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Reinterpreting urban institutions for sustainability: how epistemic networks shape knowledge and logics

Abstract

Long term urban resilience demands a transition to a low-carbon society but poses a dilemma: the institutions that stabilise and perpetuate sociotechnical systems must become agents of radical change. The possibility of alternative futures challenges the logics and values central to institutional identity.

'Sustainability transitions' thus raise questions of institutional reinterpretation. The extent of such reinterpretation hinges on the everyday 'institutional work' of actors who bring diverse understandings to bear on their roles and responsibilities. These understandings derive not only from actors' professional roles but also from their engagement in wider epistemic networks.

Based on case studies of three urban organisations in northern England, this paper examines the impact and influence of epistemic networks in validating or challenging approaches to sustainability transitions. The research found such networking a necessary, but not sufficient, condition for institutional reinterpretation. Epistemic networks serve five functions: they inspire, legitimise and facilitate potential transitions, and challenge slow progress - but they can also limit transitions. From these findings, it is argued that epistemic networks are central to the identification and development of nascent 'transition arenas' (Loorbach, 2010) where more sustainable, and ultimately more resilient, futures may be tested and trialled.

Keywords: sociotechnical transitions, knowledge transfer, institutions, sustainability, urban resilience

1 Introduction

The challenge of 'carbon lock-in' (Unruh, 2000) provides a leitmotif in the long history of environmental policy and practice. Every proposed 'sustainability transition' (Grin, Rotmans, & Schot, 2010) must grapple with embedded technologies and social practices that form sites of resistance. The vision of a 'low carbon economy and society' (Urry, 2011) becomes occluded by continued political and social commitments to carbon-intensive practices such as air travel and shipping.

In the context of carbon-lock in, aspirations towards 'sustainable cities' (Flint & Raco, 2012) and long-term 'urban resilience' (Holling, 1973; Beilin & Wilkinson, 2015; Meerow, Newell, & Stults, 2016) become sites of contest and struggle. Apparently straightforward routes to decarbonisation or ecological modernisation (Jänicke, 2008) twist and turn back on themselves. Institutions and organisations that should facilitate transformation can become stumblingblocks. Social-ecological change thus necessitates institutional change.

This article examines how institutional change can take place, embedding the policy and practice shifts needed to create adaptive and resilient cities in which the human and more-than-human worlds can co-evolve (Alberti, 2016). It focuses on how the knowledge required to reorient society can permeate organisations subject to long-established 'institutional logics' (Friedland & Alford, 1991). Based on a study of urban organisations in three English cities, it highlights the role of extra-organisational epistemic networks (Haas, 1992) and delineates the functions such networks serve in advancing or impeding sustainability transitions.

Decarbonisation is examined here as an initial stage in a quest for sustainability and for long term resilience. Sustainability is seen as encompassing, but by no means limited to, decarbonisation (Smith, Stirling, & Berkhout, 2005; Bulkeley, Castán Broto, Hodson, & Marvin, 2010; Grin et al., 2010). Urban resilience is seen as encompassing, but not limited to, sustainability. Without sustainable approaches to urban life, including decarbonisation, cities are unlikely to be resilient in an era of climate change (Folke et al., 2010; Muñoz-Erickson et al., 2017); this requires 'a shift in both science and planning paradigms' incorporating both resilience and transformation (Alberti, 2016, p. 49). I unpack this positioning further in section 2.

In drawing on institutional studies (Powell & DiMaggio, 1991; Lowndes & Roberts, 2013) I refer to institutions both as the 'rules of the game' in society (North, 1990) but more specifically as 'institutional orders' (Thornton, Ocasio, & Lounsbury, 2012) governing particular domains of social life and generating their own logics and values. These domains cover formal organisations, trans-organisational networks, and individuals. For clarity I refer henceforth to individuals as actors, constituted bodies (such as a university) as organisations, and to the domains within which organisations are situated as institutions.

The article proceeds in six stages. First, it sets the scene, briefly explaining the linkages between transitions, sustainability and resilience. Next it outlines the importance of interpretation and reinterpretation in institutional change. Change, it is argued, is highly contingent on actors' situated knowledge and their responses to dilemma or crisis (Bevir & Rhodes, 2005). Third, it introduces the three case studies and research methods. Fourth, findings from the three case studies are presented, showing how actors' situated knowledge can be deployed as a resource for change. In the fifth section I outline five characteristics of epistemic networks that are pertinent to sustainability transitions and the

(contested) quest for resilience. Finally, I consider whether such networks are a necessary or sufficient condition for change, and underline the institutionally contingent nature of discussions of resilience or transition.

