Building Research & Information
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rbri20

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To cite this article: Kathryn B. Janda & Yael Parag (2013): A middle-out approach for improving energy performance in buildings, Building Research & Information, 41:1, 39-50
To link to this article: http://dx.doi.org/10.1080/09613218.2013.743396

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A middle-out approach for improving energy performance in buildings

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A ‘middle-out’ perspective is used to investigate potential roles for professionals and practitioners in creating societal change. Social and technological innovations are commonly seen as either being induced from the ‘top-down’ or evolving from the ‘bottom-up.’ Instead, a ‘middle-out’ perspective focuses on agents of change that are located in the middle, between the top and the bottom. This perspective shows that middle actors can affect change in several different directions: upstream, downstream and sideways. By linking the top and bottom more explicitly, this approach is both an alternative and complementary to ‘bottom-up’ and ‘top-down’ efforts to implementing low-carbon innovations and practices in society. One particular kind of ‘middle’ in the built environment is explored: the role of building professionals to encourage (or discourage) societal change. Focusing on the demand side of the energy system, case studies of building professionals in the domestic and non-domestic sectors are used to emphasize the qualities of these middle agents as enablers/disablers, mediators and aggregators. Policy implications from the ‘middle-out’ perspective are drawn, and comments on the near and long-term relationship between building professions and building performance are made.

Keywords: agents of change, buildings, built environment, influence, low carbon, middle-out, professionals, stakeholder motivation

Une perspective « intermédiaire » est utilisée pour examiner les rôles potentiels des professionnels et praticiens libéraux dans la création de changements sociétaux. Les innovations sociales et technologiques sont couramment considérées comme étant induites « de haut en bas » ou comme évoluant « de bas en haut ». Au lieu de cela, une perspective « intermédiaire » se concentre sur les agents du changement qui se trouvent au milieu, entre le haut et le bas. Cette perspective montre que les acteurs intermédiaires peuvent influer sur les changements dans plusieurs directions différentes: en amont, en aval et latéralement. En liant de manière plus explicite le haut et le bas, cette approche a un caractère à la fois alternatif et complémentaire par rapport aux efforts opérés de manière ascendante (« de bas en haut ») et descendante (« de haut en bas ») visant à mettre en œuvre des innovations et des pratiques bas carbone dans la société. Un type particulier d’« intermédiaire » dans le cadre bâti est étudié: le rôle des professionnels libéraux du bâtiment, qu’ils encouragent (ou qu’ils découragent) les changements sociétaux. L’accent étant mis sur le côté demande du système énergétique, des études de cas de professionnels libéraux du bâtiment dans les secteurs domestique et non domestique sont utilisées pour souligner les qualités de ces agents intermédiaires en tant que facilitateurs/neutraliseurs, médiateurs et agrégateurs. Il est tiré des implications en matière de politique de cette perspective « intermédiaire », et des observations sont effectuées sur la relation à court et long terme entre les professions libérales du bâtiment et les performances des bâtiments.

Mots clés: agents du changement, bâtiments, cadre bâti, influence, bas carbone, intermédiaire, professionnels, motivation des parties prenantes
Introduction

To stabilize the climate, large-scale social change and energy innovation are needed. Energy systems present particular challenges for policy and governance as they tend to reflect long-term historical forces and crisis events, and to lead to lock-in rather than to change (Unruh, 2000). Therefore, emphasis needs to be placed on all the ways in which ideas, practices and behaviours might be reshaped or even transformed. A full spectrum of approaches is called for, but may not be in use.

The social science literature that discusses societal change and the spread of innovation is dominated by a dichotomist approach: change and innovation are introduced and promoted either from the ‘bottom-up’ – by, for example, individuals and grassroots organizing – or from the ‘top-down’ – by government regulations and procedures (Sabatier, 1986). Individuals are often seen by policy-makers as the target agents for changing their own behaviour. Information tools such as carbon calculators, feedback and media-relations and procedures (Sabatier, 1986). Individuals are often seen by policy-makers as the target agents for changing their own behaviour. Information tools such as carbon calculators, feedback and media-based campaigns are supposed to create bottom-up change by enabling individuals to reduce their carbon emissions voluntarily. At the same time, government employs top-down regulatory approaches to reduce emissions. These are demonstrated in the introduction of market mechanisms (e.g. emissions trading schemes), and in the regulation of energy suppliers (e.g. renewable obligations), products (e.g. minimum efficiency standards), and infrastructures (e.g. building regulations). If new ideas and new behaviours could be induced from the bottom-up or from the top-down, could they also be introduced from the middle-out? One particular kind of ‘middle’ in the built environment is the focus of this paper—building professionals and practitioners—in order to explore their potential to encourage (or discourage) societal change.

The general characteristics of bottom-up and top-down approaches will be familiar to most readers (Table 1), as is the assumed dichotomy between them. The middle, however, is relatively unfamiliar territory. Compared with the top and bottom, the middle is often overlooked. What is it about the ‘middle-out’ that leads it to be overlooked, and is something important being missed through its neglect?

