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In search of 'lost' knowledge and outsourced expertise in flood risk management

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This paper examines the parallel discourses of 'lost' local flood expertise and the growing use of commercial consultancies to outsource aspects of flood risk work. We critically examine the various claims and counter-claims about lost, local and external expertise in flood management, focusing on the aftermath of the 2007 floods in East Yorkshire, England. Drawing on interviews with consultants, drainage engineers and others, we caution against claims that privilege 'local' floods knowledge as 'good' and expert knowledge as somehow suspect. This paper urges carefulness in interpreting claims about local knowledge, arguing that it is important always to think instead of hybrid knowledge formations. We conclude by arguing that experiments in the co-production of flood risk knowledge need to be seen as part of a spectrum of ways for producing shared knowledge.

Key words flood risk management; local knowledge; expert knowledge; co-production of knowledge; consultants; outsourcing

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Introduction

> The farmers will tell you that the Environment Agency men on the ground, the people who are actually responsible for operating the pumping stations – they know what is required to be done. And they make dark noises about people sitting in offices with computer models, not knowing what the hell is going on. (Interview, rural group 1)

Much of England was affected by flooding during the summer of 2007. Heavy rainfall in May, June and July produced some of the highest monthly averages ever recorded. Of particular concern was the surface water flooding that affected large areas of East Yorkshire. This region contained good river and coastal flood protection but, as the events of 2007 revealed, there was insufficient drainage capacity to deal with surface water from heavy rainfall on such a scale. In the city of Hull over 8600 homes were flooded and more than 20 000 residents affected (Coulthard and Frostick 2010; Walker *et al.* 2011). A further 6000 households were flooded in the surrounding East Yorkshire local authority area (East Riding of Yorkshire Council 2008). In terms of the flood's impact, this was the UK's largest surface water flooding event on record.

Reports were commissioned at both local (e.g. Coulthard *et al.* 2007; East Riding of Yorkshire Council 2008) and national levels (Pitt 2008). Among the concerns expressed in these reports was the need to make better use of local expertise. In particular this concern focused on claims that the impact of the flooding was exacerbated by the loss of engineers on the ground with high levels of relevant local knowledge and experience. These post-flood inquiries showed that since the privatisation of the water industry in 1989 many local authorities had shed or not replaced retiring drainage engineers, suggesting a loss of local expertise and accumulated historical knowledge about how local drainage systems operated. This lost knowledge included the location and capacity of some of the underground sewers and culverts, as well as known trouble spots and pinch-points in the drainage system. While some detailed local knowledge remained in records, often it was partial, personal and not widely shared among the various flood protection agencies that formed post-privatisation. In the case of Hull and East Yorkshire for instance, it emerged that there was no comprehensive, accurate and up-to-date map of the area's drainage network. The implications of this were profound. During the Hull flood inquiry, retired engineers argued that this lost knowledge meant that actions that could have been taken during the 2007 floods were not, or were taken later than they might have been (Coulthard *et al.* 2007; Coulthard and Frostick 2010).

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Set up as a rhetorical counterfoil was the often expressed view that the loss of local expertise had been paralleled by the growing tendency of key agencies in the sector to outsource their work to specialist national and international environmental consultancies. These consultancies have become increasingly involved in producing complex numerical flood risk models, site surveys, project design and constructing flood protection works (Landström *et al.* 2011b). The use of consultants also emerged as a source of discontent following the 2007 floods, as they were said to be expensive and less knowledgeable than local experts (*Yorkshire Post* 2010).

Influenced by recommendations made in the 2008 Pitt Report and the need to meet the requirements of the recently introduced European flooding directive, a new Flood and Water Management Act came into force in 2010. The Act provided improved clarity over responsibilities for flooding issues and strengthened systems for coordination across relevant flood-related agencies. Local authorities were formally designated as the lead authorities for overseeing the flood policy work of local partners. Recognising the skills gaps at the local level, recommendation 19 of the Pitt Report promoted auditing and strengthening technical training for drainage engineers. A series of measures were introduced to improve training for those already within the system and to provide graduate training schemes for new entrants (DEFRA 2012, 20).

In the winter of 2013–2014, the Somerset Levels in England experienced a prolonged flood event, quickly turning into a major national media event. The Somerset Levels cover a large area of flat, reclaimed agricultural land heavily dependent on a system of pumped drainage channels dating mainly from the mid-nineteenth century. Similar to the 2007 floods in East Yorkshire, a narrative emerged contrasting local and expert knowledge, as local farmers and residents argued that the floods had been made worse by a reduced drain clearance regime imposed by national agencies (Haughton *et al.* 2014; Rose 2014). The Prime Minister was drawn into what quickly became a high-profile media debate, promising to instigate a new programme of drain clearance, despite the considered view of the Environment Agency and other experts that this would have only limited impact (Fitzpatrick 2014). The minister responsible for coordinating government actions went on TV to argue that the government had been wrong to listen to 'so-called experts'. Dutch drainage engineers were summoned to meet government ministers about what should be done, fuelling the notion that there was something lacking in British expertise (Carrington 2014; Haughton *et al.* 2014).

Disputes about local, lay, expert and international sources of expertise quickly began to play out in the media, in turn influencing national policy. In covering science controversies the news media typically try to identify alternative views in a quest for balance in their coverage, a practice that has been criticised for producing indirect bias when different views are presented as having equal validity (Boykoff and Boykoff 2004). In the case of the Somerset Levels flooding, one consequence was a 'dumbing-down of the debate on … flood risk management to a binary choice of "to dredge or not to dredge"' (Fitzpatrick 2014), reflecting long-standing concerns that the tendency to privilege local knowledge over expert knowledge can lead to poor policy (Lidskog 2008). This recent episode demonstrates how accounts of local and expert knowledge being in conflict persist in flood discourse in England, influencing policy at both local and national level.

