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Abstract

This article critically reviews social science research on unconventional hydrocarbon development in the United Kingdom. I analyse fifty research articles published over the last half decade. The articles fit into three primary categories: (1) public perceptions, (2) discourse and rhetoric, and (3) planning and regulation. This review reveals both what social scientific inquiry has taught us and what gaps remain. We have reasonable understanding of: extent of public support for and opposition to development, basic factors related to support and opposition, procedural and distributive justice concerns leading to opposition, repeated academic critiques of UK planning guidance and regulation, and the frequent use of environmental risks and economic benefits as competing discursive frames. We lack understanding of: how discourse and rhetoric about shale gas, or how knowledge about development, influence public perceptions,; how perceptions and discourse at local and regional levels in the UK compare with the national level; what information sources the public rely on and trust on this topic; whether estimates of economic benefits are reliable; and importantly, how perceptions, discourse, and policy will evolve in light of imminent changes to the production and policy landscape. I conclude with recommendations for filling the emergent lacunae in our understanding.

Keywords: hydraulic fracturing; public perception; planning; regulation; discourse; UK

I. Introduction

For a nation with so little actual development, it is truly amazing how much attention has been afforded to the topic of unconventional hydrocarbon development (predominantly shale

gas) in the United Kingdom. As of this writing (September 2018), there has been no commercial development using high-volume hydraulic fracturing to stimulate onshore oil or gas wells in the British Isles; only a handful of exploration wells have been drilled. An early exploration well in 2011 led to minor induced seismicity, prompting a brief, one-year moratorium imposed by the UK Government. Since the moratorium was lifted in 2012, development prospects have advanced glacially. ‘Fracking’ has become a major political topic, featuring prominently in political speeches and party manifestos over the last seven years – both by advocates in favour and in opposition (Johnstone *et al.* 2017).

Activists have attacked the issue with fervency seen for few other societal issues – protesting, setting up camps by prospective sites for exploration wells, chaining themselves to equipment, and facing arrests. So-called ‘accidental activists’, never before protesting anything, have become energised and aggravated by the prospect of ‘fracking’. It has been a key area of policy focus, with: (1) Her Majesty’s Treasury (2016) consulting on and developing ideas for a Shale Wealth Fund to distribute benefits to communities in which production occurs, (2) the Ministry of Housing, Communities and Local Government currently (July – October 2018) consulting on whether non-hydraulic fracturing shale gas projects should be considered ‘permitted development’, thereby bypassing the need for local planning approval, and (3) the Department of Business, Energy, and Industrial Strategy currently (July – October 2018) consulting on what requirements should be in place for shale gas development to count as ‘nationally significant infrastructure projects, meaning that a national, rather than local, approval process would be used to grant consent for production wells.

The three consultations apply only to regulation in England, as Scotland, Wales, and Northern Ireland have devolved governments that regulate onshore petroleum development themselves. The Scottish Government formalised their permanent moratorium on allowing use of hydraulic fracturing for onshore extraction in October 2017 (even though the First Minister of Scotland stated this was a ban, it is not technically a legal ban, as shown in a recent court case between INEOS Shale and the Scottish Government). A Welsh National Assembly sense-of-body resolution from October 2017 and a Welsh Government consultation from July 2018 give reason to suspect the Welsh Government will follow suit by turning their de facto moratorium into a permanent moratorium (effectively banning development) after they are devolved the authority to do so from the UK Parliament in October 2018. With a moratorium on high volume hydraulic fracturing in Northern Ireland since 2015, England remains the only of the four UK nations to allow ‘fracking’; England also contains the greatest estimated unconventional gas and oil reserves.

The mass media in the UK (e.g., broadsheet newspapers) are replete with coverage of the latest political developments and social movements on this issue (Cotton *et al.* 2014, Jaspal and Nerlich 2014, Upham *et al.* 2015). As a percentage of the population, about twice as many Brits as Americans have basic name recognition of ‘fracking’ (Stedman *et al.* 2016), although consistently only about half of UK survey respondents say they have any knowledge of the process or its effects, beyond just hearing of it in passing (BEIS 2018). The pronounced attention to this form of energy extraction in the UK has extended to academic researchers and research funding entities. Major scientific and governmental organisations (e.g., the Royal Society, the Royal Academy of Engineering, and Public Health England) have carried out reviews of the science on this topic and two of the UK research councils (the

Natural Environment Research Council and the Economic and Social Research Council) allocated £8 million of funding in May 2018 to extend physical and social science on shale gas development over the next four years.

The fifty social science articles on shale gas development in the UK that I review herein are not a comprehensive census of the literature to date, but the magnitude and diversity of even the sampled articles offer a taste of the substantial attention afforded to unconventional hydrocarbons in the UK over the last half decade. With commercial production expected to begin in the UK in autumn 2018, alongside continued policy developments and the prospect of Brexit – which will certainly shake up the energy system – I do not expect the academic, public, or political interest in and furore over the topic to dissipate in the near future.