The authors of this paper did not invent the term ‘middle-out.’ Different disciplines have used this term in different ways since the late 1970s. The term ‘middle-out’ was first mentioned by Kinchla and Wolfe (1979) to describe a visual processing sequence humans use to make sense of shapes. About 85% of its academic use over the past 30 years has been in the natural sciences, largely in computing and engineering, but also in biochemistry and the biological sciences. Its use in a social science context has been relatively infrequent and shorter lived, occurring only over the last decade. Its social science use has been in highly diverse fields, including conflict resolution (Hancock, 2008), nuclear non-proliferation (Dhana-pala, 2001), neighbourhood reform (Deschenes, 2002), and change management in higher education (Cummings, Phillips, Tilbrook, & Lowe, 2005; Hodgson, May, & Marks-Mar an, 2008).

This paper builds on previous conceptual research by the same authors (Parag & Janda 2010a, 2010b; Janda & Parag, 2011). Parag and Janda (2010a) suggest that a ‘middle-out’ approach could assist in the process of systemic transition towards a low-carbon society. They consider various ‘middles’ articulated in different academic fields, including sociology; sociotechnical studies and transitions; public policy and administration studies; public health; processes of production; and energy studies. They conceptualize the middle in energy systems and discuss characteristics of the bottom-up and top-down approaches to energy transitions. They argue that the middle is more than ‘filler’; rather, it has many qualities and functions that are unique and essential to a systemic societal transition. Parag and Janda (2010b) develop their approach by looking at agency and capacity issues of the top, bottom and middle using case studies of community-based organizations, faith-based organizations and communities of practice. Janda and Parag (2011) focus specifically on building professionals. This paper represents a further development of that work.

Building on Janda and Parag (2011), this paper concentrates on building professionals and practitioners. It conceptualizes the directions and modes of this ‘middle’s’ influence: upstream to government, downstream to clients and customers, and sideways within and between the various groups working in this area. It begins with a short introduction to the middle-out approach in the context of energy systems. It then recognizes ‘middles’ and middle-agents, which are important for improving energy efficiency in both new and existing buildings, discussing their abilities to influence other agents upstream, downstream and sideways. They manifest these influences by enabling technology adoption, mediating policy goals and aggregating technical opportunities. Examples are provided of each mode of influence, focusing on the residential and non-residential sectors. Policy recommendations are then made for incorporating the ‘middle-out’ approach into the existing energy policy landscape.

Background

Before discussing ‘the middle’ it is useful to define ‘the top’ and ‘the bottom’. Linguistically, the bottom is the opposite of the top. In binary systems (or systems that can be perceived as being binary) these two poles are easy to identify. In a simple political system, there are...
rulers and those ruled (whether these be kings and subjects, or policy-makers and citizens). In a simple economic system, there are producers and consumers, even though they are not usually characterized as ‘top’ and ‘bottom’. In an ecological system, there is a top and a bottom (predators and primary producers) as well as two additional trophic levels in between (primary consumers and secondary consumers). Not every conceptual model can or has been characterized in terms of its top and bottom, however. In their analysis of environmental opportunities for business, for example, Esty and Winston (2006) define five different categories of stakeholders that are not easily separable into a top and bottom. When top and bottom concepts are used, however, ‘the top’ generally contains fewer, larger units and the bottom contains more plentiful, smaller units (whether they be organisms or organizations). The middle lies somewhere in between.

This section reviews some of the relationships between the top, middle, and bottom in the supply and demand sides of the energy system in the built environment. Next, it focuses on a particular kind of middle – building professionals – for further analysis.

### The middle in energy systems

The middle in energy systems might be conceptualized in several different ways. Table 1 highlights some of the differences between a middle-out approach and the more traditional top-down and bottom-up approaches to carbon reductions.

On the energy supply side, the middle can be defined by levels of scale, ownership and resource aggregation. Table 1 suggests the middle lies in regionally distributed generation developed at the community or local government level. This level is in between the highly concentrated, centralized systems common in electricity markets today and the distributed, decentralized systems envisioned in the late 1970s by futurists such as Amory Lovins (Lovins, 1979).

On the demand side, there are a number of different conceptions of the middle. In 2010, the UK Research Councils devoted £4 million for research in the area of ‘energy and communities’, which includes both renewable energy supply and demand reduction projects at the community level. In the residential sector, Parag and Darby (2009) argue that there are three main groups of actors that play essential roles: central government, energy suppliers and energy users. This variant of a middle is shown as variant ‘a’ in the provision of low-carbon homes. Focusing on tenanted commercial properties, Axon, Bright, Dixon, Janda and Kolokotroni (2012) argue for the use of the notion of a ‘building community’ that is in the middle between the general political context and the physical reality of a building, as well as situated between three different disciplinary themes: (1) legal and property aspects of improving energy performance; (2) policy context and organizational response; and (3) technology adoption and environmental performance. This perspective sees organizations and their practices as middle agents who are central to the successful deployment of low-carbon buildings. This notion appears in Table 1 as variant ‘a’ in the provision of low-carbon non-domestic buildings.

