science* 1992; The Task force on the future of American Innovation 2006)—to name a few instances. Even after two decades, this number was still being used to justify government expenditure on research.

Case 2: Narin's Patents Citing Papers (United States)

The second case examined here was Francis Narin's discovery that patents were increasingly referencing scientific papers and that 73% of the papers cited by US industry patents are public sector science (Narin, Hamilton, and Olivastro 1997). In a descriptive analysis published in *Research Policy*, Narin argued that US firms were leaders in building on public science. The author's summary of the paper would have been that references from US patents to US-authored research papers tripled over a six-year period, from 1988 to 1994. Furthermore, the cited US papers represented basic research in influential journals, authored at top research universities and laboratories, relatively recent to Narin's analysis, and heavily supported by National Institutes of Health, National Science Foundation, and other public agencies. Because this can be interpreted as industry using the research the government funds, it can be used to establish the value of publicly funded research. Intermediaries incorporating the result into overviews plucked the 73% number (73% of papers cited by US industry patents are public sector science) out of the paper's introduction, and it became the focus.

Like Mansfield's work, and for similar reasons, this study was noticed and used by intermediaries—the media, advocacy organizations, and government agencies. A 1997 *New York Times* article focused solely on this paper was headlined: "Study finds public science is pillar of industry." Like Mansfield's result, Narin's was discussed in a CBO report on federal spending (Alsalam et al. 1998) and in a House Committee report (Committee on Science 1998). An addendum to NSF's report to Congress, *Science & Engineering Indicators* focused on the research (National Science Board 1998), and several later NSF reports referenced it in making the case for the value of science to the nation (National Science Board 2003, 2005)

Mansfield and Narin put forward numbers that were useful to organizations seeking to establish the value of research funding. This argument is evergreen in Washington, DC because in every budget cycle research competes with many other worthy causes for Congressional attention and funding, and it is perpetually necessary to reestablish the value of research for the nation. Additionally, both authorship teams provided quantitative evidence that US firms benefit from publicly funded research. The protagonists in these analyses, US firms, are an important Congressional constituency that stands to benefit from public research and benefits to firms are a "good." Narin also provided a new intermediate measure by pointing out that firm patents increasingly referenced publicly funded research. This suggested that firms used, and therefore benefited from, public research.

Case 3: Martin and Irvine's Gap (Britain)

In the mid-1980s Ben Martin and John Irvine produced a series of commentaries in *Nature* arguing that British science was in decline as evidenced by trends in publication output and government funding of research falling behind that of the Netherlands, France, Germany, Japan, and the United States (Irvine et al. 1985; Irvine and Martin 1986; Martin et al. 1987; Irvine et al. 1990). In this case, perhaps because the United Kingdom is a smaller policy system, *Nature* served as the only intermediary. The research was published in the widely read commentary/news section of *Nature*, therefore the functions of scholarly publishing and broader dissemination were blended. The constituencies who were the subject of Martin & Irvine's analyses were public sector actors, scientists, and universities, respectively. Science policy is a national-level concern and because of the link between innovation and economic prosperity, policymakers are concerned not to fall behind other nations.

The *Nature* series attracted the government's attention and John Irvine was asked to meet with the Minister who wanted to know how big the funding gap was, but Martin & Irvine's paper was silent on exactly how much the United Kingdom was behind. Although the paper identified a problem, solutions existed—increase spending on UK research—and was within the scope of the agencies involved. In the UK case, there was some leeway in putting a number on the size of the funding gap depending on which countries were included in the comparison group. Irvine offered 100 million GBP, which was considered doable.

Case 4: Butler's Perverse Incentives (Australia)

The fourth case comes from Australia, again as a smaller system the intermediaries here were simpler, with white papers from relevant government agencies incorporating the research findings which drove changes in policy. As a result of a 1992 policy that linked publications in indexed journals to university research funding, Linda Butler

(2003), a respected scholar at the Australian National University, found that the Australian share of world publication output grew but the citation performance of Australia fell from number 6 among 11 OECD countries in 1981 to number 10 in 1999. Butler argued that this was because once the policy took effect, authors prioritized producing more papers, publishing in lower-impact factor journals after the policy was introduced. The analysis illustrated negative unintended consequences at the national level arising from the perverse incentives built into the evaluation system; Butler concluded: "Australia's research evaluation policy had become a disincentive to research excellence" (Butler 2003).