Because the articles I review below offer their own summaries and histories of shale gas development in the UK, I cover this background only very briefly here. Johnstone *et al.* (2017) provide an excellent timeline of relevant political events. Whitton *et al.* (2017) afford an admirable review of the state of actual industrial development and the policy process. Although little change has occurred in policy, politics, perception, or development since these two publications (save the aforementioned permanent moratorium in Scotland, the Welsh consultation on petroleum policy, and the two UK Government consultations), transformation of regulation, legislation, public attitudes, and on-the-ground experience could be imminent based on the outcomes of the three recent government consultations and the anticipated advent of commercial development.

The purpose of this article is to offer a review of social science research on the topic of unconventional hydrocarbon extraction, which can alternatively be labelled shale gas

development, or ‘fracking’.¹ [I will use SGD (shale gas development) as the operative phrase throughout this article; regardless of the actual medium for extraction (e.g., shale, tight sands, coal), unconventional hydrocarbon development has become synonymous with ‘shale gas’ in public and political discourse in the UK.] Aside from this article complementing the other nation review articles in this special issue to generate a comprehensive view of social scientific research on SGD globally, this article also distils a large, and growing, body of research to help scholars in this area see what has and has not been revealed on this topic in the UK. This will help the ever expanding number of researchers working in this area to identify truly novel research topics and to push our collective knowledge forward.

My analysis includes fifty articles published in the last five years – they were identified by iterative searching of major academic search engines, conversations with leading experts on this topic in the UK, and scanning of citations within the initial articles that I identified for the sample. Search terms included combinations of ‘shale gas’, ‘fracking’, ‘hydraulic fracturing’, ‘unconventional gas’, or ‘unconventional hydrocarbons’ with any of the following geographic descriptors: ‘UK’, ‘United Kingdom’, ‘England’, ‘Scotland’, ‘Wales’, ‘Europe’, or ‘EU’. The returned search results were scanned for relevance to social science and to the geography of the UK (at least in part – some European comparison articles were included). In terms of conversations with experts, I had discussions with several of the authors cited herein, and others, about the most recent research on shale gas development in the UK (e.g., Bomberg, Bradshaw, Cotton, Pidgeon, Thomas, Whitmarsh, and Williams).

¹ I have written elsewhere about the need to avoid the label ‘fracking’ due to the strong negative and lewd connotations associated with that term (Evensen *et al.* 2014, Evensen 2016). Although my research was in the United States, recent UK research reveals that the term’s negative undertones might be even stronger in the UK than I found them to be in the US (McNally *et al.*, *in press*). Although ‘fracking’ is by far the most common term used in the UK, even by government and sometimes industry, I avoid it here due to its explicit linkage to obscenities and lewd behaviour.

I do not forward the untenable claim that this sample includes all social science research on the topic, but it does capture a strong overview of such work, especially the articles that shaped and forwarded future social scientific inquiry on SGD in the UK. When reading the research articles in my final sample, I broadly relied on thematic analysis to identify emergent themes for their primary foci; three themes arose. I sub-divide the review into three sections, denoting the major categories of research foci within the articles (acknowledging that some articles could fit in more than one category): (1) public perceptions, (2) discourse and rhetoric, and (3) planning and regulation.

II. The Review

A. Public perceptions

I located twelve research articles chronicling research on the what, how, and why of public attitudes towards SGD in the UK; this is in addition to the substantial data collection from the UK Government's DECC [Department of Energy and Climate Change] (now BEIS [Department of Business, Energy, and Industrial Strategy]) public attitudes tracker surveys that occur on quarter-annual basis (collected 25 times since 2012). Whilst some of the 'discourse and rhetoric' and 'planning and regulation' articles I subsequently review do also comment on public perceptions, the articles covered in this section had the primary purpose of collecting and analysing data from members of the public on their attitudes about SGD.

Perhaps the predominant question asked in the public perceptions research is, 'do people support or oppose SGD, and why?' This has been explored through both quantitative and qualitative approaches. Five academic articles report the results of quantitative surveys, but this does not provide as much understanding as one might first think because three of

those articles report on different findings from the same survey (Andersson-Hudson *et al.* 2016, Evensen *et al.* 2017, Stedman *et al.* 2016); another article analyses findings of a later iteration of this survey (Howell *et al.* 2018). The qualitative research draws findings from focus groups (Williams *et al.* 2017), individual interviews and meeting attendance (Beebeejaun 2016, Pearson and Lynch-Wood 2017, Szolucha 2018), and deliberative workshops (Partridge *et al.* 2017, 2018, Thomas *et al.* 2017a). The final three articles all derive from the same study, thereby also limiting the scope of the qualitative data. Six of the public perception articles collected data allowing for international comparisons – all between the UK and US (Beebeejaun 2016, Evensen *et al.* 2017, Partridge *et al.* 2017, 2018, Stedman *et al.* 2016, Thomas *et al.* 2017a), save one comparison with Poland (Szolucha 2018).

The quantitative survey research speaks to perceptions in the UK broadly, using national samples with quotas applied to make the samples approximate the UK population on key characteristics (e.g., age, sex, education, income). Whilst there is some indication that support in the UK might be declining over time (BEIS 2018, Howell 2018), both major surveys of public perceptions of SGD that have been replicated in the UK – the BEIS Public Attitudes Tracker (BEIS 2018) and the University of Nottingham / YouGov survey (Andersson-Hudson *et al.* 2016) – rely on repeated cross-sectional samples (i.e., different populations each time) rather than longitudinal data (i.e., panel samples in which the same respondents are surveyed at multiple junctures). This limits the ability to reliably conjecture about trends in support. Additionally, no survey of UK residents has revealed a majority supporting *or* opposing development. Across the surveys, 33-55 percent of respondents are non-committal (selecting options such as ‘don’t know’, ‘no opinion’, or ‘neither support nor oppose’).