It is important to note that these different conceptions of the middle are not functionally or conceptually cohesive. Table 1 presents a number of different perspectives on the middle that do not necessarily align with each other. On the supply side, for instance, utilities can be

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**Table 1** Approaches to low carbon transitions in energy supply and demand

<table>
<thead>
<tr>
<th>Targets</th>
<th>Top-down (e.g. government)</th>
<th>Middle-out (e.g. communities, professionals, businesses)</th>
<th>Bottom-up (e.g. individuals, grassroots)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply</td>
<td>Owned and planned by centralized utilities and/or national government</td>
<td>Owned and planned by communities or local government</td>
<td>Owned and operated by homeowners and businesses</td>
</tr>
<tr>
<td>Demand</td>
<td>Required by national regulations; supported by economic incentives; informed by labelling</td>
<td>(a) Encouraged by utilities or local governments (b) Provided by professionals, trades and suppliers</td>
<td>Demanded by homeowners and renters</td>
</tr>
<tr>
<td>Low-carbon non-domestic buildings</td>
<td>(a) Provided by business owners and building operators (b) Provided by professionals, trades and suppliers</td>
<td>Requires participation from tenants, occupants and users</td>
<td>Demanded by business owners and tenants</td>
</tr>
</tbody>
</table>

Source: Based on Parag and Janda (2010b).
seen as a ‘top’ agent, whereas on the demand side Parag and Darby (2009) place them in the middle.

While all of the above are important ‘middles’ in the energy field with their own effects, Wilson and Dowlatabadi (2011) emphasize the importance of a third category of stakeholder that they call ‘business partners and competitors’ and which they conceptualize as lying in between ‘rule-makers’ and ‘consumers’. A focus on building professionals and practitioners is consistent with Wilson and Dowlatabadi’s positioning. These middle agents are represented in Table 1 as variant ‘b’ under low-carbon homes and non-domestic buildings. Building professionals and practitioners neither produce nor consume energy, but through their work they shape and can alter the ways in which it is used. Building professionals are a critical part of the system needed to create zero-carbon homes, buildings and refurbishments.2

Building professions: in the middle of a system
For the purposes of this paper, the term ‘building professionals and practitioners’ or simply ‘building professionals’ is broadly construed as any person or group whose work involves the construction, refurbishment, management, letting or valuation of buildings, as well as businesses that supply materials and technologies to support these services. This definition includes what Jewell and Flanagan (2012) call ‘construction professional services’ as well as the ‘construction services’ sector itself. This cluster of ‘building professionals’ performs many different tasks that may be enacted by professionals (e.g. licensed architects or engineers), practitioners (e.g. builders), retailers (e.g. ‘do-it-yourself’ stores and their employees), and other members of the supply chain. Most of the examples presented in this paper involve professionals and practitioners rather than other members of this broadly defined middle group. However, as some retailers and other businesses in the supply chain are getting involved in providing advice on building refurbishment (Watts, 2012), they fit the proposed framework whenever they offer expertise as part of their service.

Building professionals may be particularly important middle agents for initiating, delivering and promoting infrastructural changes. These groups are often considered to be ‘intermediaries’ in the technology adoption process, and as such are expected to provide low-carbon new build or refurbishment services if their clients demand it. However, intermediary groups have been shown through ethnographic research and situated work studies to have their own habits, practices, ways of thinking about problems and ways of working that affect their ability to provide (and interest in promoting) low-carbon buildings. This effect has been identified in supply chains (Guy & Shove, 2000), property agents (Schillerup & Gwilliam, 2009), chartered surveyors (Hill & Lorenz, 2011), builders (Killip, 2008), and architects and engineers (Janda, 1998, 1999).

Given that professions have their own ways of doing things, how might the new activities involved in low-carbon building and refurbishment change the roles of existing professions? Will it change their interactions with their clients? Will it change their interactions with their peers and other professional groups interlinked in the current distribution of work?

Janda and Killip (forthcoming) argue that a ‘system of professions’ approach may help move the discussion from what needs to happen towards who is going to make the necessary changes and how. This approach draws upon the systems theory of professions, developed by Andrew Abbott (Abbott, 1988) which fits (generally) within the sociology of professions (Tripier & Dubar, 2005). Abbott’s work is concerned with the ways in which different professional or occupational groups define their work and compete for authority, which is linked to their use and appropriation of knowledge. This framework includes but goes beyond the ethics-related discussions about what a given profession ‘ought’ to do according to its charter (e.g. Hill & Lorenz, 2011). A system of professions approach posits that only professions that are seen to successfully address a socially accepted problem will be able to compete with other groups and maintain their status as a profession. This definition of a ‘profession’ or ‘professional’ is not based on milestonessuch as formal educational qualifications, licensing examinations, codes of ethics or membership in a professional association. Hence, the definition allows a range of work and workers, from skilled craftpeople who train on the job to designers with university degrees and professional licences.