A series of reports between 2002 and 2004 by Australia's Department of Education, Science and Training (DEST) in many places incorporated descriptive data from a bibliometric study by Donovan and Butler (2003) and used the finding of declining citation impact (Australia Department of Education, Science and Training, 2002, 2003a, 2003b, 2003c, 2004). A healthy public research sector is considered a public good broadly beneficial to society, so weakening universities' overall research competitiveness would be salient for national policymakers.

In contrast to the other cases presented here, the Butler case never focused on a single number. There was a number to highlight, namely that Australia fell from the 6th to 10th ranked country in citation share/publication share which was in the second sentence of the paper's abstract. Nevertheless, perhaps because simplistic focus on a single number was the cause of the problem Butler highlighted (universities could put a dollar value on a paper indexed in the Web of Science), intermediaries including Butler's result in their overviews explained that Australia's relative citation impact was falling behind most other comparable OECD countries (Australia Department of Education, Science and Training 2002), that the fastest publication increases were in below median impact journals (Australia Department of Education, Science and Training 2003b), or that policies have led to an increase in Australian articles appearing in lower-impact journals (Australia Department of Education, Science and Training 2003a).

Despite the lack of "a number" the message was quite clear and tangible, was feasible and within the scope of government action, and was acted upon. As a result, Australia changed its university evaluation system to incorporate two to four weighted categories of journals, a feature directly responding to the conclusions of Butler's analysis. The result was an alteration of a current program.

DISCUSSION

Looking across the two paradigms of theory, which elements are seen in our four illustrative cases of high impact scholarly work? We find that overlaying the cases on the two sets of theories provides some insights for grounded theory development. We discuss the strengths and weaknesses of the two frameworks below and offer a critique of a critical gap in theory.

Presence and Absence of Elements of the Two Communities

Interestingly, the elements of the theories that appeared in all four cases were those that appeared in both the academic and practice literatures. Suggesting that, for at least the big points, both scholars and practitioners get it right. These elements are: magnitude/geography, effect size, authority and jurisdictional feasibility, credibility, and use of quantitative elements.

In each of the four cases, we saw that geography and the magnitude of the problem played a role in moving evidence to policy. There were comparisons built in to each of the analyses, sometime explicitly and sometimes implicitly. Since these cases were all national research funding policy cases, the comparisons were international. Though for more local policies, the comparisons could be regional or other cities. Additionally, the comparison had a magnitude embedded in it—"big" problems (a drop in ranking or falling behind comparators), or being exceptional (in the two US cases). These magnitudes led to the effect being drawn out. Either a policy was needed to remedy the problem, or the policymakers needed to stay the course to maintain excellence. Importantly, in each of the cases, we could see that the policymakers had the means and ability to address the needs that the analyses presented—appealing to the need for authority and jurisdiction to be considered when posing policy issues to decision makers.

While the theories had many strong points, focus on quality of evidence was perhaps the strongest aspect illustrated in our cases. Well executed analyses that illustrated the extent of a problem generated by a credible messenger were central to each of the four cases. The messengers in our cases were a mix of the scholars themselves and intermediaries that aggregated and interpreted the findings for policymakers. What is useful to underscore is that scholars do not necessarily have to participate directly in the policy process to have their work used (Dagenais, Laurendeau, and Briand-Lamarche 2015).

Finally, the breadth of quantitative approaches that are used and valued by policymakers were illustrated in these cases. A range of quantitative methods are sufficient to make a case, but descriptive quantification seems to be more important than sophisticated modeling. Three of our cases highlighted descriptive numbers and one a cost-benefit analysis. Description is more easily understood and helps with a basic understanding of the problem and an imperative to act.