The problematic nature of binary accounts of 'universal' scientific knowledge and local lay knowledge is used by Lane *et al.* (2011) to help situate the innovative nature of their own engagement with new ways of co-producing flood risk knowledge in Pickering, North Yorkshire. This novel experiment in bringing together expert and lay knowledge to produce an novel intervention is at the leading edge of co-producing flood knowledge. But as this paper reveals, there are other methods in circulation for producing shared flood knowledge, accelerated by the recommendations of the Pitt Report. This has led to a situation where hybrid knowledge production practices have fast become pervasive on the ground, yet debates about flood risk knowledge continue to rely on tropes such as 'local knowledge'. In this paper we set out to unpick the credibility of claims around different types of flood risk knowledge and how these feed into public debates about flood policy. In particular we focus on constructions of local knowledge, lost knowledge and different types of scientific knowledge, and how the selective deployment of such terms came to be used to privilege certain types of knowledge over others, sometimes in quite problematic ways.

The research team was interdisciplinary, comprising a human geographer/planner, a historian and a physical geographer, who between them conducted all the interviews. All three authors were involved in the post-floods policy work in East Yorkshire, two serving on the Hull independent review of floods and two serving on the advisory committee overseeing work on surface water flooding in the city. This engagement helped in framing the initial research questions and influenced our choice of respondents. It may also have encouraged some of our respondents to agree to being interviewed and to open up to us.

Interviews were undertaken between 2009 and 2013 with leading figures engaged in flood risk management, from the national through to local scales. The 42 individuals interviewed included a minister with responsibility for flood issues, Members of Parliament, national statutory and regulatory authorities, consultants,

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drainage engineers and the insurance industry. Also included were regional bodies, water company representatives, local politicians and officials, community flood groups, internal drainage boards, local media and blue light rescue services. All the interviews were transcribed, then analysed to identify key themes. We also undertook archival research into the history of flood policy in East Yorkshire. There was a clear geographical focus on East Yorkshire, linked to the floods there in 2007 and the changes that followed. The two local authority areas covered, Hull and the East Riding of Yorkshire, are among the ten local authorities with most properties at risk of flooding in England (Environment Agency 2009).

The next section of this paper seeks to locate claims about lost local knowledge and outsourced expertise in relation to recent academic debates around environmental controversies and the construction of local knowledge. This is followed by an overview of the evolution of flood risk governance and the major actors involved. The empirical sections start by unpacking claims about lost local knowledge and outsourced expertise, followed by a case study of Burstwick Drain as an example of the messy configuration of local flood knowledge.

Knowledge controversies, credibility claims and hybrid knowledge practices

There is a rich debate already about knowledge controversies and the construction of credibility claims that seek to privilege certain types of knowledge over others. Such claims are often rhetorically cast by contrasting different forms of knowledge against each other, drawing on popular tropes and sentiments, such as distrust of distant experts and government officials (Clark and Murdoch 1997; Petts and Brooks 2006). This distrust reflects a wider societal shift, with the privileged position of the techno-rational expert being challenged, as the selectivities involved in how scientific work is framed and conducted are increasingly opened up to critical scrutiny (Eden *et al.* 2006; Irwin 1995; Wynne 1992 1993).

There have been considerable attempts over recent years to improve public engagement in science policy development and to bridge the gap between expert and lay knowledge (Lidskog 2008; Petts and Brooks 2006). However, success has been partial, with claims that lay and expert knowledge are in opposition still in wide circulation. This tendency to place particular knowledge forms into specific categories (e.g. local, lay, expert, scientific) is itself problematic, since it tends to reify particular forms of knowledge, which are then presented as having qualities that are somehow fixed, certain and worth privileging (Clark and Murdoch 1997). There is a fundamental problem here that these labels can be misleading: local or lay experts may also be technical experts for instance (Petts and Brooks 2006). But there are dangers too that those dismissing particular forms of knowledge as somehow less reliable or valuable miss out on the insights that come from such sources. Until quite recently, for instance, official agencies tended to be dismissive of local flood information and knowledge (Brown and Damery 2002).

One explanation for such stand-offs is that professional experts and lay interest groups may be using fundamentally different knowledge frames, drawing on different types of information (e.g. Irwin 1995; Wynne 1992 1993). A well-known example revealed how Cumbrian farmers and external experts saw the problems of radiation fallout post-Chernobyl in very different ways, requiring an analytical focus sensitive towards these different knowledge framings (Wynne 1992). Of particular relevance to the subject of this paper has been work on the different understandings of nature–human relationships and the consequent differing preferred approaches to wetland conservation of farmers and conservationist bodies (Burgess *et al.* 2000; Clark and Murdoch 1997).

This emerging body of work has helped move our understanding beyond early accounts of local knowledge, which sometimes presented a romanticised view of the role of communities in creating and stewarding situated knowledge, while tending to present an oversimplified version of state knowledge as its antithetical opposite, a form of remote, expert knowledge that overrides local knowledge (Robbins 2000). Taking issue with such accounts, Robbins (2000, 142) argues that it is more productive to see the state as a 'fractured knowledge production machine' that participates in alliances on the ground rather than a monolithic entity that imposes its will on others. This perspective usefully signals the need for a better understanding of how expert and lay knowledge intersect in concrete contexts, challenging accounts constructed around false binaries and an incomplete appreciation of the complexity of knowledge formation practices.