One survey (Whitmarsh *et al.* 2015) focuses on regional (as opposed to national) samples, comparing residents between areas with and without prospects for development. This research reveals respondents in an area with potential for development (Lancashire) as more supportive than respondents in areas without viable shale plays. Nevertheless, the only other survey to gauge support at the local level (Howell 2018) showed substantially less support for SGD when respondents were asked about development in their local community versus development in the UK broadly. The Howell (2018) survey used a national sample – therefore, not likely people living in areas with actual potential for development. The Whitmarsh *et al.* (2015) survey only chronicled the higher support in one area with development potential. The limited nature of these data provide clues, but not a robust understanding of how support and opposition vary between the local and national levels in the UK.

Across the public perceptions articles, the same factors emerge repeatedly as being associated with support and opposition: for support – being male, Conservative (i.e., the UK political party – the Tories), associating SGD with clean energy, cheap energy, and energy security; for opposition – having strong environmental values, associating SGD with water contamination, earthquakes, and increased greenhouse gas emissions. Additionally, a few studies have spoken to the relationship between knowledge about SGD and support or opposition. Stedman *et al.* (2016) show support is higher amongst people with awareness of SGD (compared to those unfamiliar with the topic at all), the BEIS (2018) tracker reveals the opposite, and Howell (2018) demonstrates that knowledge leads to more polarisation (both more support and more opposition). The surveys used different operationalisations of ‘knowledge’ or ‘awareness’ (either self-report or a single factual question measuring basic

name recognition of the terms ‘fracking’ and ‘shale gas’). Neither measure is reliable or valid enough to provide us with a trustworthy understanding of the actual relationship, if any, between knowledge and support or opposition.

One study (Whitmarsh *et al.* 2015) did use an experimental treatment to investigate the effect of provision of *additional* knowledge on attitudes towards SGD. Provision of additional information on benefits of SGD fostered increased support for SGD. This relationship was manifest most strongly for individuals who were ambivalent in their attitudes towards SGD to begin with. Because of the large percentage of the UK public that is repeatedly shown to remain undecided on this topic, the Whitmarsh *et al.* study suggests that much of the public still remains open to influence in relation to attitudes about SGD.

The qualitative research on public perceptions in particular highlights how opposition to SGD in the UK cannot be explained away as due to a lack of technical understanding or limited awareness of impacts associated with prospective development (Beebeejaun 2017, Szolucha 2018, Thomas *et al.* 2017a, Williams *et al.* 2017). Procedural concerns about the role in decision making afforded to the general public (Beebeejaun 2017, Szolucha 2018, Williams *et al.* 2017) and distributive concerns about unequal exposure to risk across populations (Thomas *et al.* 2017a) motivate opposition and activism. A lack of trust in industry, government, and publically available scientific information, alongside a questioning of the purported benefits of SGD also contributed to public scepticism of the necessity for SGD in the UK (Partridge *et al.* 2017, Thomas *et al.* 2017a, Szolucha 2018, Williams *et al.* 2017).

B. Discourse and Rhetoric

Closely related to what members of the general public think about SGD is what has been said about SGD in societal discourse. Research has examined both the content communicated and the way in which the information is shared. I located fifteen articles that fit this category; they focused on different types of and fora for discourse:

- (1) Discourse amongst institutional actors such as government, pro-SGD, and anti-SGD groups, analysed through surveys, interviews, and literature reviews (Bomberg 2017a, 2017b, Fischer *et al.* 2017, Jones *et al.* 2013),
- (2) Discourse in newspapers, analysed through quantitative and qualitative content analyses and interviews (Cotton *et al.* 2014, Jaspal and Nerlich 2014, Neil *et al.* 2018, Stephan 2017, Upham *et al.* 2015),
- (3) Public discourse, analysed through data from public inquiries and Q-method activities with key informants (Cotton 2015, Nyberg *et al.* 2017, Rattle *et al.* 2018),
- (4) Discourse in social media, via analysis of YouTube video content (Jaspal *et al.* 2014), and
- (5) Legal discourse, through analysis of planning legislation alongside documents and arguments arising during debates on such legislation (Hilson 2015, Pedersen 2015).

The diversity of methodological approaches and types of discourse analysed provides a wealth of information about communication and framing of SGD across key segments of UK society.

In my review of the fifteen articles, it quickly became apparent that markedly divergent findings arose from these studies. Perhaps this owes to the timing of the studies (e.g., some, particularly mass media content analyses, were from the early years of discourse in the UK [2011-2014; Cotton *et al.* 2014, Jaspal and Nerlich 2014, Neil *et al.* 2018, Upham *et al.*

2015]). The notable difference could also derive from the varied methodological approaches and theoretical frameworks applied for analysis of the data.