From a system of professions’ perspective, each work group is linked (neither permanently nor absolutely) to a set of socially accepted tasks considered to be its jurisdiction. Architects, for instance, may see themselves (and be seen by others) as the profession with the responsibility for creating quality of place and aesthetic values in the built environment; while engineers are more concerned with the technical practicalities of making structures that are structurally safe, healthy and thermally comfortable. The Royal Institute of British Architects (RIBA), for example, says it works with its members to ‘champion good design the world over’ (RIBA, 2012b), whereas the Chartered Institution of Building Services Engineers (CIBSE) claims its profession is responsible for:

- everything inside a building which makes it safe and comfortable to be in.

Without building services, the CIBSE asserts, even ‘the most fabulous building in the world’ would be just a ‘cold, dark, uninhabitable shell’ (CIBSE, 2012).
Professional groups compete and develop interdependently, based in part upon their ability to perform (and defend) the tasks within their jurisdiction. Jurisdictions and professions change over time and are shaped by a number of social, economic, historical and institutional factors (Abbott, 1988; Evetts, 2006; Bureau & Suquet, 2009).

Abbott (1988) admits that his framework explains the shape of existing professional groups better than the development of new groups. However, he posits that growth in general knowledge can create a ‘new’ socially legitimate set of problems and therefore an opportunity for new professional group(s). Is growth in knowledge about climate change – its impacts, causes and opportunities for mitigation – sufficient to challenge the current system of professions operating in the built environment today? Some industry and government organizations believe so. The World Business Council for Sustainable Development (WBCSD) (2009) argues that a new ‘system integrator’ profession is needed to develop the workforce capacity to save energy. The UK is training domestic energy assessors to draw up Energy Performance Certificates (Banks, 2008), while the Australian government supported the development of a new profession of in-home energy advisors (Berry, 2009). Each of these entities asserts that a new profession will help solve the ‘problem’, but each proposed professional solution is different.

The current authors contend that both existing professions and potentially new ones have an important, yet understudied, role in enabling the physical changes needed to meet carbon reduction targets. If this role is left unexamined and unplanned, these groups have the potential to disable (rather than enable) carbon reduction targets in the built environment.

Building professionals: from the middle-out

The previous section considered various middles in the energy sector and concluded by calling attention to the jurisdictions, goals, and training of professionals and practitioners who work in and on the building sector. A conceptual model is now introduced for where and how building professionals exert their influence from the middle-out. This influence is shaped by but is distinct from governmental guidance on building practices (e.g. policy mechanisms exerted from the top-down) and from client choices (e.g. requirements that shape work from the bottom-up). The proposed model suggests that building professionals have three different directions of influence – upstream, downstream and sideways – that affect both their own groups and groups around them. They manifest this influence in many different ways, which include (but are not limited to) three categories of actions or modes of influence: enabling, mediating and aggregating. The conceptual framework is described below, using a mix of specific and general examples to articulate the concepts. Empirical examples of how the framework applies in the domestic and non-domestic sectors will be introduced in the following section.

Directions of influence

Figure 1 shows a conceptual map of the top, middle and bottom of a system, depicted as parts of a triangle. The top can exert influence down towards other parts of the system; the bottom can exert influence up. The middle, however, can exert influence up, down or sideways. These directions are suggested as a schematic rather than a fully articulated map. The ideas presented below do not indicate every possible type or direction of influence. But it is important to acknowledge that building professionals and practitioners do more than follow government policies and serve client needs.

Upstream

Building professionals may exert influence upstream to policy-makers (whether local, regional, national or international) in a number of different ways. For example, individual members of a profession may serve as an expert on a government commission. A group or company may provide feedback on a government consultation. A trade or professional association may develop public reports that articulate issues of importance to their trade or profession in policy-relevant ways. The Federation of Master Builders, for example, commissioned research to produce policy recommendations on how to build a greener Britain (Killip, 2008). RIBA has an ‘influencing policy’ page on its website and a policy department that coordinates its efforts in this area. Its goals are:

to help, inform and influence government policy and offer policy solutions which will help architects produce better buildings and communities.

(RIBA, 2012a)

The upstream direction of influence recognizes that professional roles can go well beyond the direct work
for which they are trained and paid to perform. Professionals and practitioners can shape current and future practice in their field by communicating with regulators, public agencies and policy-makers.

Downstream

Many professionals claim to be ‘client centred’ in their work. However, as experts hired to perform a service, they provide the range of options and prices from which the client chooses. This range is rarely the universal set of options; instead, it is based on the set of strategies, technologies and options with which the professionals are familiar (Scheuer, 2007), or perhaps excited about trying. If the client brings in an idea that is not a part of the initial offering, the professional may argue for or against the client’s ideas. For example, a study of the diffusion of condensing boilers in the UK showed that before regulations came into effect heating engineers dissuaded customers from installing this technology (Banks, 2001).