The dynamic nature of knowledge formation practices is strongly evident in English flood risk management, which until recently remained a largely science-driven policy arena drawing on expertise in the various regulatory agencies, particularly the Environment Agency, local government, the academic community and increasingly commercial consultancies. Attempts to engage with local communities have only gained substantial momentum in the past decade or so, as a result of official reports into major flood events calling on officials to work better with local people, for instance assisting high-risk communities to improve their preparedness (Brown and Damery 2002; Butler and Pigeon 2011; Johnson *et al.* 2005).

Local flood knowledge is not simply the preserve of communities and lay people, however: it can also be

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found in different professions operating at the local level. It is important to note that the construction of particular types of scientific knowledge as 'local' is different to how local knowledge is normally portrayed in academic debates, where 'local knowledge' is typically attributed to lay experts, such as farmers and residents (Irwin 1995; Wynne 1993). This distinction between local and remote practices of scientific knowledge proved to be an important aspect of the knowledge claims made in flood risk debates.

Claims about 'local' scientific knowledge reflected tensions around different types of flood risk science, in particular the way in which the former pivotal position of drainage engineers has been challenged in recent years by the rise of numerical modelling. Flood risk modelling has become increasingly important to policymakers, generating detailed forecasts that can predict with increasing accuracy the probability of inundation and the likely magnitude of floods (Porter and Demeritt 2012). White (2013) usefully charts how such knowledge is still fast evolving, with earlier models leading to what he refers to as an era of false precision in flood prediction, as demonstrated by rapidly escalating official estimates of properties at risk from surface water flooding over the past decade in response to growing awareness of this issue.

Recent years have seen a series of attempts to improve the interaction of the scientists involved in flood risk work and the communities they serve, initially mainly to improve communication. More recently, however, there has been a more fundamental shift towards recognising that some of the historic gaps in flood risk information might be filled by asking communities for their input (see for instance the Environment Agency-sponsored work on the Lower Severn; http://www2.glos.ac.uk/severnfloods/MajorFloods.htm). In addition there have been attempts to achieve a better integration of scientific knowledge with local knowledge and expertise. This has resulted in some high-profile attempts to co-produce flood risk knowledge (Landström *et al.* 2011a; Lane *et al.* 2011; Odoni and Lane 2010; Ryedale Flood Research Group 2008; Whatmore 2013). It is also increasingly common practice for expert technical reports to draw on local expertise in various ways, from sourcing data to checking facts and interpretation (Landström *et al.* 2011b; Wilby and Keenan 2012).

These recent moves towards sharing knowledge are important advances in flood risk management, which at one level would appear to meet calls for the development of hybrid knowledges (Clark and Murdoch 1997). However, as the events in East Yorkshire in the 2007 and the 2014 flood events in Somerset both revealed, in times of crisis public debate and media coverage of flooding remains shaped by powerful claims to privileged knowledge.

In conclusion, this research addresses three questions. What factors led to a claimed loss of local flood risk expertise and the growing outsourcing of design and technical expertise to commercial consultancy companies? How are notions of local and expert knowledge being defined and circulated within flood risk management debates as a result of this process? And finally, how have local actors responded to reports calling on them to share their knowledge more openly?

Fragmented flood risk governance

There have been significant changes to the governance of flood policy over the past three decades (e.g. Butler and Pigeon 2011; Johnson *et al.* 2005), aspects of which are briefly outlined here. Working alongside regional water authorities, local authorities remained important agents in maintaining local drainage systems until the late 1980s, with many having expansive drainage departments involved in direct works – sometimes also working under contract to regional water authorities. Internal Drainage Boards play a crucial role in agricultural drainage in lowland areas, operating on local taxes and precepts on landowners (Bankoff 2013). There are currently around 120 Internal Drainage Boards in England, covering 9.7 per cent of the most flood-prone land area of England (Association of Drainage Authorities 2013). A rich web of local and regional knowledge grew around the resulting flood defence and drainage systems, vested particularly in the regional water authorities, local governments and the Internal Drainage Boards.

In 1989 the regional water authorities responsible for providing clean water and sewerage provision were privatised. In addition to responsibility for providing clean water to homes and businesses, the new private companies were given responsibility for much of the drain and sewerage network, while the regulatory functions of the former regional water authorities were separated out and given to independent regulatory bodies (Haughton 1998).

Responsibility for environmental regulation became primarily the responsibility of the National Rivers Authority (later restructured to become the Environment Agency) and the Drinking Water Inspectorate. The Environment Agency is now the national lead agency for floods policy and also has responsibility for flood work on coasts and Critical Ordinary Watercourses, covering main rivers and main agricultural drains. The Office for Water Regulation (OFWAT) was created to provide economic regulation of the water companies. This regulatory oversight covers flooding related to sewage systems, including these systems becoming surcharged or full beyond capacity.

A combination of local government restructuring since the 1970s and water industry privatisation meant that local authorities gradually lost many of their statutory drainage responsibilities, albeit retaining responsibilities for highway drainage and for local waterways not overseen by the Environment Agency. A

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certain level of drainage engineering expertise was required to ensure that planning and building work approvals included appropriate network connections. Nevertheless, many local authorities began to reduce dramatically their specialist staff working on drainage issues. By 2007 many local authorities, including Hull, no longer had a specific drainage section or even a single post dedicated to drainage and flooding issues. Some of the work such as cleaning road gullies was put out to tender, in line with the New Public Management philosophy of the 1980s and 1990s, which encouraged local authorities to contract out for much of their delivery work. However, the picture was hugely variable, with some authorities managing to find ways of continuing to support in-house expertise.