2 Decarbonisation, sustainability transitions, and urban resilience

The 'urban' matters because of the intensification of human life in cities, turning cities into 'coupled human-natural systems' (Alberti, 2016), but also because the sociotechnical systems that contribute to carbon lock-in and to potential decarbonisation are situated, managed and often designed in cities (Hallegatte & Corfee-Morlot, 2011). Urban organisations' impacts on carbon consumption extend far beyond the organisations themselves and may facilitate or limit efforts at an institutional scale to make cities more sustainable, and more resilient in the long term.

As indicated above, I discuss decarbonisation here as a requirement for sustainability, and sustainability as a requirement for long term urban resilience. This is contested territory: Redman (2014), for example, advocates a decoupling of the concepts of urban resilience and urban sustainability. While, as Redman argues, some undesirable systems can be resilient, the resilience of fossil-fuel dependent cities is limited by the effects of climate change. If thresholds or tipping points for stable urban functioning are exceeded (Ernstson et al., 2010; Folke, 2006; Matson, 2009) urban resilience is tested to the limits. A more resilient city, therefore, is one that acts in advance to reduce and mitigate systemic risks through adaptive governance (Olsson et al., 2006; Boyd & Juhola, 2015); its evolution involves a strong element of intentionality, with actors setting goals and initiating processes to achieve them (Folke et al., 2010).

By nesting ideas of decarbonisation within sustainability, and sustainability within long term resilience, it is possible to acknowledge both the passive-responsive characteristics of resilience (Redman, 2014; Zhang & Li, 2018) and the active-transformative intentionality of sustainability (Voß, Bauknecht, & Kemp, 2006; Loorbach, 2010). Such an integrative approach helps to avoid the risk of erasing power and politics from discussions of urban futures (While, Jonas, & Gibbs, 2010; Swyngedouw, 2010). It links the normative aspiration for continued urban functioning in the context of a changing environment (Klein, Nicholls, & Thomalla, 2003, Folke, 2006) with more critical aspirations to ensure that adaptation and continuity are socially equitable and ecologically sensitive. Such aspirations are embedded in concepts of social-ecological resilience (Holling, 1973; Leach et al., 2010; Beilin & Wilkinson, 2015). The context of an inequitable global economic system constantly raises the question, 'resilience for whom, what, when, where, and why?' (Meerow et al., 2016, p. 46).

The notion of a sociotechnical transition (Rip and Kemp, 1998; Geels, 2002;

2004) engages with similar issues of adaptation in a context of complexity, but narrows the focus to the technological and institutional changes needed to achieve 'sustainability' - whether conceptualised within the limited objectives of 'ecological modernisation' (Jänicke, 2008) or more ambitious calls for 'prosperity without growth' (Jackson, 2009). In the context of a rapidly changing climate with direct impacts on human survival, the intentional and urgent character of sociotechnical transition is foregrounded (Smith, Stirling, & Berkhout, 2005). Such purposive action demands a critique and remodelling of institutions.

3 An institutional perspective

This article explores the processes of institutional change required to advance 'sustainability transitions' by focusing on organisations sited at the urban interface of policy and practice. It examines the changes in logics and values required at an institutional scale (Thornton, Ocasio, & Lounsbury, 2012) and the contested and changing knowledges that inform actors' decisions. It deploys the concept of epistemic communities (Haas, 1992) to examine the importance of boundary-spanning knowledge networks in informing and moulding organisational and institutional change. It asks what role knowledge networks (Nurse-Bray et al., 2014; Frantzeskaki & Kabisch, 2016) perform in processes of changing institutional logics. The findings reported here are based on a study of three organisations operating at an urban scale in different cities in the north of England and providing an 'anchoring' function within the urban economy (Taylor & Luter, 2013).

3.1 Challenging institutional logics

As a general category, institutions are distinguishable from organisations in that they exert a socially structuring, durable role, asserting and perpetuating systems of meaning and value (March & Olsen, 1989; Powell & DiMaggio, 1991). They fulfil sensemaking and sense-giving roles (Weick, 1995). These give rise to what March and Olsen call 'logics of appropriateness', rules and patterns of behaviour that hold sway within particular institutional environments. Such logics exert influence within institutional orders such as the capitalist market or the domestic sphere (Thornton et al., 2012); within sectors or fields such as education or local government; and within individual organisations and the actors working within them. All these have a bearing on sociotechnical transitions, affecting the interplay of niche innovations (Geels, 2002) and 'regime resistance' (Turnheim & Geels, 2013; Geels, 2014).

Each institutional order generates its own logics and drivers for action. Friedland and Alford conceive of society as 'a potentially contradictory inter-

institutional system' (p. 240). They identify five 'core institutions' with lasting influence over western capitalist society: the capitalist market, the bureaucratic state, democracy, the nuclear family, and the Christian religion. While their categorisation is contestable, their argument stands: institutions generate potentially conflicting systems of value and appropriateness. These tensions provide actors with ways of navigating, managing and opposing their institutional environments. The authors assert (p. 254):

Without actors, without subjectivity, there is no way to account for change. And without multiple institutional logics available to provide alternative meanings, subjects are unlikely to find a basis for resistance.