If technologies seem unequal to professionals, so do clients. Design firms have been shown to specialize in different types of clients and different types of work (Coxe, Hartung, Hochberg, Lewis, Maister, Mattox, & Piven, 1987). Design firms and builders usually do not bid on projects that do not match their interests, expertise and abilities. Builders, for example, have been shown to avoid projects where they sense the client may be difficult to work with (Killip, 2011). Accordingly, clients who have unusual projects may have difficulty finding professionals to do the work, and may then have to pay a premium to do things ‘differently’ (Janda & von Meier, 2005). Some firms are more willing to take risks and innovate than others (Blau, 1984; Coxe et al., 1987) which may or may not be apparent (or desirable) to clients when selecting someone to hire.

Therefore, professionals and craftspeople exert influence downstream to clients by (1) bidding on or avoiding the project, (2) providing an initial set of options in response to the work programme, and (3) how vigorously they defend or expand the initial set of options.

Sideways

Professionals can have an influence on their profession and on other professionals in a sideways direction. Consider, for instance, the standard-setting organizations within a profession that accredit schools and training programmes (e.g. the US National Architectural Accrediting Board). Then there are the examinations that lead to professional licences, which are developed over time and administered within the professions (e.g. the UK Architects Registration Board). Then there are the professional associations themselves, where for an additional fee licensed professionals can ‘enhance and promote’ their profession (RIBA, 2012b).

Below the level of the overall profession, firms may influence each other by sharing practices or ideas. Work practices that prove successful in one firm might be copied by other firms; work practices that are unsuccessful may be avoided (Blau, 1984). A recent blog on the engineering firm ARUP’s ‘thoughts’ webpage argues that whole-life carbon assessment should become standard practice. The writer concludes his article with a professional call to action:

As engineers, I believe it’s up to us to show politicians what’s possible. After all, if engineers don’t do it, then who will?

(O’Riordan, 2012)

Although an article on the ARUP website may be read mostly by other ARUP employees, it written in a publicly accessible format and is available to other interested parties. The implication is that the writer’s viewpoint actually matters outside his own firm.

While much of the sideways activity may be within a particular profession, the systems theory of professions introduced earlier suggests that professions operating within related jurisdictions may also influence each other. For example, an architect who is enthusiastic about passive solar design will be likely to push the other professionals on a design team to incorporate solar strategies into their work (e.g. considering solar access and reflectivity in the landscaping, procuring a heating and control system that responds well to thermal mass). Indeed, the promise of benefits from integrated design depends on professionals of different types influencing each other in a synergistic way (Reed & Gordon, 2000).

Thus, professionals and practitioners can influence not only just their own practice, but also those of their compatriots and competitors. Sideways influences can occur between individuals, firms or even professions. Public challenges such as ‘if engineers don’t do it, then who will?’ can galvanize professionals within a firm, provoke professionals from other firms, or even induce different kinds of professionals to consider what their ‘standard practice’ is or should be.

Modes of influence

In addition to capability that professionals have to exert influence upstream, downstream and sideways, they have different ways of exerting this influence. The following ‘modes’ of influence are meant to be indicative categories rather than a full list of actions. For simplicity, each mode is named for its positive aspect, but most of these modes are bidirectional. For instance, if professionals can enable adoption, they can also disable it. Conceptual examples are provided below to articulate the ideas; empirical examples of these modes are contained in the following section.
**Enabling**
The middle-out framework sees enabling (or disabling) as a binary variable related to technology adoption. **Enabling** means allowing (and possibly promoting) a technology or strategy to be used in a project. To enable, the professional adopts a strategy but does not have to alter it to fit the circumstances. An example would be a professional installing cavity wall insulation to the level required by building regulations. The counter example (disabling) would be a professional who rejects or refuses the technology or strategy. An example would be a professional who recognizes that the wall cavity is not sufficient to install the required level of insulation. Rather than doing a job that cannot meet the regulations, the professional may refuse to do the work.

**Mediating**
In contrast to enabling, mediating is about participation, change and alteration. A professional who adopts a technology, strategy or process and then adapts it to suit the situation better is **mediating** it. An example would be a professional who installs cavity wall insulation to a performance level higher than required by law. It would similarly denote a professional who installs a lower level of insulation, *e.g.* if the cavity depth does not accommodate the legal level. Both of these professionals mediate the strategy. Mediation, as a participatory mode, is also the process of iterative discussion, such as that involved in collaborative design.

**Aggregating**
This action category recognizes that building professionals work with, in and on a large number of buildings. Whereas clients may just be involved in a single project (e.g., refurbishing their own house), professionals are involved in many projects, either concurrently or sequentially over the years they are involved in the sector. **Aggregation** refers to the abilities of professionals to see and act upon patterns across the building stock based on their work experience. An example would be a professional who recognizes that houses of a particular type might require a combination of strategies (e.g., cavity wall insulation on some walls, external and internal insulation in others) to produce the required level of thermal insulation throughout a project.