The regional water boards and later the privatised water companies recruited some of the former local authority engineers, while also buying-in specialist expertise from consultancies, particularly for numerical modelling. The Environment Agency also began to transform its working practices from the 1990s, increasingly drawing on sub-contracted expertise from universities and international consultancy bodies. In the case of building flood defences, this was an extension of existing practices, while the rise of sub-contracted work on numerical modelling reflected changing government policy to provide probability-based flood risk maps for decisionmakers and the public (Landström *et al*. 2011b; Porter and Demeritt 2012).

It should be added here that outsourcing was not new to the water sector; private companies had often been contracted in to build new drainage systems. However, the scale and the extent of outsourcing increased significantly with the restructuring that followed privatisation. One consequence of privatisation has been increased regulatory, public, media and political scrutiny of those responsible for devising and implementing water and floods policy (Escobar and Demeritt 2014; Haughton 1998).

The Internal Drainage Boards have operated largely outside of this framework. Though happy to contract out aspects of their maintenance work to local contractors, Internal Drainage Boards were the one part of the system not radically overhauled in recent years. While they undoubtedly faced pressure to achieve greater efficiencies and have accordingly responded through mergers, alliances and the pooling of expensive equipment, they appear to have retained much of their distinctive, locally rooted ways of operating. This was to prove a key source of tension following the 2007 floods, when Internal Drainage Boards were upheld by local communities and some politicians as repositories of historically embedded knowledge involving tried and tested practices, while the Environment Agency was criticised for reducing its drainage engineer capacity while becoming increasingly reliant on outsourcing work to consultancies. A frequent concern in rural communities, evident in 2007 in East Yorkshire and again in 2014 in Somerset, was that the new waterway maintenance regime instituted by the Environment Agency to help protect wildlife habitats typically involved less frequent cleaning of rivers and agricultural drains, which some locals felt increased flood risk (Rose 2014).

In search of lost local knowledge

For the majority of those we interviewed, there was a definite feeling that local drainage engineer capacity had been lost and that this was to the detriment of the system as a whole, in terms of both flood preparedness and response. This 'old school' techno-scientific form of expertise was valued on two counts. First for its grounding in local drainage networks, linked to on-the-job training that saw knowledge passed across generations; and, second, for the more stable and holistic working practices that had once prevailed, especially compared with the current 'project management' approach involving external consultants sometimes lacking experience in the field. One interviewee succinctly outlined the difference:

> A lot of local authorities and a lot of people at the Environment Agency now employ engineers who have very limited practical experience of actually building things. They can fill in forms and they can tell you what the catchment area of a particular watercourse is. But what happens is they then hand it over to a consultant engineer for design.

> I spent from 1972–1986 as a site engineer basically, initially designing and building, but latterly building flood defence schemes, outfalls at pumping stations, those sorts of things ... When I started at the Rivers Authority, we had our own men, our own plans, and basically as an engineer, I was in charge of the site ... It's not like that anymore; it's all contract workers, outside consultants, designing the scheme. (Interview: retired drainage engineer)

While engaging and mobilising community capacity is now often recognised as an important factor in flood risk policy, less attention has been paid to the extent that regional water utilities and municipal government are also repositories of local knowledge. We identify two ways in which this institutional knowledge exists and circulates. First, in the form of the records and maps stored (or lost) in the recesses of archives; and, second, in the experience and conversations of former and present employees.

The loss of a detailed record of local drainage systems was often presented as particularly problematic. In the 2007 Hull and East Yorkshire floods, different bodies (Environment Agency, water utility and Local Authorities) were responsible for different parts of the flood and drainage network (Coulthard *et al*. 2007; Coulthard and Frostick 2010). Sometimes organisations simply refused to share their records; on other occasions, it was more a matter of not passing

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over records when responsibilities changed between institutions. We were told, too, that records were often destroyed when local authorities moved office or when their changed responsibilities meant they could no longer justify storing old paper files in scarce office space. There were also suspicions that some retiring engineers treated their records more as personal property and took them with them when they left.

The interviews also revealed that the loss of local knowledge was not simply a recent phenomenon, with gaps in local records long-standing due to very patchy approaches to record keeping and filing. In many offices, it appears there was no explicit requirement for maintaining detailed records, updated and shared across individuals or departments even within the same organisation. As a few interviewees noted, sometimes this situation arose from individuals attempting to retain power, as well as a lack of time or incentive to record data. Particularly when concerns about redundancy were in the air, rightly or wrongly, knowledge might have been seen as a source of power and not necessarily shared readily or unconditionally.