In addition to overlapping aspects of the academic and practice literatures that appeared in our cases, there were elements from these literatures that were not overlapping but did appear in our cases. From the academic literature only, the element of norms of appropriateness was present. In the cases presented here, science policy is related to national economic competitiveness through innovation. Thus, a well-funded science ecosystem is directly related to economic growth, and is appropriate to be addressed at the national level. In other policy areas, the question about whether or not government is the appropriate actor to address the policy issue can be more contested. This is held constant in our cases.

There were also several elements solely from the practice of policymaking literature that appeared throughout our cases. All the cases provided information to the policy system that addressed the needs of the policymakers. This is evidenced by the repetitive use of the data and analyses by decision makers and policy actors in reports and testimonies. Importantly, these needs differ across countries. In the US system, justifying public spending on research is a recurring issue because conservatives argue that industry will fund necessary research and government should stay out of research funding (c.f. Michaels 2017). Science policymaking in other countries is sensitive to league tables and accusations of falling behind, since there is no way to calculate from first principles how much should be spent on research.

A final element present was the emphasis on a strong narrative. As one author has said, it's the ideas that sell a policy, not the data behind it (Lavis et al. 2003). The ability to weave a compelling story about need, obligation, and solutions is crucial to the success of the policy idea (Troy and Kietzman 2016). While a single captivating number is an effective contribution to narratives supporting the story being put forth, the cases examined in this paper incorporated numbers into a strong narrative that identified great strengths or great deficits. This is a central aspect of the practice of policymaking literature that seems to be missing in the more academic descriptions of the processes. Since we examined the genesis of our cases centered on the academic origins of high impact numbers, it makes sense that the numbers in these cases were central. However, a nuance about these narratives surrounding those numbers is that in most of our cases the narrative was constructed by an intermediary, not the scholar.

There were six elements from the academic literature that were not present in the cases we presented. The first three elements cluster around issues of the socio-technical system of policymaking. The cases presented here did not illustrate public pressure for or against research funding policy. Also absent were bundling/punctuations that have been discussed in the literature. Nor did we detect any discussion around technical solutions to problems. The second three elements concern heuristics and cognitive processing. Issues of isomorphism, specifically mimesis to copy thought leaders and providing shortcuts to decisions were not evident in our cases. Likewise, elements common to the Carnegie School—satisficing and limits to search processes—were also not evident in our cases.

One limitation of the work presented here is related to our case selection. Given that our examination of cases involved compiling evidence of impact, we have no counterfactuals, though the myriad of papers that cite these four papers or even later papers from the same authors on similar topics would qualify as similar cases that did not have policy impact. Also, because we selected cases in the same substantive domain to hold important contextual elements constant, we have no way of knowing if the elements that were not present are artifacts of the policy domain. Therefore, we are unable to comment on the usefulness of these elements in other policy domains with different characteristics such as those with higher uncertainty or contestation. This would be important future work to further substantiate the analysis presented here.

A Critique: Elements Driven by Intermediaries

In each of the two literatures, scholars and policymakers are the main actors. However, the cases presented here point to a third party in the public decision-making ecosystem: intermediaries.[1] While intermediaries are mentioned in the literature, their role is one of a supporting, but minor, player. We posit here that these intermediaries are actually a critical and equal actor in evidence-based public decision-making knowledge translation processes.

As Contandriopoulos and colleagues (2010) point out, the paring, synthesizing, and conclusion drawing functions of knowledge for non-experts is a major undertaking that demands both resources and expertise differing from skills honed in academia.

What we saw through our cases was a clear division of labor in the policy process that harkens back to Oakerson's (1999) division of the production (scholarly output of research) and provision (effective targeted synthesis of research) of public goods—the good

1 We choose in this paper not to highlight any specific type of intermediaries, but rather focus on this class of actors. There has been growing interest in recent years on the role of think tanks—one type of intermediary (c.f. Abelson 2000; Guston 2001; Rich 2004). However, despite the attention given to these actors, the literature remains descriptive about what they are and the potential role they play in policymaking. Currently, there is little to no insight into their internal operational processes as it relates to knowledge translation—the focus of our work here.

here being policy evidence. Compiling studies to craft overviews in clear language targeted to a single policy domain and making unambiguous claims about the desired direction of policy is not considered scholarly—but these are necessary tasks in order for research to be used in real world communication (Fiske and Dupree 2014; Troy and Kietzman 2016). Scholars do not feel comfortable lobbying themselves, as being an advocate would reduce their credibility as objective information providers in the eyes of decision makers (Fiske and Dupree 2014). In fact, at least one study illustrates that researchers' lack of warmth interferes with their trustworthiness when interacting with professionals (Troy and Kietzman 2016).