**Roles, opportunities and influences: middle-out examples**
Further research is needed into how the ‘middle’ can be activated and how it can start to play a more important role in the transition to a low-carbon economy. Some ongoing research and projects in this area are described below.

**Domestic sector: professionals as enablers**
Much effort is needed to bring about the transformation of the UK housing stock to meet low-carbon standards. Transforming the entire stock of existing homes in the UK to be more energy efficient by 2050, for example, is a challenge that requires 500,000 refurbishments of older, inefficient properties every year (Killip, 2008). The sheer scale of these transformations requires radical changes in both technology and work practices. Although optimizing the suite of available technical and social strategies for each existing dwelling will yield the best results in reducing carbon emissions, it is a tremendous challenge to assign this task to a fragmented construction industry. In the UK and elsewhere, housing refurbishment is the domain of small and medium-sized enterprises (SMEs) which include general builders, specialist builders (e.g., roofing contractors), plumbers, heating engineers, electricians, architects, design engineers, project managers, and building control inspectors. The UK’s Green Deal is designed to provide financing for the challenge, but it assumes that the skills necessary either exist or will be produced in response to the opportunity.

Low-carbon refurbishment amounts to a completely new service provided by the SME construction industry, combining new and traditional skilled trades in ways which result in low-carbon refurbishment. Figure 2 shows a general conceptual map of the fragmented construction industry, with professional roles arrayed along the horizontal dimension, and skills or competencies stacked along the vertical dimension. It provides a two-dimensional representation of how professional jurisdictions are differentiated (or not) from one another in the current system. Notably, gaps appear at the intersections of the professions and competencies, indicating spaces and imperfections in the current system. To the existing system, low-carbon refurbishment would appear as a possible new profession and/or jurisdiction. Existing professional roles (e.g., architect, structural engineer, general builder, roofer) may expand to encompass new competencies (e.g., energy assessment, installation of roof-mounted renewable energy systems, whole-home system integration). Competencies which are well established within one profession may need to be expanded to become the preserve of other roles, for which they have not traditionally been a concern; also, new roles and new competencies may be needed.

In September 2010, researchers at Oxford University and ECLEER[3] started a three-year cooperative, comparative study in Britain and France to explore the ways in which built environment professionals see gaps, opportunities and challenges for integrating low-carbon refurbishment in their work[4]. The research focuses particularly on the work practices of innovators as providing a key to understanding the social construction of new competencies and/or
roles that may alter the current system of professions. This focus on innovation is set against a backdrop of more general work practices and policy context. Nösperger, Killip and Janda (2011) present initial results of this research. Janda and Killip (2012) follow a socio-technical system of professions approach to the research. These authors argue that making significant change in the built environment is not a matter of re-engineering a technical system on paper, it is about reshaping a socio-technical system by redefining established skills, work practices and professions on the ground. Many vocational qualifications will need to be amended so that awareness of energy and carbon issues among the SME construction industry is significantly improved and practices changed to meet these new requirements. To increase the chance of success, refurbishment initiatives need to take into account the ways in which building trades people operate, making the objectives of policy practically deliverable.

From a middle-out perspective, the lack of a mature low-carbon building refurbishment industry could inhibit or even disable policy goals for transforming the housing stock. On the other hand, if building trades people are enabled to do the work by changes to their professional training, they could help to lead and produce innovation. For example, an engineering company in France has developed an innovative way of insulating the interior of party walls in cooperative multifamily apartment buildings. Their innovation is not just embodied in materials, it is a process innovation. This innovation is enacted in a shortened delivery time, which requires detailed measurements, reskilling two workers to do the work of several different trades, and some prefabrication off-site.

What is important to recognize from this case is that increasing client demand from the bottom-up for low-carbon building refurbishment (e.g. through the UK’s Green Deal) does not directly produce amendments at the middle level (e.g. vocational training or producer-led innovation). Policy imperatives from the top-down may eventually result in amendments at the middle agent level, but are likely to trickle through the industry starting with innovators rather than washing across the mainstream.

**Non-domestic sector: mediation and aggregation**

*Between client and landlord: professionals as mediators*

Recent research (Bright, 2008; Hinnells, Bright, Langley, Woodford, Schiellerup, & Bosteels, 2008; Better Buildings Partnership (BBP), 2009; Centre for Research in the Built Environment (CRiBE), 2009; Investment Property Forum (IPF), 2009a, 2009b) has examined how leasing arrangements can be developed to improve environmental performance standards in commercial property. There have been a number of initiatives designed to help landlords and tenants. Good practice guides and toolkits have been developed (e.g. Langley & Stevenson, 2007a, 2007b; British Property Federation (BPF), 2009; Langley & Hopkinson, 2009); ‘green leases’ have also been promoted. Green leases may involve a shift in traditional leasing patterns to share the tenant’s savings with the landlord so that both benefit, thereby providing an incentive for the landlord to undertake sustainable investment. Where leasing patterns are altered, there may be an impact on property rental value or yield (Royal Institute of Chartered Surveyors (RICS), 2009). Given that leased premises provide the space for much of the economic activity in retail and service-based industries in the UK, the impact that valuation changes may have on investment in commercial property is important to the UK economy.