Thornton and colleagues (2012) develop Friedland and Alford's perspective, identifying seven 'institutional orders' (p. 273) that shape society and provide actors with epistemological and motivational resources. These are categorised as the market, the corporation, the profession, the state, community, family, and religion. They use the concept of 'embedded agency' (Seo & Creed, 2002) to describe how actors may exert influence for change within institutional settings. Such agency finds expression in the open debates that take place within organisations, but also through actors' everyday 'institutional work' of 'creating, maintaining and disrupting institutions' (Lawrence & Suddaby, 2006). Scholars of institutional work emphasise the agency embodied in routine activities and practices; Smets, Morris, and Greenwood (2012, p. 877) argue that 'field-level institutional change may emerge from the mundane activities of practitioners struggling to accomplish their work'.

3.2 Institutional change: interpretation and situated knowledge

An institutional perspective highlights three characteristics of change processes. The first is that institutions are durable and persistent in informing actors' rationalities. The second is that actors can draw on multiple value systems and thus exercise agency in responding to events and workplace demands. Third is that, as a consequence of actors' embedded agency, change involves processes of interpretation and reinterpretation, reading and re-reading the 'rules of the game' and situated practices in order to justify choices and adapt to changed circumstances.

An interpretive institutionalist perspective emphasises both the possibility of institutional change and the potential of locally situated agency: institutions are malleable as well as durable. Hay (2011, p. 533) highlights that to emphasise institutions' social construction is to argue that an institution 'can (and perhaps should) be different'; it involves 'a rejection of any presupposition of institutional equilibrium and acute sensitivity both to moments of crisis and their political constitution'.

Reinterpretation comes about in response to moments of crisis or dilemma (Bevir & Rhodes, 2005; Krueger & Gibbs, 2010). These dilemmas may be organisation-wide, such as a financial crisis, or individual choices about ethics or practice. Bevir and Rhodes analyse institutions through the lens of prevailing beliefs, institutional traditions, and the dilemmas posed when policy decisions or goals clash with institutions' historic roles and functions. Faced with a dilemma, actors as well as organisations must make sense of conflicting meanings and thus re-examine their own beliefs and practices.

The notion of a transition to a low carbon or sustainable society confronts institutions and organisations with an overarching dilemma of how to interpret their mission in accordance with environmental objectives, and confronts actors with individual dilemmas concerning their own roles. To take an example from the research reported in this paper, a facilities manager in a university must maintain functions that enable the university to fulfil its institutional mission of education. Keeping the lights on and the floors clean serve that institutional purpose. But if the university sees part of its mission as reducing its environmental impact, the facilities manager may become responsible for reducing the energy and environmental costs associated with lighting and cleaning. Educational and environmental goals may demand conflicting actions. Such dilemmas may be mundane but they demand that actors prioritise one logic over another, deciding which knowledge to privilege in taking action. Muñoz-Erickson et al. (2017) discuss such dilemmas as organisational, operational and political complexities that interact with organisational knowledge systems. In the context of an overarching challenge such as climate change, one can expect such situated dilemmas to be repeated at every scale, affecting individual actors, local organisations and social institutions.

These tensions raise questions of how action is justified and evidenced through the sensemaking stories that circulate at organisational and institutional levels. Organisations exhibit a corporate quest for sensemaking through narratives of their past, present and future (Weick, Sutcliffe & Obstfeld, 2005) while actors within organisations tell stories of their own roles and of the organisation they work for (Gabriel, 2000; Boje, 2008). These stories deploy existing and new knowledge to serve or contest organisational ends. Such sensemaking supports (but can also undermine and challenge) organisational and institutional processes of knowledge production and meaning-making (Jasanoff, 2010; Nursey-Bray et al., 2014; Frantzeskaki & Kabisch, 2016).

Within institutional settings, canonical knowledge may be developed, established, challenged and replaced via epistemic networks (Haas, 1992; Olsson et al., 2006), enclaves of acknowledged expertise within and beyond organisational and institutional confines. The boundary-spanning nature of such networks offers a locus of resistance to established paradigms and a site where new knowledge may be generated and legitimised. Haas argues that 'networks of knowledge-based experts' help to frame policy environments by 'articulating

the cause-and-effect relationships of complex problems' (p. 2). Through such networks the 'codified knowledge' of academia or professional learning diffuses into the 'personal knowledge' or 'tacit knowledge' of practice (Eraut, 2000). Epistemic networks can 'provide novel ways of governing social-ecological systems' (Olsson et al., 2006), support new 'network imaginaries' (Muñoz-Erickson et al., 2017), and introduce and legitimise 'cosmopolitan knowledge' from different local environments (Hulme, 2010). Through their openness to insights from practice and 'local knowledge' they may promote reflexive adaptive learning (Nurse-Bray et al., 2014).