Use of empirical evidence in public decisions requires that study findings be couched in the language and context of the decision-making body intended to use it. This often requires tailoring the messaging to the specific constraints of multiple intended audiences. Because the requirements of multiplex messaging are somewhat at odds with the requirements of scholarly incentives, and because any single study is rarely definitive enough to guide policy by itself, intermediaries play a large role in facilitating use of research in policy. There are two types of intermediaries, individuals who broker relationships (Dagenais, Laurendeau, and Briand-Lamarche 2015; Meagher and Lyall 2013) and organizations who support their arguments with research-based evidence in the documents they produce (Contandriopoulos et al. 2010). Both are valuable links between the empirical literature and public decision makers. Intermediary organizations can produce systematic overviews incorporating research-based insights crafted in clear language, targeted to a policy domain.

Interviews with policymakers illustrate that many have "go-to" sources that they feel play an "honest broker" role and who communicate synthesized information in clear ways (Lemay and Sa 2014; Nelson, Leffler, and Hansen 2009). These go-to organizations are reliable clearinghouses of information relevant to the policy discussion. But these transfer strategies require expensive organizational investments of time, attention and/or money (Contandriopoulos et al. 2010), and thus those that invest in interpreting, packaging and distributing research evidence for policymakers and practitioners play an important role in the knowledge and policy use ecosystem (Contandriopoulos et al. 2010; Nelson, Leffler, and Hansen 2009; Tseng 2012). Intermediaries serve as the linchpin between scholarly output and inputs to the policy process. They work to bundle related studies that bear on the topic of interest, contextualize, and interpret the information for salience to and easy processing by the decision-making body (c.f. Dodson, Geary, and Brownson 2015; Dutton 1997).

Another way that intermediaries facilitate knowledge transfer is through the contextualization of important numbers. For example, in our cases, a single number played an outsized role, capturing the essence of the scholarly analyses and facilitating its communication. In only one case did the study's author highlight the single number. In two other cases, intermediaries or the decision maker extracted it. Credible academics are wary of the single number and its potential for misuse—witness the caveats surrounding the 28% number that was offered in the Mansfield case. But on the other hand, it is unreasonable to expect policymakers to invest in understanding the complicated formulas unique to every study. Intermediaries know this and strive to offer a story of numbers that is uncomplicated, clear, and stripped of unnecessary content except the credibility of the author and/or the number. This is why white papers and policy documents contain references. The number is never truly alone. It is always accompanied by a halo of credibility derived from its referenced source. Thus staged, the number could captivate the discussion and motivate change. Despite the power of a captivating number, policy stories are narratives containing more than one number. The documents that included these numbers incorporated them in syntheses that contextualize numbers in broad issue overviews, thus avoiding the biases of single paper findings (Tricco et al. 2016).

Intermediaries can also resolve the tensions scholars face when interacting with policy and policymakers (Sarkki et al. 2014). The discomfort with drawing conclusions and making recommendations combines with the role of information synthesizers to underscore the importance of information intermediaries in this process (Dagenais, Laurendeau, and Briand-Lamarche 2015). Our cases suggest that intermediaries play a crucial role in brokering the massive corpus of empirical research in a digestible and targeted way for a policy problem. These organizations have high credibility and visibility, thus garnering attention from public decision makers and making scientific evidence "findable" (Dodson, Geary, and Brownson 2015). Given the role played by intermediaries in our empirical cases, the existing frameworks' acknowledgements of their importance, and the encapsulation of visibility, credibility, and objectivity of these organizations, we posit that they play a central role in the uptake of evidence in public decision making, a role outsized to existing characterizations of them.