A fundamental difference across articles was in claims of which ‘side’ is winning the debate over SGD. Whilst some authors contended that the anti-SGD groups’ framing of SGD is most effective and winning the debate in the UK (Bomberg 2017a, 2017b, Neil *et al.* 2018, Stephan 2017), others forwarded the exact opposite – that the pro-SGD actors’ rhetoric and characterisation of SGD is the dominant framing (Cotton *et al.* 2014, Hilson 2015, Nyberg *et al.* 2017, Upham *et al.* 2015). Although many articles offered an assessment of which actors or coalition had the more effective discoursing framing of SGD, ‘effectiveness’ was rarely operationalised. In most cases it seemed the assumption was that effectiveness and ‘winning the debate’ equated to frames that had resonance with the public, but only one of the articles collected data from the general public on their perceptions of the frames being analysed (Cotton 2015). All the articles contending the anti-SGD rhetoric is winning in discourse on this issue come from the last two years, whereas the articles contending the pro-SGD side is winning were published earlier. This, alongside the contention in some of the articles themselves that the debate has evolved over time (Bomberg 2017a, 2017b), offers evidence that discourse might be shifting more towards opposition to SGD.

Even if the anti-development side is winning the debate, however, this does not have a direct correlation with whether development will progress or not. Cotton *et al.* (2014) and Hilson (2015) both argue that whilst an anti-SGD discourse was present, the UK Government could (and did) simply disregard the opposing discourse. Although this might have been true in the early years of conversation on this topic, it seems this capacity to brush away opposition may be fading. Neil *et al.* (2018) and Jones *et al.* (2013) argue that opposition

and activist groups have used social media particularly effectively when spreading their messages about SGD, with Neil *et al.* further arguing, based on their time lag analysis, that anti-SGD groups have developed substantial capability to influence mainstream mass media reporting. Bomberg (2017a, 2017b) and Stephan (2017) draw attention to the incorporation of broadly-focused concerns into anti-SGD rhetoric as one factor supporting its success. Pro-SGD discourse focuses rather narrowly on a few specific economic benefits (and sometimes the questionable environmental benefit of reduced greenhouse gas emissions [see Greiner *et al.* 2018 on this topic]). In contrast, anti-SGD rhetoric and framing picks up environmental risks alongside concerns about trust in pro-SGD actors, procedural and distributive justice, and local issues (including a lack of democratic opportunity for local decision making on SGD).

In the most recently-published article captured in my review, nevertheless, Rattle *et al.* (2018, p. 238) point to substantial local resistance, but still note, ‘given the imbalance of power and resources between local and national players, it is likely the will of the national government will prevail’. The extent to which local resistance can affect the will of the government is unknown, although some Tory MPs have expressed concern over the Tory Government’s approach to SGD, particularly from a procedural justice standpoint (Vaughan 2018). Again, the scholars seem to have a range of perspectives on the capacity of public opposition to limit the Conservative party’s desire to facilitate shale gas development in England.

From all the authors writing on discourse and rhetoric in the UK, it is clear that the UK Government does not actively engage with or incorporate public framing of SGD into its own rhetoric on the issue. Nonetheless, it remains unclear which actor groups’ frames have

the greatest resonance with the public (e.g., Government, industry, anti-SGD non-profits, activists). Jaspal and Nerlich (2014) add welcome nuance to the conversation on effectiveness of competing SGD frames when they contend that no set of frames is holistically winning, but rather that certain frames are employed more frequently in different outlets, with some newspapers taking pro-SGD stances and others taking anti-SGD positions. Whilst this nuance exists *across* actors communicating about SGD, it was extremely rare *within* an actor. Amongst all fifteen articles, the only institutional actor mentioned who contributed to the SGD debate without a clearly pro- or anti-SGD perspective was the Church of England. The Church chronicled many concerns related to SGD including specific environmental and social effects as well as distributive and procedural justice consideration, but still stopped short of demanding no SGD (Hilson 2015).

In terms of the content of discourse and rhetoric on SGD, the authors were in greater agreement than on who was winning the debate. All acknowledged a dominant environment versus economics frame, similar to much discourse in the States (Jacquet *et al.* [this issue]). Many authors cited a local focus in anti-SGD discourse, but unlike in the States, this local discourse was not predominantly around social impacts of SGD (e.g., traffic, road quality, housing prices and availability, crime, community character, industrialisation), but primarily justice issues – for example, are residents near development being asked to shoulder too many risks with too few benefits, and do locals have enough opportunity to effect decision making (Bomberg 2017a, 2017b, Cotton *et al.* 2014, Szolucha 2018).

YouTube videos were the only public forum in which meaningful discussion of social impacts was chronicled – for example, via social and psychological threats to identity – but nearly all of these videos were created in the States (although, of course, they could be

viewed internationally) (Jaspal *et al.* 2014). (Stretesky *et al.* (2018) analyse social impacts by empirically examining crime rates in UK communities with conventional oil and gas development, but this is an analysis of the impacts themselves, and not discourse about them.) The lack of attention to social impacts in public discourse may be bifurcating and polarising the discourse more than is necessary, as Cotton (2015) revealed that social impacts of development were amongst the few topics on which all stakeholders and experts on SGD, coming from various perspectives, generally agreed.