The permeability of institutions to new knowledge and logics is recognised in Thornton, Ocasio and Lounsbury's categories of institutional order. Actors may be simultaneously situated within multiple orders - they may adhere to a religious faith, have family responsibilities, strive to meet professional standards, and be subject to an employer's instructions. Tension between such institutional demands is the rule rather than the exception. An epistemic network validates and prioritises forms of knowledge pertinent to particular institutional orders - notions of academic excellence or professional ethics, for example. Such knowledge may counteract and challenge organisational 'logics of appropriateness'.

An epistemic network may build on actors' 'cognitive proximity' (Boschma, 2005) achieved through a shared academic background or training. This provides a potential counterweight to the physical proximity of colleagues in the workplace and the geographical proximity of partner or client organisations. The challenge of a sustainable future is worked out within a mesh of jostling micro-relationships.

3. Case studies and research methods

An interpretive case study approach was adopted (Baert, 2003; Alvesson & Sköldbberg, 2009) in order to uncover, examine and critique the construction of meanings and possible futures implicit and explicit within the organisations studied. Zilber (2002) places the construction of meanings by actors at the heart of institutional change and reinterpretation. Interpretation provides an opportunity to advance new possibilities, 'to illuminate what was previously unquestioned or taken for granted' and allow actors 'to envisage alternative future scenarios' (Baert, 2003, p. 101).

The three case studies - a university, a municipal government and a provider of affordable housing - were chosen as 'strategic' cases (Flyvbjerg, 2006): each had publicly positioned itself as a leader in environmental action. The experiences of these organisations would shed light on the degree of reinterpretation and change taking place, and on the possibility of wider

institutional change. Such a methodology is inevitably exploratory and does not seek to be generalisable (Stake, 1995; Blass, 2003); its aim is to examine and evaluate possibilities as a springboard for further investigation. Like other recent studies of institutional change and actors' 'institutional work' (Seo & Creed, 2002; Blackler & Regan, 2006; Greenwood, Díaz, Li, & Lorente, 2010; Smets et al., 2012) the research sought out the 'microfoundations of institutional logics' (Thornton et al., 2012) through attention to situated practices within organisations.

Each case study organisation could be described as an 'anchor' within its location. The notion of an anchor describes relatively stable entities such as education or healthcare bodies that are rooted in urban locations, are significant employers and contributors to the local economy, and affect the urban form through their investment in real estate and infrastructure (Alperovitz & Howard, 2005; Taylor & Luter, 2013). Each example chosen for this research also exemplifies an institutional domain within the UK: higher education, local government, and social housing. Each is situated in a different sizeable city in northern England in order to provide a range of contexts to triangulate the research (Stake, 1995). Anchor organisations offer an insight into patterns and possibilities of transition at an urban scale because of their wide socioeconomic impacts. In the discussion that follows, I have used pseudonyms for the case study institutions, to preserve the anonymity of individual interviewees who might otherwise be identifiable.

The higher education body, 'Millbrook City University', had moved rapidly to espouse environmental principles in recent years, eventually topping a league of 'green' universities compiled by the NGO People and Planet. Its slogan, highly visible on the main campus, was 'Let's make a sustainable planet'. Material evidence of its environmental mission included the use of carbon-reducing technologies in new buildings and the construction of a new campus with a combined heat and power system and district heat network. The university was among the first in the world to achieve the ISO 14001:2015 environmental management standard. However, during the course of the research it significantly under-achieved its carbon reduction targets.

The municipality, 'Upper Midsville Council', had been seen as a forerunner in action on climate change among English local authorities for more than a decade. Its achievements included the introduction of a tram network, investment in electric buses, the installation of photovoltaic panels on domestic properties and municipal leisure centres, and energy efficiency measures for low-income households. In recent years it has focused on its role as an energy producer, highlighting the low-carbon credentials of its municipal waste-to-energy plant and district heat network, and has become an energy retailer, competing with commercial companies to offer lower-cost fuel tariffs to local residents. Its aim, in the words of one interviewee, is 'making climate change an opportunity' for economic growth.

The housing organisation, 'Rivets Housing Group', is an example of an institutional form particular to the UK: a quasi-independent landlord, providing affordable homes to people on low incomes and governed by a central regulatory body established by government. A reorganisation and rebranding in 2007 provided its directors with an opportunity to recast it as a 'people, planet and property business', ostensibly following a philosophy of 'one planet living'. The organisation recruited a 'green team' to oversee energy efficiency work, install solar panels on residential properties, and explore the links between housing improvements such as new boilers and improved health. It rapidly gained a reputation for environmental leadership, but when the research began it had begun to retrench in response to a financial crisis. This crisis had been prompted by a change in the national regulatory regime for housing finance, combined with reductions in the tariff payable for solar energy contributions to the national grid.