Attempts were made to address this problem in the early 2000s when the government asked local actors to come together to create multi-agency flood plans for their areas. A regulator involved in one of the first of these plans provided a detailed account of how he and his colleagues in some of the other agencies decided to create more detailed permanent records at that time:

> So really, going back to that multi-agency plan ... we said 'look, let's download our brains, let's get as much captured'. And people said 'why are you doing this – I don't need this'. But what we were doing was actually downloading people's brains for the future generations – that was one of the concepts that we were trying to tackle. You know, get it on paper – it might seem stupid to somebody who has been working on it for 40 years, but at least it's there for future generations ... From my point of view, I downloaded all the bits I knew about the flood defences. If this overtopped, this could happen. It could overtop, it could breach – and if it could, what were the consequences? That sort of basic stuff – it was all very simple stuff. And what was the risk of it happening? Was it high risk or was it low risk? (Interview Regulator 6)

More coordinated attempts to codify historical and contemporary knowledge emerged from this period. It is also worth noting that while some drainage engineers did indeed retire and take with them their knowledge and in some cases their records, others simply moved to other jobs within the flood policy community. Interviewees sometimes noted that they and others may have left a local authority, for instance, only to be employed later in other parts of the network – the water authorities or the Environment Agency or consultancies. Sometimes, however, individuals did move area or sector with a consequent loss of their 'local' knowledge, at least for a while, but this was not to say it would not reappear at some later point in time enriched by the experience of working elsewhere.

In fact, not everyone was convinced by the arguments that local expertise had been lost to calamitous effect, with several of our interviewees arguing that local drainage engineers continued to be locally important, employed within the water company, the Environment Agency and, of course, Internal Drainage Boards. They may have become less numerous or less dominant as the source of authoritative advice on flood risk, but provided you knew where to look, it was argued, this expertise still existed. One of those involved in the Gold Command incident room in Hull during the 2007 floods, for instance, told us how impressed he and his colleagues had been by Environment Agency duty officers:

> They are very experienced and their knowledge of different levels that occur in the different drains and how long it takes a certain amount of rainfall to reach into the drains and how it will affect it. They relied an awful lot on historical knowledge and it was very good. It was tremendous to see. (Interview: Emergency services 1)

Nonetheless there was widespread acceptance that, before the 2007 floods, information had not been widely shared between different agencies. For some interviewees one major cause was privatisation, with the private water company held to be reluctant to share its information, variously attributed to either data confidentiality in case it was commercially valuable or to incurring the unwanted attention of regulatory authorities. This situation changed dramatically following the Pitt Report, which made a series of recommendations for all the key actors to develop asset registers allied to a duty to share. These were quickly acted on, becoming widespread practice even before the Flood and Water Management Act (2010) was passed. As one Environment Agency worker told us:

> It's been a partnership effect to get there – I mean some of it has come from the Internal Drainage Boards, some of it has come from local landowners, some of it has come from the knowledge we have got, not just within our kind of asset teams, management teams, but also, you know, where Planning Applications have been submitted and large areas have been culverted and then never documented elsewhere. And a large part of knowledge has come from Yorkshire Water and East Riding [local authority], so everyone obviously has bits of records about their own kind of sections and things like that, but there was never a joint kind of map, mapping everything out. And that has been quite an achievement actually. (Interview Regulator 8)

The advantages of this new approach quickly became apparent to those involved. The detailed plotting of individual floods on to shared GIS made identifying any clustering of events much easier. It also encouraged the parties involved to seek common causal factors and the

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joint resolution of any issues rather than treating each event as an individual, one-off problem. What we begin to see here is that while some local knowledge has been lost, much still remains in circulation.

The arguments for and against outsourcing expertise

Recent research has highlighted the rise of a cadre of experts in consultancies, universities and elsewhere who make a living by identifying best practice solutions to particular problems and selling these around the world (McCann and Ward 2011; Peck and Theodore 2010). In the water industry specifically, studies have shown how the opening of water markets to international competition has been accompanied by the rise of experts offering their services (Haughton 2002; Larner and Laurie 2010). Rather than simply accepting such outsourcing as good or bad, in our interviews we sought to encourage reflections on the merits and problems that come when heavy reliance on outsourced expertise becomes the norm.

For many of those involved, outsourcing was not seen as a problem:

> Consultants have always been used in the water sector. I think there has been a time during the '70s and '80s when in-house technical expertise peaked. What does help is that some of the numerical modelling is difficult to resource if you are not sufficiently sized. Some of it can get quite complicated, so I see that as a benefit . . . We regulate on the basis of outputs. How they deliver is not an immediate concern to us. (Interview Regulator 1)

> I don't get any sense that the Agency is uncomfortable with the use of consultants in the way that we do it now . . . So there isn't much modelling skill, it's mostly with the consultants. (Interview Regulator 2)

These quotes reveal how both regulatory authorities appeared to be comfortable with outsourcing work to consultancy companies as a broad principle.

Our interviews also revealed how some of those most concerned about the loss of drainage expertise and the rise of remote experts typically qualified their comments when they were asked to set out the pros and cons of both sets of expertise. Indeed, many of the drainage engineers we spoke to were quite critical about the limits of earlier approaches, which they admitted were less good at dealing with catchment issues and relied too heavily on assumptions about historical patterns repeating themselves.

One of the drainage engineers we interviewed illustrated this well by talking about the experience of his colleagues in Carlisle:

> They were showing these theoretical maps and they were going to public meetings, and all the public, the experts, the locals, you know, were saying 'aye, it'll never happen – we have lived here 40 years, that won't happen'. And then, lo and behold, the 2005 flood came and . . . it virtually mirrored the actual theoretical outline. So after that they were all 'yes, we believe you now – give us a flood defence, tomorrow'. (Interview Regulator 6)

The two types of expertise increasingly emerged from our interviews as complementary, addressing different scales of problem. The numerical modellers were accepted as particularly expert in catchment-level issues, while drainage engineers remained pre-eminent in their knowledge of the intricacies of specific drainage systems at the local level. The underlying concern appeared to be that outsourced expertise is not necessarily well-versed in local issues and that consultants are typically not locally rooted, of necessity moving on from job to job.