Additional discourse content foci that the articles explored were: whether regulation is adequate or not (Pedersen 2015; this is covered heavily in the ‘planning and regulation’ section below), attention to green energy and international comparisons (Jaspal and Nerlich 2014), whether SGD is a novel or established technology, and whether the focus of SGD impacts should be at the local, national, or global scale (Hilson 2015). Pro- and anti-SGD factions each made use of the above frames, with pro-SGD actors using the frames of adequate regulation, SGD as greener than coal, positive economic impacts in the US, SGD as an established technology, and the national scale as the appropriate level of analysis. Anti-SGD actors framed SGD as lacking necessary regulation, a dirty fuel contributing to carbon emissions, having caused environmental contamination and health problems in the US, as a novel technology, and needing analysis of local and global impacts.

Specific mention of the ways in which pro- and anti-SGD actors dealt with the connection between SGD and carbon emissions arose in multiple articles. Nyberg *et al.* (2017) argue that due to proximate versus distal temporal framing, continued use of fossil fuels in the near term has greater resonance, whilst Bomberg (2017a) focuses on the strength of the anti-SGD frame of SGD leading to fossil fuel ‘lock in’. Upham *et al.* (2015) discuss the

heavy focus in newspaper reporting on how SGD is inconsistent with the UK Government's climate targets.

Taken together, the highly varied research on SGD discourse and rhetoric in the UK revealed a heavy focus on justice and local decision making and the problematic relationship between SGD and climate change. The authors seemed to universally agree that neither the local or climate change frames were reflected in UK Government discourse on SGD, but the authors took various positions on whether these frames were influencing public perspectives on SGD. The effects of SGD on climate change are debated as being negative or positive based on actors' positions on SGD. Nevertheless, the local concerns around procedural justice deficits and the need for local democracy and meaningful local decision making authority do not seem to have a competing pro-SGD frame.

If, as some authors contend (Bomberg 2017a, 2017b, Stephan 2017), the focus on procedural justice and local democracy has increased in SGD discourse over time, this could imply difficulty (if not disaster) for pro-SGD rhetoric, unless either: (1) meaningful local governance is afforded on SGD or (2) a convincing argument can be constructed for why such governance is not appropriate. Attention to local benefits will not fill this gap, as the procedural justice concerns are not about the impacts/ends of SGD, but rather the means/processes that lead to those ends. The failings of UK regulation on SGD from a procedural justice perspective were also a chief focus of articles in the 'planning and regulation' category.

C. Planning and regulation

Across the three categories of articles that emerged during my review (public perceptions, discourse and rhetoric, planning and regulation), the largest number fell into this final category – 23 articles. The magnitude of scholarship on the content, adequacy, implications of, and reasons for planning guidance, government policy, and regulation of SGD in the UK evinces how important planning and regulation have become in relation to the potential future for SGD or not in the UK. Whilst there is certainly robust scholarship on policy and regulation in association with SGD in the States, the prominence of this focus as a percentage of all social science inquiry on the topic is dwarfed by the scholarship in the UK. When compared to the US, Canada, and Australia, one reason the UK may have a relatively stronger focus on regulation and policy is that governance in the UK occurs at a national, as opposed to state or provincial, level.

The articles in this category did not exhibit the same methodological diversity as the articles on discourse and rhetoric; a majority of the planning and regulation articles derived their conclusions from review and analysis of current UK Government policies, regulation, and planning guidance (Cotton 2013, 2017, Evensen 2017, Hawkins 2015, Hays *et al.* 2015, Hill 2014, Johnstone *et al.* 2017, Jones *et al.* 2014a, 2014b, 2016, McGowan 2014, Patterson and McLean 2017, Reap 2015, Stokes 2016, Whitton *et al.* 2017, Whitton and Charnley-Parry 2018). Within this general approach, some additional means of analysis emerged: evaluation of policy in relation to ethical theory (Cotton 2013, 2017, Evensen 2017, Whitton and Charnley-Parry 2018), using census data and metadata on planning applications to analyse regulation strength (Reap 2015), and examining a range of political actions beyond regulation itself to understand the reasons for governance approaches (Johnstone *et al.* 2017, McGowan 2014).

Beyond analysis of current regulation and planning guidance, other methodological approaches included surveys with policy-relevant actors (Cairney *et al.* 2018, Ingold *et al.* 2017), interviews with key informants (Ochieng *et al.* 2015, Short and Szolucha 2017), field observations (Short and Szolucha 2017), qualitative comparative analysis across attributes potentially affecting regulation (van de Graaf *et al.* 2018), and analysis of planning applications and debates within a public inquiry on SGD (Bradshaw and Waite 2017). Additionally, half of the articles in my ‘planning and regulation’ sample compared the outcomes of regulation between the UK and another nation (the US, Switzerland, the Netherlands, or multiple European nations simultaneously). Although approaches to regulation do differ meaningfully across nations, the research generally found few differences in the content, concerns with, or adequacy of regulation cross-nationally (Cairney *et al.* 2017, Ingold *et al.* 2017, Patterson and McLean 2017, Reap 2015, Whitton *et al.* 2017).