Each case study involved a series of semi-structured interviews of 45 minutes to an hour in duration, conducted over the course of a year, with individuals at a range of seniority levels who were involved either strategically or operationally in environmental activities. Individuals were recruited because of the leadership or influencing roles (Mikecz, 2012) or through snowball methods (operational staff were nominated by organisational 'gatekeepers' or by colleagues). Interviews were also conducted with local stakeholders with established relationships with the case study organisations. A focus group discussion was held in each location to test and explore initial findings. A total of 50 interviews took place and all interviews were audio-recorded, transcribed and thematically coded. Quotations were selected to illustrate the themes emerging from initial analysis. While such methods lack the observational detail of long-term ethnographic studies (Zilber, 2017) they enable a relatively speedy overview of an organisation's approach to a specific issue.

4. Complementary and competing knowledge: resources for change

The notion of multiple logics, discussed above, focuses attention on dilemmas as resources for change. Such dilemmas pivot on questions of legitimacy and appropriateness: given conflicting options, which is the right way forward? In deciding these questions actors draw on different sources of knowledge, which may be embedded in official guidance or instances of 'best practice' (Bulkeley, 2006) or in locally generated 'community knowledge' (Nurse-Bray et al., 2014) but is unlikely to be directly adopted from science (Jasanoff, 2010). In each case study organisation, a dilemma was observed in which a logic of environmental action was at odds with another dominant logic operating at an institutional scale. These dilemmas and the degree of change observed are summarised in table 1.

Table 1: Logics and dilemmas observed in case study organisations

Organisation	Core logic	Alternative logics	Dilemma	Illustrative quotation	Extent of reinterpretation
Millbrook City University	Civic, community	Market	Competitive advantage versus carbon reduction	'We're not going to say we're not going to build that building because it will increase our carbon... but we'll build the building and we'll try and make sure it is as smart as possible' (Senior manager)	Sustainability policies adopted; staff recruited to advance sustainability mission; investment in buildings and technologies.
Rivets Housing Group	Civic, social welfare	Market	'Good governance' versus environmental initiatives	'We've given the Homes and Communities Agency an undertaking that we will be the best social housing provider that we can ... and get ourselves rid of the distractions' (Senior executive)	Organisational mission revised; policies adopted; staff recruited; investment in buildings and technologies - but all reduced or stopped following organisational crisis.
Upper Midsville Council	Civic, social welfare	Market	Green initiatives must support commercial agenda	'If you asked them, where are you actually buying your energy from, it's like, we're buying dirty energy. The cheapest possible so we can pass on the financial savings...' (External stakeholder, referring to the council's decision to retail fossil-fuel energy to local residents)	Sustainability policies; some staff recruited on energy and transport issues; partnerships with other organisations on funded projects; investment in buildings and technologies. Primary focus on commercialisation and financial savings.

At Millbrook City University, the dilemma of growth versus carbon reduction had been addressed through a ‘green growth’ approach, illustrated by the example of making a new building ‘as smart as possible’. An accommodation between competing logics had been found. Rivets Housing Group, conversely, eventually retreated from institutional reinterpretation in the face of pressure from a regulatory agency, promising to ‘get rid of the distractions’. Upper Midsville Council found a compromise between competing logics, but at the expense of its reputation for environmental leadership: its decision as an energy retailer was to buy ‘the cheapest possible’.

An examination of the sources of knowledge relied upon by actors sheds light on how dilemmas are likely to be addressed, and on the interaction between the micro level of institutional work and the macro level of institutional change. Actors’ cognitive, organisational and institutional proximities (Boschma, 2005) inform the establishment and persistence of meanings and values.

An epistemic network or community (Haas, 1992) creates a forum where cultures or shared beliefs coalesce. Within these expert circles actors are relatively free to fashion, critique and lobby for particular agendas alongside peers in other organisations. Their mutually-validated expertise positions them favourably to influence policy agendas and inform institutional strategies (King, 2005). Such communities may wield influence by dint of their ‘authoritative claims to knowledge’ (Raven, Schot, & Berkhout, 2012) and by establishing normative ‘best practice’ (Bulkeley, 2006). The case study evidence shows that these processes take place in specific organisations, but also within broader and more informal peer networks.