This is not to suggest, however, that intermediaries are not without controversy. In politically polarized contexts (Contandriopoulos et al. 2010) deep subject matter expertise and interested use of knowledge raises questions about the fidelity with which intermediaries transmit research evidence. Indeed, studies

of intermediary organizations working as advocates in a policy area find that intermediaries "at times rejected research studies that cast doubt on the policies they promoted" (Gandara, Rippner, and Ness 2017, 720). The literature also suggests that the influence of intermediaries, and the evidence they transmit, is highest in the agenda setting phase of the policymaking process, though some newer analyses do point to influence of acknowledged experts later in the policymaking process (Contandriopoulos et al. 2010; Gandara, Rippner, and Ness 2017; Ganz and Soule, 2019).

The underexplored nature of intermediaries draws out a series of important questions about this third community. First, and most importantly, how does the third community interact with the other two? While the search and discovery processes of policymakers have been explored in the literature, with a few exceptions how search involves intermediaries—and the weight put on information from intermediaries versus "pure" scholarly articles—has not been identified in the extant literature. Additionally, the search and discovery processes the intermediaries themselves use are somewhat unknown. How do scholars' work get to be known by intermediaries, and how do intermediaries themselves become known to decision makers? We also do not know how accurately intermediaries represent the knowledge they use in their translation materials. Do the syntheses present information with high fidelity to the source or does the original message get distorted through transmission?

Another important question is related to the pathways of knowledge transmission from empirical finding generation and publication to use in public decision making and the role intermediaries play in that pathway. How does knowledge move from generation/reporting to discovery by intermediaries and then through translation and communication and use? How does this pathway vary by substantive domain? Understanding these dynamics could move discussion beyond well-known recommendations for clarity and outreach to enable deeper understanding of policymaking in the era of information abundance.

Figure 2 illustrates the pathway from knowledge production to use. Currently, the existing theoretical literature conceptualizes the pathway as having two nodes: production (which includes research studies and the publication of those findings) and then use (which includes administrative and legislative use), indicated by the solid lines in the figure. Our work suggests that this conceptualization misses a critical node in this pathway, which we show can be done effectively by intermediaries such as think tanks, national expert groups like the National Academies, and issue specific advocacy organizations. This is the provision node—where the knowledge produced is transformed into a useable format and provided to the policy decision-making systems at appropriate times and places. The dotted box in the illustration highlights this node. Until now, these intermediary functions have not garnered much attention from scholars. Thus, we do not know how these inputs operate and under what conditions this pathway is most effective. Further, the processes within the provision phase, such as search and discovery of the scientific corpus and how it then feeds into the synthesis and communication of knowledge is unknown. Therefore, not only does the provision phase of the knowledge-use pathway need to be examined generally, but we also need to unpack the black box to understand how processes work within this node.

CONCLUSION

Our contribution is twofold. First, this paper represents one of the first times policy use frameworks from both the academic and policymaking practice literatures have been used together to frame illustrative cases of scholarly work with known policy impact. While many other papers examine *how* research gets used, or *why* it gets used, we took a more pragmatic approach. We leveraged the existing frameworks to examine whether the frameworks could illuminate cases where scholars had impact in public decision making. While we found the frameworks could capture the dynamics