In comparison to the discourse and rhetoric research, there was also substantially more agreement within the planning and regulation articles on key findings. Well over half of the articles offered notable critiques of the planning process. Jones *et al.* (2014b, 2016) argue the planning process is either flawed or weighted heavily in favour of development, and are supported by Hawkins (2015), Smythe and Haszeldine (2017), Reap (2015), Hays *et al.* (2015), and Hill (2014) who all point to specific gaps in extant regulation – especially insufficient protections for water, environment broadly, and human health. Hawkins (2015) characterises the regulatory system as a piecemeal compilation of regulations designed to deal with other issues and not well suited to regulating the various effects and processes associated with

SGD. Similarly, Stokes (2016) describes the UK Government using sometimes contradictory policy approaches to facilitate SGD.

Patterson and McLean (2017) critique the UK Government for stating that it endorses the precautionary principle, but then being reticent to apply that principle to SGD; likewise, Hays *et al.* (2015) point to the need for more effective use of ‘harm reduction strategies’ in SGD regulation. Multiple authors point to too little meaningful involvement in decision making for local residents living proximate to proposed development sites (Bradshaw and Waite 2017, Cotton 2013, 2017, Short and Szolucha 2017, Whitton *et al.* 2017). Whitton and Charnley-Parry (2018) point to some concerns for representation of public voice in decision making, but highlight other potential reasons for optimism. All of the research I cite here, nevertheless, was published before the recent written statement from the UK Secretary of State for Business, Energy, and Industrial Strategy, to the House of Commons and House of Lords (HCWS690 and HLWS671), on 17 May 2018, stating the government’s position to further centralise decision making on this issue (towards the government in Westminster and away from local authorities). The outcomes of this statement are yet to be seen, but the two current UK Government consultations on SGD suggest substantial movement towards centralised authority.

In comparison to the varied critiques, a single article within the sample of twenty-three characterised regulation as sufficient (Ochieng *et al.* 2015), asserting that the extant UK Government regulation is adequate for risks to be managed with best practices (this article does not, however, comment on the critique related to insufficiency of local democracy). The very strong indication that scholarship on planning and regulation views SGD policy as inadequate and deficient should give the UK Government pause in its adherence to high level

reports, such as those from The Royal Society (2012) and Public Health England (2014), which assert that current best practices and current legislation are enough for SGD to proceed. Bradshaw and Waite (2017), Whitton *et al.* (2017), and Short and Szolucha (2017) all make a convincing case that current planning regulations and guidance make it almost impossible for SGD to proceed with a ‘social licence to operate’ in the UK.

Beyond the attention to the inadequacy of current UK regulations, some articles in this category also sought in part to identify factors leading to the current UK policy on SGD. Linking the status of policy back to discourse, Cairney *et al.* (2017) and Ingold *et al.* (2017) offer coalition structure on SGD in the UK as a rationale for the state of both policy and (current lack of) development. Cairney *et al.* (2017) highlight the imbalanced coalition structure, with a single dominant coalition (the UK Government) that offers only tentative support for SGD. Ingold *et al.* (2017, p. 455) discuss how UK coalitions on SGD formed mainly through reliance on former contacts, as opposed to shared ideology, which leads to some fragmentation in the potential coalition that would ostensibly support SGD, because ‘actors with a right-conservative background and economic interests do not agree on policy measures to address hydraulic fracturing’.

McGowan (2014), in a comparison of regulation in EU nations and the United States, asserts that several factors were notably associated with role out or not of development across the countries: treatment of risk in regulatory culture, presence or lack of tax breaks, importance of energy security in that nation, and level of grassroots mobilisation. van de Graaf *et al.* (2018), in their analysis of sixteen European nations, contend that a concerned public and a ‘green’ government are sufficient for restrictive regulations to be promulgated for SGD. They view the level of concern in the UK as insufficient to incentivise restrictive

regulation (although the recent potentially growing opposition may affect this analysis). van de Graaf *et al.* (2018) also claim that lack of multilevel governance allows for permissive SGD regulation in the UK.

In their review of a range of political actions beyond specific legislation and regulation, Johnstone *et al.* (2017) explore how policy emerged in favour of SGD in the UK. They advance four strategies promoted by actors with power (i.e., the Conservative government and industry players with political influence) to keep a focus on fossil fuels and away from renewables. They cite:

1. 'Masking' (hiding the full costs of the approach, e.g., climate change),
2. 'Capture' (placing vested interests in decision making capacities, e.g., industry influence in the Cabinet Office, Treasury, DECC, and DEFRA),
3. 'Reinvention' (making an incumbent system seem innovative, e.g., citing the shale revolution from the States), and
4. 'Securitisation' (connecting the topic to national security; e.g., reduced dependence on Russian gas).

Although the Johnstone *et al.* (2017) analysis seems initially to conflict with the aforementioned coalition-based research, in that the former speaks of strong government support for SGD whilst the latter portrays tentative support, a reason for this difference might be that Johnstone *et al.* speak to earlier events (2010-2015) whereas the data from the coalition work comes from the end of this time frame (2014). Indeed, based on the current (September 2018) prolonged hesitation from the Department of Business, Energy and Industrial Strategy (BEIS) over granting final permission for SGD in Yorkshire, it does seem that government support for SGD is slowly and quietly being ratcheted down.

Additionally, the UK Government is composed of several entities who have authority over SGD and not all share exactly the same views; some of the more cautious actors within the UK Government seem to be picked up in the coalition-based research.