Table 2: Most-cited epistemic links in case study organisations

Key relationships cited by case study interviewees	Rivets Housing	Millbrook City University	Upper Midsville Council
Knowledge networks, professional bodies and lobby groups	UK Green Building Council	National Union of Students	Core Cities Group
	Peer housing organisations	Environmental Association of Universities and Colleges	APSE (Association for Public Services Excellence)
		People and Planet	Peer municipalities
Government, regulatory and political links	Homes & Communities Agency Department for Energy		Department for Energy & Climate Change

& Climate Change			
Local partners	City Council	Carbon Literacy projects	Regional local authorities
		Local Climate Change Agency	Local 'green partnership'

4.1 Millbrook City University

Interviewees at all three organisations were asked which relationships and networks were significant in their work, both in their own location and at a wider scale, in order to examine the processes influencing actors' positions and actions on environmental issues. Table 2, above, summarises the most-cited links relating specifically to environmental action.

Connections cited at Millbrook City University included a rich local network of agencies involved in climate action; the national student body for the UK; and the Environmental Association of Universities and Colleges. External stakeholders confirmed the university's strong local reputation, as one interviewee reported:

...they provide me with countless good news stories, case studies, and bits of ammunition for when we go and talk to other organisations.

Millbrook's initial impetus for environmental action was pressure from its own students. However, since the recruitment of an environmental strategy coordinator in 2007 the most significant links have been among professional and peer groups. Success in awards schemes has generated buy-in from senior management and legitimacy internally, as well as an external reputation for innovation. Key relationships have been with the Environmental Association of Universities and Colleges (EAUC), the NGO People and Planet which runs the 'green league' of UK universities, and the National Union of Students.

EAUC provides a forum that both legitimises environmental action, especially through its annual Green Gown awards, and helps to mould institutions' thinking through its own articulation of a low carbon future. It has existed for 20 years, providing a continuity that has outlasted government policies and initiatives. One interviewee commented that 'people have had to really become part of those [professional] networks to keep their finger on the pulse, and to be honest that's what I did when I first came here'.

Membership of this network has not only reinforced a shared epistemology; it has become a necessary step in generating and validating such an epistemology at an organisational scale. The university's head of environmental strategy was already a member of EAUC when recruited; another senior executive at the university has chaired EAUC's board; and members of staff have presented at its

annual conference.

EAUC itself is highly conscious of its influencing role. Its increasing internationalisation allows it to occupy a defensible 'expert' space outside state-based governance networks (Scrase & Smith, 2009). Association with and validation by this epistemic network reinforces individual universities' environmental commitments and public reputation. Through such public positioning, divergent logics can begin to become institutionalised: universities compete, for example, to win one of EAUC's Green Gown awards and change practices and priorities in order to do so.

4.2 Upper Midsville Council

At Upper Midsville, important links cited included the city's universities, a 'carbon club' involving local businesses, and a council-led 'green partnership'. Further afield, other municipalities within the region were considered important partners. At a wider scale the links include national political leaders and government departments, including the former Department of Energy and Climate Change (now merged into the Department for Business, Energy and Industrial Strategy). At an urban scale, Upper Midsville sees itself as an influencer, sharing its expertise with others:

... [we should] be a leading player in a partnership of not just public, but private sector organisations as well, right across the city, in order to encourage a low carbon transition. (Senior executive).

Three sites of knowledge exchange are prominent. At a local level the green partnership provides a forum to inform other actors in the city of municipal policies and to seek views and suggestions. Nationally, knowledge exchange takes place via the Association of Public Service Excellence (APSE), a membership organisation for local government officers and councillors, and the Core Cities group, which represents the largest English cities outside London. Perhaps because of its long history of environmental action, Upper Midsville Council has an established reputation as a source of good practice, a reputation affirmed by external stakeholders.

Being seen as a beacon of innovation legitimises activity to external audiences, but also internally. Such legitimation helps to cement change in place (Thornton et al., 2012); Upper Midsville Council has hosted fact-finding visits by government ministers and employees of other municipalities, for example, reinforcing local perceptions of environmental leadership. There is less evidence, however, that its own vision and practice has been informed by epistemic networks outside the city. Its approach is at heart a pragmatic response to a problem of local fuel poverty, driven by the logic of social welfare, as one senior executive explained:

Actually, the remit for this role was much more about tackling fuel poverty [...] it's not primarily about green energy. It's about the cheapest energy that we can get ...

The sustainability agenda has been driven by the need to respond to local problems. Once established, that agenda has both informed and been informed by wider epistemic networks, but dilemmas have been addressed within pre-existing paradigms of civic responsibility.

4.3 Rivets Housing Group

The story of Rivets Housing Group's environmental activities begins with a reorganisation and rebranding in 2007. One director went to the then chief executive and asked to work on 'green stuff'. In their words:

...my induction to the green stuff was, I emailed Tim Smit [founder of the Eden Project in Cornwall] and said can I come to the Eden Project for a fortnight? So I ... just knocked about with people at the Eden Project. And they really taught me that non-preachy approach, make it interesting, make it relevant, make it easy, and I also started networking.