In November 2010 these tensions spilled into the regional press, with the Yorkshire Post carrying a story in which farmers and a local MP criticised the Environment Agency for spending over £30million since 2005 on external experts. Farmers argued that much of this advice was freely available if the Environment Agency had asked the local experts, the farmers themselves. The Environment Agency representative interviewed in the report responded sympathetically, but also noted: 'There is a big difference between local anecdote and local data. If you are drawing up a £10million flood defence scheme you cannot do that on the back of anecdote – you need more science' (*Yorkshire Post* 2 November 2010). It is noticeable here how both farmers and the Environment Agency jockey for advantage through stressing their claims to being identified as possessors of 'local' knowledge.

For routine building and maintenance work, our interviewees generally acknowledged that the benefits of outsourcing included cost efficiencies as contractors could afford specialist equipment and spread the overhead costs of this across different contracts.

> But, you know, we hear of the days of when it was the Water Board and things, and Agency yards full of machines and people and this and that, and they don't have . . . they are not staffed up to the sort of levels. So that sort of service has diminished unless it is contracted out. But on the other side, if you look at modern management, people who specialise in particular trades sometimes could do it more effectively and more efficiently than doing it yourself. (Interview Infrastructure Provider 3)

> You can pull in lots of different skills which you probably can't afford to employ in-house because there isn't enough work, and you can switch on and switch off, so if work suddenly disappears you've not got someone idle on your hands. (Interview, Local Authority 4)

Consultants, many of them former engineers in the water companies, regulatory authorities and local

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authorities, valued their ability to work creatively to find the best solutions for their clients, building up and sharing knowledge in-house and, through engaging with professional bodies and conferences, putting into practice some of the strategies referred to in the recent policy mobilities literature (e.g. Peck and Theodore 2010). One consultant felt that competition between different consultancies raised standards generally and helped spread innovative ideas:

> I can only talk about the engineering side of things, but I feel as though setting competitively one consultant up against another consultant is a good way of forcing us all to try and do things better, to try and do things efficiently and to try to push the game on to develop new ideas that are attractive and represent better solutions and better value for money. (Interview Consultant 1)

Some of our interviewees were less sanguine, however, pointing to the risk that consultants might simply replicate approaches they had developed for other localities without adequately sensitising them to local conditions, or that they might build up a bank of local knowledge only to take it with them at the end of the contract. While some of these concerns could be met by designing better contracts, it was acknowledged that sometimes this was not done. In general, in local authorities as elsewhere, there was recognition of the balance of positives and negatives that came from work being outsourced:

> If it's contracted out you can have a consultant that has established themselves as an expert nationwide in producing these documents. So they've got knowledge and experience of what has worked elsewhere which they can then draw on to assist them with doing something locally. So that's clearly a benefit because if you're one local authority or two local authorities working collectively and you only produce one of these, you're not going to be that great at it because it is the first time you have done one.
>
> ... The one disadvantage is often they won't understand the issues locally ... [therefore you need] someone in the council that's got that local understanding and knows enough about the technical elements of what the piece of work is about. (Interview Local Authority 1)

This was a recurrent theme: to work well the contracting body had to have enough in-house expertise to act as 'an intelligent client'. Where this was lacking there were heightened risks of consultants producing poor quality work to a poor specification, or of being offered 'off-the-shelf' advice rather than bespoke solutions. Others, too, expressed concern about organisations that had lost their technical expertise and defaulted to being what were sometimes dismissively referred to as 'project managers':

> Well my experience with the Environment Agency is not good. They are an organisation of administrators; they rely on consultants for nearly everything. The consultant in my opinion has a vested interest in keeping to be consulted. He will almost 'do as they say' is my opinion. (Interview Community Floods Group)

The concern that consultants would default to giving easy answers that clients wanted to hear in order to generate repeat business rather than challenge them was voiced more than once. Alternatively, speaking to consultants, they valued their independence and prided themselves on working with clients to ensure that good project briefs were developed before work started and that work was then carried out to a high standard. For those we spoke to reputation was crucial in helping to generate repeat business.

Since even the best consultants can make mistakes, an intelligent client was felt to be essential:

> I think it leaves us vulnerable. The majority of people who are project managing the consultants are utterly reliant on the skill of the consultant teams. ... [When you have project managers] who are generally fit, bright, but young, who don't have much real-world experience, not only do they not have some of those skills, but they don't have the skills to be able to eyeball and spot if there is a mistake. (Interview Regulator 2)

This lack of real-world experience was addressed in multiple ways, including employing another consultancy firm to verify the work of the main consultant, or establishing steering committees to oversee projects that included people from partner organisations who brought with them some of the necessary technical expertise and local knowledge. Consultancy firms now increasingly value and come to rely on accessing such expertise to make sure their models better match local reality. As one consultant told us of some work they had recently undertaken:

> What that shows up is that the model, the assumptions made in the model for those instances, weren't right. Because [different stakeholder representatives were] saying this doesn't match with what we found, which shows us that the mathematical side of things there don't tally up. ... This is where the experience becomes very important. (Interview Consultant 1)

There are other ways of developing stronger relationships between consultancies and those who commission the work, not least the use of five-year frameworks, used by both water companies and the Environment Agency (Landström *et al.* 2011b). These frameworks create a panel of preferred contractors who once selected can be contracted in quickly for individual projects as required. This brings a level of continuity and certainty in work for the consultancies and allows the contracting institution to set out clear expectations for how contractors work. As one infrastructure provider told us:

> we go through a really lengthy process to ensure that who is on that framework are quality people, an extended arm of

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> the business and drive things forward and they are specialists in certain fields. (Interview: Infrastructure Provider 1)

The five-year time periods allow the portfolio of contractor companies to be periodically refreshed, and also in the case of water companies reflect the five-year Asset Management Plan (AMP) investment cycles that they must operate to. The AMPs are a requirement of OFWAT, the economic regulator, keen to ensure that investment is closely monitored to ensure there is no 'gold-plating', that is unnecessarily high investments that raise costs for consumers. For Yorkshire Water the frameworks agreement have been used to persuade contractors to share their knowledge and innovations with each other.