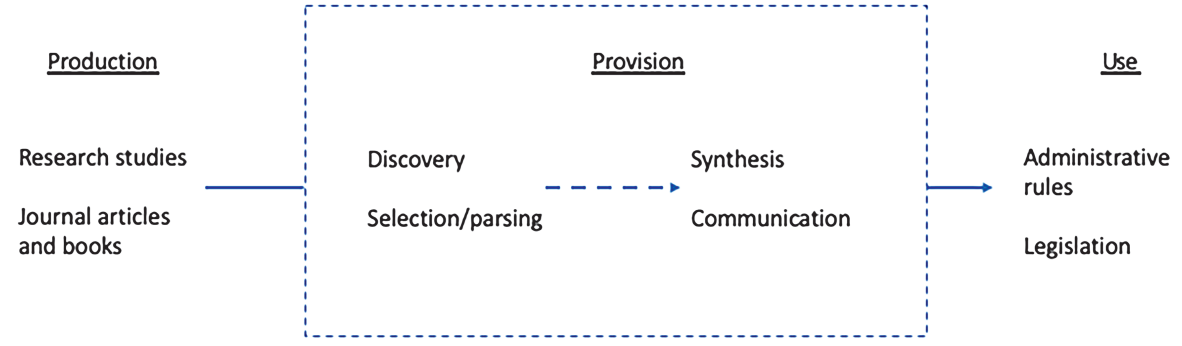

Figure 2. Schematic of pathways from research into public decision making.

of our cases, our analysis led us to conclude that the current frameworks undervalue the role of knowledge intermediaries and the role they play in discovery and translation processes for public decision making. Thus, the second contribution is the identification of how knowledge intermediaries play a role in this process. We have also identified concrete activities these entities perform to better represent the use of empirical knowledge in public decision making.

Within the current paradigm,we know that the existence of accessible, high-quality research does not significantly increase the use of evidence in policymaking (Dobbins et al. 2009; Gamble and Stone 2006; Hanney et al. 2003; Kitson et al. 2018; Stamatakis, McBride, and Brownson 2010). We also know that public decision makers agree that evidence *should* be used in decision making (Brownson, Fielding, and Maylahn 2009; Newman, Cherney, and Head 2016). However, what public decision makers and researchers consider to be evidence may differ (Dodson, Geary, and Brownson 2015; Trautman 2016).

Existing characterizations of the translation of science to policy use are strong on technical quality. However, these models were by and large developed as grounded theory to conceptualize what happened when evidence was used in public decision making. Sometimes, what did happen was also combined with what *ought* to happen—as a normative assessment of what leaders and scholars believe. These frameworks over emphasize the technical portions of the process and highlight the use of numbers to drive decisions. But the kinds of numbers that are useful and that were seen in our cases are more descriptive, rather than the highly sophisticated modeling techniques used by scholars in academic publications. And the numbers that get the most interest are often determined by intermediaries aiming to encapsulate the effect of the proposed problem or policy—not by the authors themselves. The field's understanding of which numbers matter and when is still rudimentary.

We also saw that despite the emphasis on quantitative evidence, numbers rarely stand alone. They are embedded in a story that provides context and captivates the audience. Again, it's the ideas and the obligation to act (Isett, Laugesen, and Cloud 2015; Lavis et al. 2003) that compel action, not the numbers themselves. These ideas are effectively crafted by the honest broker—intermediaries in the policy system that draw conclusions from broad syntheses and are inserted into the policy discussion at inflection points.

A more general concern with the existing two communities literatures about public decision making is that it is an overly rational and sanguine way to perceive the policy process (e.g., Cairney, Oliver, and Wellstead 2016). Public decision makers necessarily combine values and evidence when making decisions (Atkins, Siegel, and Slutsky 2005; Cairney, Oliver, and Wellstead 2016)—that is their job. If public decisions were purely technical affairs, there would be less debate on the "best" course of action (Hanney et al. 2003; Heikkila and Isett 2004; Jewell and Bero 2008; Lavis et al. 2003). Empirical evidence does not eliminate debate, but is simply one input into that debate (Atkins, Siegel, and Slutsky 2005; Troy and Kietzman 2016). Any conception of the public decision-making process that posits a purely technical approach to the influence of evidence is naive and misguided. However, the current era of "evidence-based policy" could be driving this narrative creating pressures to appear more reliant on more "objective" sources of evidence. Thus, the cognitive processes associated with the Carnegie School and other institutional effects like mimesis and legitimacy of intermediaries may be downplayed in the current practice of policymaking literature. These dynamics should be teased out in future empirical investigations of this phenomenon.

Our work suggests that our knowledge of policymaking is incomplete and overlooks an important connector of knowledge generation and knowledge use. Future work should explore how this third community contributes to the use of evidence in public decision making. When and how this community is effective, gathers their sources and then feeds them into the system, as well as the parameters under which their contributions matter will lead to better theoretical models and insight into democratic governance.

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