The former director describes how this network-building took place:

I realised quite quickly that all the activity, all the conversations, were in London, so I had to go to London. [...] I just made it my business to be available to chat, I got invited onto a couple of working parties, and once I'd been invited onto a couple of working parties that was kind of it - once I'd been accepted into the community, I then got offers - would you speak at this event, would you give a presentation on this or that...

As a way of tapping into an epistemic network and then recreating it internally, this is more buccaneering than the processes observed in the other organisations. The initiatives of individual actors, approved by the organisation's leadership, were reinforced through a well-oiled public relations department and presence at conferences and events. There was a deliberate attempt to shift understandings, both among staff and across the housing sector, of what a social housing organisation could do. One interviewee described this process as 'associating ourselves with credible partners'. These included peers in housing and construction, the National Housing Federation (the trade body for housing associations), and the UK Green Building Council (UK-GBC).

The organisation explicitly sought out peer experts to inform and legitimise its own ambitions. While these links do not delineate the boundaries and population of an epistemic network, they point to its existence and importance. The housing organisation's financial crisis, however, led to a reduction of its involvement in policy and knowledge transfer. Fewer staff went to conferences

and there was less capacity for speculative meetings with civil servants and environmental experts. A culture of networking that was strongly entrepreneurial proved difficult to sustain when an institutional dilemma resulted in the removal of resources for such entrepreneurship.

The links cited across the three organisations show the networks that help to establish new ways of thinking. As importantly, though, they reveal the institutional work of actors in terms of forging relationships and gaining support for, or limiting, courses of action - by, for example, adopting 'good practice', competing for awards, or framing environmental action within an agenda of financial responsibility and value for money.

5. Discussion: how knowledge resources are used

In selecting and presenting relevant information, epistemic networks also act as interpretive communities, solidifying meanings and generating shared understandings of policy priorities. Such processes, previous studies suggest, are fluid, contested and without predictable outcomes. Because they straddle the 'knowledge-governance gap' (Nurse-Bray et al., 2014), they involve establishing social meanings as well as agreed facts (Jasanoff, 2010); their expertise needs to be understood as credible, legitimate and salient (Muñoz-Erickson et al., 2017).

The case studies presented here suggest that actors seeking to enact transitions at an institutional scale align themselves with appropriate epistemic networks. This joining-up is most visible at a senior and middle-management level. The ties with expert groups are closest among the employees most intimately associated with transition strategies. Employees use expert groups to validate their own knowledge, to learn from their peers, and, perhaps most importantly, to legitimise their activities - both among their peers, and within their own institutional hierarchies.

These expert communities mould transition agendas in five ways. First, they act as sources of inspiration. At Rivets Housing Group, initially, this was a case of both identifying suitable partners and identifying with them: for example, it paid a membership fee to UK-GBC in order to access a community perceived as leading expert practice. At Millbrook City University, association with People and Planet and EAUC enabled actors to see how their peers in other institutions were receiving accolades for achievement, generating a bank of transferable ideas and practices.

Second, epistemic networks provide a source of legitimation. Receiving a Green Gown award from EAUC, as one senior university manager put it, shows 'you are doing some good stuff'. Upper Midsville Council has been cited as an example of good practice by APSE Energy, legitimising its activities to potential sceptics and to peer organisations. Rivets Housing Group's appearance on

conference platforms has lent credibility to its initiatives, both among peers and internally.

Third, epistemic networks provide a source of critique and challenge, galvanising organisations to strive for greater achievements. Awards and league tables (such as People and Planet's annual league tables of 'green' universities) discourage complacency. Organisations are encouraged to measure themselves against their peers and act if they fall short.

Fourth, epistemic networks facilitate a flow of staff and knowledge between organisations. Millbrook City University's lead manager on sustainability was already a member of EAUC when recruited from another university. Rivets Housing Group's former operations director was recruited because of his involvement in renewable energy in the construction industry. Upper Midsville Council's head of energy projects was already involved with APSE Energy when recruited from another local authority.

There is also a fifth function: epistemic networks can limit concepts of transition, excluding or backgrounding particular discourses and conversations. The dialogue that does not happen may be as important as that which is heard, seen and publicised. APSE's focus on commercialisation and financial stability within local government, for example, marginalises questions of 'prosperity without growth' (Jackson, 2009).

These features match several of the conditions for transition identified in the literature on sustainability transitions (Grin et al., 2010). An 'arena' needs to be established and an agenda set (vision); experiments need to take place and learning must be shared (legitimation); and the process must be monitored and adjusted (challenge and facilitation). The concept of transition arenas stems from the vision of transition management developed by scholars including Berkhout, Smith and Stirling (2003) and Loorbach (2004, 2010). Transition management could be described as a form of intentional evolution, in which actors and circumstances are manipulated to achieve desired outcomes. In the context of resilience, as Folke and colleagues point out (Folke et al., 2010) 'deliberate transformation involves breaking down the resilience of the old and building the resilience of the new'. The transition arena is formed by recruiting a group of individuals chosen for their 'competencies, interests and backgrounds', working alongside 'frontrunner' organisations from government, commercial firms, NGOs, academia and 'intermediaries' (Loorbach, 2010, pp. 174-5). Implicit in this model is a convening body and a programme to which transition actors will commit resources and reputation.