III. Synthesis and Future Directions

The foregoing review illustrates where the focus has been in UK research on SGD; this also clearly identifies which areas of inquiry have received minimal attention. We know a fair bit about public perceptions, discourse and rhetoric, and planning and regulation, but there is little understanding of the connections between these topics. How are public perceptions influenced by the discourse and rhetoric analysed in the articles in this review? Neither the public perceptions nor discourse and rhetoric articles have any data to offer on this question; the articles that do conjecture on this front disagree with each other. We know almost nothing about how mass media, political commentary, industry positions, environmental and anti-SGD group communication, and information provision generally affect public perspectives on development.

Beyond the effects of communication and information provision on public perceptions, we also understand little about where members of the public currently obtain their information on SGD. Research in the United States has shown strong differences in the public's propensity to trust various institutional actors communicating about SGD, typically with independent scientists trusted the most, industry and anti-SGD groups trusted the least, and government falling somewhere in between (Jacquet *et al.* [this issue], Theodori [this issue], Thomas *et al.* 2017b). There is notable regional variation, however (e.g., with industry having greater credibility in Texas, and universities benefiting less from trust in

Pennsylvania than New York). This suggests value in obtaining UK-specific data on trust in relevant actors who share information on SGD, and in examining this data for moderating effects of, for example, political affiliation and location of residence on ascribed trust.

In addition to gaps in what information on SGD people access and what information they are open to, the public perceptions articles discussed above reveal no convincing understanding of the ways in which magnitude of knowledge about SGD or specific knowledge content affect perceptions. One study included an embedded experiment to examine the effects of provision of additional knowledge on support for and opposition to SGD (Whitmarsh *et al.* 2015). Additional work employing similar methods could be useful in revealing communication and knowledge gaps on this topic and effective approaches to communicating about SGD. As highlighted earlier, the substantial percentage of UK residents undecided or uncommitted on SGD suggests both the value and potential effectiveness of additional communication, if coming from trusted sources and speaking to issues relevant to the audiences.

Although we have a fair understanding of the relationship between various demographic factors, a few key beliefs about SGD, and support for or opposition to SGD, we know little about how several other beliefs, shown to be important in the United States and elsewhere, affect support/opposition. Sense of place, place attachment, and social-psychological stress associated with development pressures have emerged as important factors shaping views on SGD in recent literature (Haggerty *et al.* [this issue]; Jacquet *et al.* [this issue], Seeliger *et al.* 2016). This is discussed in relation to Lancashire, UK, by Short and Szolucha (2017), but more investigation is needed to understand the potentially unique

ways in which connection to place in the UK conditions perspectives on and reactions to SGD.

We have an awareness that both scholars and the public think planning processes and regulation for SGD are inadequate, particularly from the perspective of procedural justice and local democratic decision making, but we know nothing about what the public think about non-planning government policies or processes (e.g., HM Treasury policy on the Shale Wealth Fund or the British Geological Survey [BGS] and Environment Agency [EA] meetings with the public in areas with SGD potential). Both the SGD industry and the UK Government have discussed various financial benefits they are planning to provide to communities to ostensibly incentivise development; we know nothing about how the public feels about such policies – in reporting on the topic these incentives have been variously described as windfalls or bribes. Similarly, we have no understanding of what the public knows or thinks about *specific* regulations (e.g., the ‘traffic light’ system for monitoring and controlling induced seismicity, chemical disclosure policies).

Thinking about the disciplines in social science broadly, there is a notable absence in the UK of any economic literature evaluating claims about the benefits associated with SGD (one article compares economics of SGD in the US with those broadly in Australia and Europe [De Silva *et al.* 2016]). Williams *et al.* (2017) report scepticism amongst their focus group participants about the purported economic benefits (e.g., from job creation in the gas sector, taxes collected, expansion of ancillary industries to support SGD in areas with development), but economists have yet to assess, in the peer-reviewed literature, the UK Government and industry claims (e.g., House of Lords 2014). Research in the States has repeatedly shown real economic development associated with SGD, but also that projections

of growth are consistently overestimated (Fry *et al.* 2015, Kinnaman 2011, Lee 2015, Melikoglu 2014, Paredes *et al.* 2015, Weber 2012). Particularly because members of the UK public seek equal scrutiny of ostensible economic benefits to the scrutiny that has been applied to assessing potential environmental risks (Williams *et al.* 2017), such economic analysis applied to the UK would be helpful. Of course, the most convincing analysis would compare realised results with predicted expectations, and this will only be possible after production has begun in England.

Beyond content-specific gaps in knowledge, the strong attention to public perceptions, discourse/rhetoric, and planning/regulation on national UK levels highlights the dearth of knowledge at local or regional levels, and particularly the lack of understanding of how findings compare across geographic scales. A few studies are situated in specific, locally-defined, geographic areas (Bradshaw and Waite 2017, Partridge *et al.* 2017, 2018, Short and Szolucha 2017, Thomas *et al.* 2017a, Williams *et al.* 2017), but none of these compare across geographic scales (e.g., local, regional, national) within the UK. A valuable direction for future inquiry in the UK would be a single study that systematically compares perceptions, knowledge, communication, rhetoric, and/or policy processes across local and national scales. How do the factors affecting support and opposition differ at each level? Which arguments and rhetorical devices are used at each scale; do they differ? Are the procedural and distributive justice concerns the same across geographic scales?