From a middle-out perspective, the important question is who will be likely to negotiate and mediate between tenants and landlords to enable green leases to be adopted in practice? Industry groups (e.g. the Investment Property Forum (IPF)) and select groups of building owners in partnership with government (e.g. the Better Buildings Partnership (BBP)) are investigating the utility of green leases. However, the mediators between the client and landlord may be missing. There are gaps in between technical opportunities; leasehold structures and language; and the financial and economic goals of owners and occupiers. Depending on how the field evolves, these gaps may be filled by different kinds of professionals, from lawyers who specialize in tenant–landlord law, energy service companies (ESCOs) that think they can minimize energy use by working with both parties, or building management companies that see a way of providing a new service. Fitting ‘best practice’ ideas to particular sets
of actors and their current various physical surroundings requires a great deal of tailoring. It is as yet unclear which professional groups or organizational activities can help foster the growth of cooperative building communities (Axon et al., 2012).

**Between businesses: professionals as aggregators**

In addition to mediating between landlords and clients, professionals may also be able to provide additional carbon reduction opportunities through aggregating between businesses. The middle agent in this case is the energy service company (often called an ESCO), a single firm hired to operate, maintain or upgrade a number of properties owned by different organizations. Pacific Gas & Electric (PG&E), an investor-owned utility company in California, has started a project called ‘More Than a Million’ (MTM) which changes the traditional way in which energy efficiency programmes are delivered (Pande, 2009; Pande, Schmidt, Mahone, Debelleveue, & Turnbull, 2010). Traditional utility programmes offer incentives to owners on a building-by-building basis. Recognizing that this process has limitations for rapid upscale of activity, PG&E implemented MTM. MTM is a vehicle to deliver the utility’s existing energy efficiency services to a fleet of buildings. It uses a tool developed by the US Environmental Protection Agency called ‘portfolio manager’ that enables organizations to assess the energy performance of a fleet of buildings.7 Spurred by the MTM programme goals and support, ESCOs have been creating sets of buildings based on their client lists. What is important about this process is that these buildings may not be owned, operated or rented by the same groups, so would not have been eligible for the programme without the unifying lens of the ESCO. The connection between discrete buildings in some of the MTM clusters is the energy professional, rather than the owner, operator or occupier. Because reducing the aggregate demand in PG&E’s service territory is the goal, MTM relies on aggregation to deliver the demand reduction. It allows for greater economies of scale than the traditional bottom-up building-by-building approach, as well as access to higher levels of organizational decision-makers (e.g. chief financial officers instead of building engineers), and streamlining of delivery services. Yet unlike a top-down regulatory or a technologycentred approach, it is tailored to a specific set of buildings and their practical opportunities.

**Discussion and conclusions**

Professionals and practitioners such as builders, contractors, architects and energy service providers are important middle actors. They are neither top nor bottom, and neither suppliers nor consumers. This paper considers them as middle agents because they shape the practices through which energy is delivered and used by people in buildings. In this context, their actions have an impact on both the strategies installed in buildings and the capacities of energy users to reduce emissions. Building professions and professionals have enabling, mediating and aggregating functions which connect the top and the bottom in meaningful ways. Because of their middle position they can communicate needs and constraints to the top (upwards), to clients and users (downwards), and to similar institutions and professional practices (sideways).

The case studies highlighted in the previous section suggested how building professionals can and do serve as enablers, mediators and aggregators. Table 2 summarizes and extends these services, mapping the three directions and three modes of influence included in the conceptual framework onto a $3 \times 3$ matrix. Much as the middle-out framework is conceptual, Table 2 is more heuristic than deterministic. Although the directions of influence (upstream, downstream and sideways) are relatively clear, the modes of influence are not quite as distinct. The line between enabling and mediating an innovation is likely to be blurred more often than not. For example, in refurbishment work, an off-the-shelf triple-glazed replacement window may need some adaptation to fit perfectly into an existing space that has fallen out of square over time.

This paper suggests that different middles have important roles and functions in the transition to a low-carbon economy and society. These actors’ positions and training provide them with agency and the capacity to move, facilitate and support the transition process in ways that government (top) and individuals (bottom) do not have.