We encountered another way in which flood risk knowledge is sometimes lost or re-circulated. In construction work the AMP cycle means that there is a lot of design work in years one and two, as new projects come on-stream, but much less in year five as work is focused on completion and new projects have yet to be commissioned. As a result:

> you do lose a huge amount of knowledge every fifth year and that's one of the concerns with the whole subcontracting model is that the people would be building up five, ten, fifteen, twenty, thirty years knowledge actually get to four and a half years and you struggle to try and keep it going on because they'll go and do something else if they can. They'll go and work in a different area or different type of utility . . . Let's not butter it up, they are being made redundant. . .
>
> Interviewer: It's a product of the regulatory regime really.
>
> Yes it is, absolutely. (Consultant 2)

Contested knowledges at Burstwick Drain

Within our study area, Burstwick Drain in rural East Yorkshire came to be a scene of conflict over flood science and competing claims to local knowledge between a rural community at risk and Environment Agency officials.

Burstwick Drain was over-topped during the 2007 floods, inundating a substantial number of residential properties in Burstwick, a village eight miles to the east of Hull. During and immediately after the 2007 flood, bitter recriminations emerged about the maintenance of the open drain. For some time local farmers had been concerned that agricultural drains in the area were not being cleared deeply or frequently enough. The Environment Agency in particular was blamed for this. To some extent, this conflict can be explained in terms of different framings of nature (Burgess *et al.* 2000), with the Environment Agency seen as having gone too far to protect nature and not doing enough to protect local communities. But the issues in Burstwick became particularly emotionally charged because of the experiences of those whose homes were flooded.

A number of factors helped fuel the disagreement. Residents and farmers branded the Environment Agency as outsiders who lacked local experience and the consultants they hired as demonstrably wrong despite their qualifications and their sophisticated methods. Examples circulated that some of the Environment Agency modelling data on topography was inaccurate for instance. The working practices of the Internal Drainage Boards of the area were cited as compounding evidence that the Environment Agency was getting things wrong. The Internal Drainage Boards were held to be using tried and tested techniques that were at odds with those of the Environment Agency, but that still met the regulatory requirements of nature protection.

In the aftermath of the floods, a community floods group, Burstwick United, was set up that raised funds and also lobbied hard for a new drainage maintenance regime. Ambiguity over what constitutes local knowledge took a further twist when the group decided to commission a study by a Dutch water engineer. The resulting report provided support for the view that part of the problem stemmed from the Environment Agency's drain clearance regime. Although the community included trained engineers and local landholders who had been maintaining drains for years, it was felt this expertise alone would not be sufficient to sway the authorities. The choice of a consultant from the Netherlands was deliberate; the engineer was seen to be neutral and with experience in a country heavily reliant on its drainage system. The report largely confirmed the views of local residents and was publicised in the local media (*Hull Daily Mail* 2008a 2008b).

In the context of some highly charged local politics, the Environment Agency set out to address the concerns of locals while not conceding that its own models were inaccurate. The drain maintenance regime was altered and more work undertaken. The dredging issue continues to resonate locally (*Hull Daily Mail* 2011). In addition, a grant of three million pounds was obtained for defence work, including embankments around the worst hit area (*HU12 Online* 2011). Even while welcoming this substantial investment, one of our interviewees argued that it might have been unnecessary if earlier spending had focused on better maintenance practices informed by local expert input.

At work here are two knowledge frameworks based on different assumptions and different datasets. Yet this was far from a classic local versus external expertise dispute. Both sides of the debate ended up using external experts and tried to argue that they were speaking with local knowledge. The Environment Agency outsourced its modelling work to consultants but claimed that it also had workers in the area able to add their local expertise. Though scarring to many of those involved, the experience of being forced to try

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and reconcile their differences seems to have brought changes to both sides of the dispute as both the Environment Agency and the community have sought to acknowledge and respect each other's viewpoints and to find areas on which they can agree rather than simply focus on what they disagree about:

> One of the biggest dangers is that you can alienate the Environment Agency: Big problem. If they are not talking to you then you have lost the battle. What's the point? Just the fact that we listen to them and we put our point across in a reasonable manner.

> Now that we have been involved in this dredging project they have been doing, we have been fully involved ... They are talking to us about what they are going to do and they have asked for help. 'Are there any engineers out there?' And we say 'well there are a couple'. 'Will anyone like to help us?' And we said 'tell us what you want to do'. And we get involved in it and just by doing that and working with them as opposed to working against them, it's paid in aces you know, it's great because people will talk to you all of a sudden whereas before, they wouldn't. (Interview: Local Politician 1)

We do not seek to pass judgement on whose science was best, or whose local knowledge was proven right or wrong in the Burstwick dispute. Instead, the key issues that emerged are the need to respect the different types of expertise available rather than privileging one over the others and the hybrid practices that lay behind claims around 'local knowledge'.