The relationships explored within the case study organisations do not amount to transition arenas as conceived by transition management theorists. However, they contain comparable elements: networks of expert influencers, a 'frontrunner' organisation that is prepared to invest human, financial, physical and reputational capital; and a web of partners at different scales with whom

knowledge and experience is shared, exercising their 'situated agency' (Bevir & Rhodes, 2005) through the 'institutional work' of disrupting and amending organisational practices and priorities.

The networks revealed in the three studies have the potential to act as crucibles for transition and inform transition agendas. In each case there are links with local partners, with wider epistemic networks and - to differing degrees - with government and with policy communities. Each organisation can tap into sources of knowledge and expertise to bolster its programme of action. As they proceed along preferred transition pathways and engage in projects (or 'niche experiments') each is likely to come into conflict with vested interests.

The growth and continuity of relevant epistemic networks, especially EAUC with its international links and validation through awards ceremonies, conferences and exchanges, presents the possibility of alternative forms of transition steering at arm's length both from the sites of experimentation and from the state. Epistemic networks present intellectual niches in which experimentation is encouraged and rewarded (Grin et al., 2010). They offer possibilities of locally enacted but collaboratively generated reinterpretations of practices and purposes.

If epistemic networks can mould transition agendas and contribute to latent transition arenas, this raises the question of whether they are a necessary or sufficient condition for institutional reinterpretation. While the case study evidence supports this in part, it is not definitive.

Knowledge networks, distant or local, were a significant feature in disseminating and legitimising narratives of environmental leadership. Epistemic networks are a necessary condition for the modification of prevailing logics (and thus for transition) because they stimulate institutional porosity. They permeate institutions with new forms of knowledge and provide a forum to validate and approve 'best practice' (Bulkeley, 2006) and to build knowledge co-production (Frantzeskaki & Kabisch, 2016) beyond local management and national government. Epistemic networks not only provide cover for actors to exert agency in promoting divergent and innovative knowledge, but may actively work with governance agencies to embed such knowledge in policy (Gough & Shackley, 2001) - EAUC, for example, promotes itself to universities as an organisation that can lobby government and policymakers. At the same time epistemic networks may act as brakes on transition, ossifying consensus around particular forms of knowledge and practice. They are not a sufficient condition for institutional reinterpretation, but are part of a jigsaw: without a positive institutional response and a favourable context, their influence will be limited.

6. Conclusion

The functioning of epistemic networks and their influence on, and vulnerability to, established institutional logics can shed light on Meerow's question (2016): 'resilience for whom, what, when, where, and why?' Not only must we ask how resilience is defined and in whose interests, but what kind of resilience may emerge from the institutional logics and institutional work evident in particular settings. The notion of an urban system (Alberti, 2016) must be qualified by acknowledgement of the politically and circumstantially contingent actions of institutionally-sited actors. The kinds of resilience emerging in the case study organisations present differing opportunities and risks; there is a dynamic tension and interplay between the 'resilience of the old' and the 'resilience of the new' (Folke et al., 2010).

At Upper Midsville Council, resilience is closely associated with the capacity of existing systems of energy production and consumption to adapt to two sets of potentially conflicting demands: the demand to reduce fossil-fuel consumption, and the demand to meet local social welfare objectives by providing affordable fuel.

Millbrook City University's contribution to urban resilience is predicated on the institution's success in an increasingly commercialised higher education context. Investment in low-carbon technologies depends on a continual flow of new building projects to compete for consumers in the higher education market. Growth provides opportunities for innovation, and the nature of innovation is strongly informed (but also potentially challenged) by sector-wide epistemic networks.

Rivets Housing Group, by contrast, shows only limited ability to adapt or to influence the resilience of the wider urban context, reducing its own capacity following a financial crisis and shedding activities labelled 'distractions'. The radical changes envisaged in the organisation's initial environmental positioning have been significantly slowed. Without a rebuilding of the knowledge networks that contributed to its initial reputation, there is a danger that environmental action at Rivets Housing Group will lose legitimacy, impeding rather than accelerating social-ecological resilience at a wider urban scale.

Taken together, the findings present a picture of varied trajectories of resilience, strongly informed by local and institutional circumstances and dependent on actors' situated agency and access to knowledge resources. Further research should thus shift the focus from refining resilience concepts to understanding institutional *resilience journeys*, paying attention to actually-evolving forms of resilience in the light of present as well as future environmental risks.

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