Although it has been argued that making use of the middle has the potential for greater strength and impact, this approach also suffers from weaknesses. The middle has its own agendas, its own interests and may lack the resources that are available to the top. While architects, engineers and others involved in the building industry are in a position to provide low-carbon or energy-efficient buildings, it is not their job to do so. They are required to comply with energy codes, not to exceed them. Any efforts to activate these middle actors to do more than the minimum required by law must assess environmental objectives in context with other work-related goals. The major force affecting most building professionals is not the quest for energy-efficient, high-performance or low-carbon buildings but the need to survive in a competitive and changing marketplace (Blau, 1984; Gutman, 1988). Survival in a changing marketplace is a difficult business, and there is more than one way to do it. Coxe et al. (1987) suggest there are six ways for firms in project-based industries to be successful. Given the recent interest in market segmentation of consumers (Consumer Focus, 2012; Department for
what would a market segmentation model of building professionals look like? And what might it be used for?

One thing that a segmented as opposed to a population-wide approach could aid is getting beyond the ‘early adopters’ and innovators to reach the mainstream. Construction statistics, however, already fail to capture a number of important attributes of the industry (Briscoe, 2007). Market segmentation work would be useful in providing a better depth of understanding about which types of firms do what kinds of projects, particularly in the informal and private sectors which are not well covered by existing statistics.

Not all middle actors are well situated to become leaders in their field. But in the near-term, raising the baseline of building energy performance could be accomplished by helping firms fit the attributes of available technologies and strategies more closely to their existing practices.

In the long-term, the building professions would need to change in such a way that producing low-carbon, high-performance, energy-efficient buildings and refurbishments is a part of rather than apart from their professional goals. Moreover, different types of professions and practitioners would have to work more synergistically than they do now to achieve this joint goal. Efforts have been made within professions (e.g. Environmental Design in University Curricula and Architectural Training in Europe (EDUCATE), 2010, 2012a, 2012b) to articulate possible changes to education and licensing examinations, but these efforts rarely address the interdisciplinary and project-based nature of construction and refurbishment practices (Taylor & Levitt, 2010, Scott, Levitt, & Orr, 2011). Beamish and Biggart (2012) argue that the commercial building industry is organized not according to firms or markets, but to project production networks (PPNs). PPNs are a form of economic organization that networks producers, buyers, sellers, subcontractors, clients, and consultants into a temporary and flexible organization. For building change to occur, it would need to spread across PPNs as well as within professions. Exactly how this would be done is unclear, but it is unlikely to occur spontaneously without active participation from middle actors themselves.

From a systems theory of professions perspective, it would be useful to perform a comparative exploration of whether greater levels of professionalization within middle actor groups help or hinder a middle-out approach to building change. Better organization, coherence and coordination within a profession or practice could be seen as increasing a group’s ability to exert influence, particularly upstream (to policy-makers) and sideways (to other professionals), but also downstream (to clients). On the other hand, increasing activities internal to the profession or practice could detract from the group’s perceived relevance in the outside world, thereby decreasing its societal raison d’être.

<table>
<thead>
<tr>
<th>Modes of influence</th>
<th>Upstream</th>
<th>Downstream</th>
<th>Sideways</th>
</tr>
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<tbody>
<tr>
<td><strong>Enabling</strong></td>
<td>Middle agents can support (or inhibit) efficiency opportunities required by governments and utilities</td>
<td>Professionals can variably encourage or discourage low-carbon technologies in specific projects and designs for which they are hired</td>
<td>Innovations and practices are transferred to professional communities through social learning and professional norms and requirements</td>
</tr>
<tr>
<td><strong>Mediating</strong></td>
<td>Professionals can influence the trajectory of their professional requirements; they may also shape government policy through reports and consultations</td>
<td>Mediating between landlord and tenant to promote cooperation; collaborative design with clients</td>
<td>Innovations and practices may propagate between middle agents as competitive business opportunities; groups may change to accommodate new opportunities</td>
</tr>
<tr>
<td><strong>Aggregating</strong></td>
<td>Aggregating across portfolios to maximize and mainstream savings opportunities for utilities or government</td>
<td>Aggregating across portfolios to maximize understanding for clients, particularly important in small businesses without dedicated capacity</td>
<td>Aggregating between businesses and professional firms to improve learning and knowledge sharing</td>
</tr>
</tbody>
</table>

Note: The terms professionals and practitioners are used in this context to include architects, engineers, energy service companies, builders, property agents, chartered surveyors.

Environment, Food and Rural Affairs (DEFRA), 2008)
Therefore, the challenge is harnessing the middle for transition efforts, particularly given the flexible structure of production networks and the unmapped but potentially powerful role of professionalization itself. A full analysis of this challenge is beyond the scope of this paper. However, some related efforts may be helpful in developing this arena, including active development of the middle’s capacity to deliver as needed (e.g. the case of vocational training for builders), the possibility of professionals serving as mediators for green leases, and ESCOs acting as aggregators across businesses.

The projects discussed in the case studies conceptualize the market as more than supply meeting demand in a frictionless plane. Many take a socio-technical view of change, which suggests a complex interrelationship between people, social practices and things. A more complete review of research that could be characterized in a similar vein would be a useful platform on which to build further work in this area. Further work on the middle-out is necessary to complement and enhance the existing emphasis on top-down and bottom-up approaches to changing the energy system.

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A middle-out approach to building professionals

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