One geographic level that is notably neglected in UK SGD research is the sub-UK national level (i.e., research that focuses specifically on the nations with devolved governance capacity – Scotland, Wales, and Northern Ireland). Stephan (2017) focuses specifically on Scotland and Whitmarsh *et al.* (2015), Partridge *et al.* (2017, 2018), and Thomas *et al.* (2017a)

include regional populations from Wales in their studies; the other forty-six articles either include findings based on the UK broadly or England specifically. Because all three nations with devolved governance capacity have moratoria or bans on SGD, discourse, rhetoric, perceptions, planning guidance, and policy actions and instruments will be quite different in Scotland, Wales, and Northern Ireland. More attention to these nations within the UK, or perhaps even comparison across them, could be useful in highlighting the nuanced ways in which SGD is perceived, discussed, and regulated in the UK. Developments and discourse in the other three UK nations could also have meaningful implications for policy in England (e.g., how the public might respond to proposed policies and developments).

A form of geographical comparison that did surface was analysis of UK findings in relation to other nations. A number of studies, at least in the public perceptions and planning and regulation categories, included cross-national data, but only one (Szolucha 2018) compared local areas with prospects for development cross-nationally. Additionally, the studies cited herein only compare the UK with the US or European nations. The range of contexts for comparison is expanding (see Witt *et al.* [this issue] for a UK-Australia comparison, and Aczel [this issue] for a UK-France-Algeria comparison). Nevertheless, there could be both theoretical and empirical value in understanding the ways in which social, cultural, and policy processes operate similarly and differently on this contentious issue across more varied contexts. For example, research in South Africa, Mexico, and Argentina – developing nations where SGD is at a similar stage to the UK – could offer interesting comparisons in terms of social movement development, rhetorical positioning, procedural justice concerns, and rationales for public opposition or support (see Atkinson

[this issue], Finkelday [this issue], Andreasson [this issue], Ontiveros *et al* [this issue], Ibarzábal [this issue], Costie *et al.* [this issue]).

IV. Conclusion

This is an exciting time to be studying SGD in the UK. We are at a critical juncture in our understanding of public reaction and response to this contentious issue, where we are beginning to realise what we know and what questions we now need to ask. Because actual shale gas extraction has been so slow to occur, strong factions and discourse coalitions have formed, entrenched themselves, and taken up what are now standard rhetorical frames. Some of these frames, as well as the composition of discourse coalitions, may change once shale gas wells, rigs, trucks, and workers spread across the English landscape. With commercial extraction of shale gas predicted to commence in summer 2018, a potential shift in perceptions, relevant actors, and key topics of discussion in relation to SGD could be imminent. Once production commences, I expect one change to be increased attention to social impacts such as effects on community character and sense of place. Increased attention to these effects of SGD could actually be quite healthy, as it might draw discourse away from the tired, rhetorically entrenched, and completely unnuanced arguments about environmental risks and economics benefits.

I cautiously await the outcome of the two UK Government consultations on SGD. Both are written with the intention of centralising decision making authority on SGD in the UK. With the nearly universal academic critique of current planning guidance and regulation on SGD in the UK, the UK Government has the opportunity as it updates its regulations to address and rectify the deficiencies chronicled in the ‘planning and regulation’

section above. Nevertheless, if the UK Government ignores, and potentially even exacerbates, the perceived procedural deficiencies in regulation on SGD, this will only lead to a more contentious issue further stripped of public support.

Another policy development that will invariably impact perceptions of and discourse about SGD, but in unpredictable ways, will be 'Brexit' (the UK's exit from the European Union), which is slated to occur in March 2019. We still have very little concrete understanding of which energy policies or energy market transactions will be impacted and in what ways. Several public perceptions articles showed concerns about energy security to be powerfully linked to support for SGD; if the UK ends up in a situation where trade relationships change and tariffs are imposed on transactions with the EU, new discursive frames about energy security in relation to SGD will likely emerge.

The £8 million of funding from UK Research and Innovation (UKRI) will be an important conduit for increasing our understanding of discourse on, regulation of, and perceptions towards SGD. One and a half million pounds of this funding have been allocated for social science inquiry; funding is also explicitly earmarked to facilitate coordination between natural/physical science and social science researchers funded under this scheme. Such interdisciplinary findings and outputs should also advance knowledge of SGD in the UK. Finally, UKRI sought to fund research that examined the ways in which members of the public interacted with government, industry, and non-profit organisation actors over SGD. Understanding better the nature of these interactions and relationships will shed important light on: (1) approaches to and effectiveness of communication, (2) perceptions of trust, and (3) the ways in which different information sources are used to learn about SGD.

I have efforted to be as comprehensive and inclusive as possible in this review of social scientific research on unconventional hydrocarbons in the UK. Nevertheless, the anticipated developments of the next couple years could bring much change. I will be interested to see where the UK finds itself on this topic by 2020; I expect the magnitude of research on this topic only to continue to proliferate. I do hope research moves in at least some of the nuanced directions I have highlighted herein as potentially valuable. An update of this article in 2020 or 2021 would likely be both useful and revealing.

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