Conclusion

The starting point of our research was a curiosity about portrayals of locally grounded, historically accumulated flood expertise as good, and external flood modelling work as being problematic, remote and out of touch. The research quickly revealed how both these framings performed powerful discursive work in how they privileged certain types of knowledge over others, playing them off against each other as binary opposites. In some ways this reflects the dissatisfaction expressed by Lane *et al.* (2011, 15) with the conventional dichotomy between 'universal' scientific knowledge and 'local' lay knowledge. But where Lane *et al.* use their critique to develop a novel experiment in coproducing knowledge, this article focuses on unpicking the malleable and problematic nature of knowledge claims around what constitutes 'scientific' and 'local lay' knowledge.

Our research reveals how far from being seen as 'universal', when it came to knowledge controversies, scientific knowledge quickly became subject to credibility claims based on hybridised categories, such as the local expertise practised over many years by drainage engineers, portrayed as somehow both more local and more grounded than the rhetorical counterfoil of 'remote experts' based in distant offices with only limited understanding of local conditions. In similar vein, claims about 'local knowledge' concealed some very different underlying constructions, as demonstrated in the case of Burstwick Drain. Local knowledge and expert knowledge proved to be highly malleable concepts, appropriated for particular uses in particular debates.

Layered over problematic constructions of certain forms of knowledge as 'local' was the way in which claims were made about 'lost' knowledge. The basis of these claims lay in the fact that some institutions had lost their drainage engineer capacity, particularly local government, while many agencies had sought to achieve efficiencies by outsourcing aspects of their technical work to consultants. This fed into concerns about the loss of drainage engineer expertise, and the increasing reliance on complex numerical modelling to inform flood policy. Economies of scale have meant that modelling work has been typically bought in from consultancies rather than hosted in local authorities or in government agencies. This fuelled concerns that somehow 'local' knowledge was being replaced by that of remote experts, working with what Landström *et al.* (2011b) refer to as black box solutions, not readily understood by those without the relevant technical expertise. The research revealed that while there was indeed some justification for the concerns about 'lost' knowledge, in practice some of the knowledge of drainage engineers thought to have been lost was instead relocated. It could be found in other parts of the flood risk polity, at least temporarily, with some former local authority drainage engineers for instance moving to consultancies or water companies.

Our findings also revealed that, when prompted to reflect on the relative merits of outsourced expertise, even those most concerned about the rise of 'remote experts' tended to acknowledge that there were advantages to be had in using consultants, for instance in reducing costs and bringing in new ideas. Many also quickly acknowledged that different types of scientists had different, often complementary skills. In short, a more nuanced appreciation of the roles of different types of expert emerged once we probed under the surface of claims about lost local knowledge and its replacement by remote experts.

The Burstwick Drain study was highly revealing of the power plays behind hybrid knowledge formation practices, with both sides contracting external experts to bolster their positions. A rapprochement of sorts was achieved at Burstwick as eventually the two sides of the debate began to talk to each other more openly, without either ever accepting its knowledge claims as being a problem. At one level this might be seen as evidence of how knowledge controversies have moved on since Wynne (1993) proposed that public attitudes tend to be more open in engaging with science and that

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scientists typically appear resistant to accepting public claims of expertise. Alternatively it may be that communities have simply anticipated which kinds of knowledge will be accepted and treated as legitimate by the authorities, leading them to commission independent scientific reports. The hidden problem here is that this may lead to policy asymmetries, with wealthier communities best equipped to take on authorities by commissioning their own studies.

It is important to go beyond challenging claims about the loss of local knowledge and dependence on external experts, to examine how knowledge claims more generally are presented. Rather than essentialist readings of particular forms of knowledge, it is better to think of knowledge formation practices in which different types of knowledge are assembled in hybrid forms, where local, lay, professional, scientific and other understandings are combined. The term 'local knowledge' is effectively more a credibility claim rather than a meaningful stand-alone concept. Indeed, arguably there is no such thing as pure local knowledge: it only ever exists as part of hybrid knowledge formation practices. The search for lost local knowledge was inevitably doomed in this respect, yet what it revealed was the powerful and problematic discursive practices still at work in flood policy as different actors jockey to gain attention to their preferred forms of flood knowledge. Flood policy consequently remains fettered by an under-developed appreciation of how knowledge claims are mobilised in highly partial and sometimes emotionally charged ways.

Co-production of flood knowledge is a strong theme in recent literature in this field (e.g. Landström *et al.* 2011a; Lane *et al*. 2011), yet the findings here suggest the need to situate these experiments involving academics, lay experts and scientists within a spectrum of possibilities for producing hybrid knowledges. This is becoming particularly important as joint working arrangements to improve knowledge sharing and knowledge generation were encouraged by the Pitt Report, and also as successful academic experiments in the co-production of knowledge have begun to influence policy advice (Whatmore 2013). Examples include local partnerships working to capture and record into GIS the flood risk information held by multiple actors, including official bodies, and their consultants, plus sometimes local landholders and communities. The practices of consultants are being reshaped too, as many realise for themselves the importance of ground-truthing their work against the knowledge of local actors. Simultaneously, commissioning bodies have increasingly sought to ensure that new contracts include provisions for sharing information and that advisory group arrangements include a range of sources of local expertise. These emergent practices indicate how the co-production and sharing of flood knowledge is becoming widespread and more diverse as a set of practices. The policy challenge for the future is to identify how these various arrangements progress, which ones falter and which thrive, and most importantly, which ones result in better flood risk policy.

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