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Barriers to English housing energy efficiency: stakeholders' perspectives

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Abstract: Sustainable transformation to energy efficient housing remains very challenging. While implementing effective governance remains specific to local and global contexts, more encompassing interrelated essential conditions have emerged which serve as prerequisite to varying degrees in implementing strategies for energy efficient housing in Europe. Notably, the existing English housing system has incorporated these critical drivers to leverage effective governance for energy efficient housing environments. Whilst these are important, there is a paucity of work on the understanding of 'barriers' against the backdrop of these prerequisite essential conditions from the whole system-wide stakeholders' perspectives. The purpose of this paper is to address these issues and identify a list of correlated and commonly agreed barriers from the stakeholders' perspectives. From the initial set of 40 barriers, this research identifies ten, as prioritised by online survey respondents. The paper, therefore, directs future research to investigate strategies that can overcome these key barriers.

Keywords: systems-thinking; stakeholders' perspectives; principal component analysis; sustainable transformation; energy efficient housing; English housing system; EHS; correlated and commonly agreed barriers; online survey.

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1 Introduction

Implementing a number of policies for energy efficiency in existing housing has become a priority for most countries in Europe including the United Kingdom (UK) (for example, UNFCCC, 2012; EC, 2011; CCC, 2013). This is in unison with widely accepted fact that housing offers the opportunity of extensive reduction in carbon emissions (ECOFYS, 2005; Lechtenböhrer, 2005). This assumption underlies a large volume of existing housing stock in Europe. As a consequence, the existing housing stock remains a primary concern for European housing policies (Bell et al., 2014). This is equally important for the UK on the grounds that it will have 70%–80% of existing housing stock in use in 2050 (Palmer and Cooper, 2011, 2014; Boardman et al., 2007). In addition, it is widely acknowledged that the English housing system (EHS) promises delivery of 60% of carbon emissions reduction through extensive implementation of energy efficiency measures such as increased air tightness, insulation, double or triple glazed windows and highly efficient boilers or heating systems and low-carbon strategies (Preston et al., 2013; HM Government, 2011).

The strategic transformation embedding energy efficiency in housing sectors in general is therefore currently recognised as a very important element for improving energy security, energy supply and housing sustainability (Marchand et al., 2015; Holdren, 2008). The empirical evidence show that there are enough technological solutions for energy efficiency (DECC, 2013; Killip, 2013). Besides, instruments like building regulations play a significant role in increasing energy efficiency (Krause et al., 2013; Lowe, 2000; Hitchin, 2008; Hoogma et al., 2005; Lowe and Oreszczyn, 2008). Moreover, the EHS has now constituted a regulative mechanism. Therefore, the oldest and most inefficient housing stock are identified as a target for the national energy efficiency strategy (UK CCC, 2010; DECC, 2012a; DCLG, 2015). In anticipation of contributing towards international agreements and in order to turn the energy efficient EHS into a successful contributor to climate change mitigation (UNFCCC, 1998), the UK's Climate Change Act (2008) and the Energy Act (2011) and a raft of energy efficiency and sustainability (EE&S) initiatives have been introduced in the EHS.

The account of transformational processes of the EHS development agenda section though not fully investigated (discussed later); demonstrate influence of policy processes within the EHS development pathways. These transformational processes are affected by how system-agents frame their activities informed by different perspectives, world-views and experiences. Simultaneously, regulations have growing influences on the organisational behaviour at different organisational levels. The development in the regulations and the regulatory mechanisms, seen as governance arrangements, has increased complexities in housing provision. Therefore, in spite of advances in the organisational structures; issues pertaining to complexities, effectiveness, and governance are not attended (Moore, 1995; Benington and Moore, 2010). Alongside, the dynamic of organisational field is influenced by inter-agency and inter-organisational working pattern (Benington, 2001; Sullivan and Skelcher, 2002), which in turn impacts EHS organisational leadership, strategic management and organisational change (Ferlie et al., 2003).

The strict and incremental energy efficiency regulations have been the results of broad institutional negotiations between regulators, policy makers and industry pressure groups, without considering greater number of niche level experiment activities involving householders (Marchand et al., 2015; Scott et al., 2014; Haines and Mitchell, 2014). As a consequence, the strategic development of energy agenda has resulted into peripheral incremental and confined to energy savings rather than ensuing strategic transformation. The outcomes of existing energy efficiency policies in general have mainly contributed on developing energy efficient technologies and not encouraged diffusion of these technologies (Jaffe et al., 1999; Kok et al., 2011; Fleiter and Plötz, 2013). In other words, the current energy efficiency policies are ineffective in changing behaviour of system-agents and the associated framings. This signifies that the scientific experiments of associating technologies' applications and technical change to actions and decisions of individuals are carried out without recognising the social or institutional context including localised practical knowledge and experience (Rogers, 2003; Macey and Brown, 1990). In a nutshell, strict disciplinarity of different actors have hindered the diffusion of technological advances; and the EE&S agenda of the EHS during the past

20 years have not realised into decrease in energy consumption and change in behaviour and values for sustainable use of resources (Dowson et al., 2012; Mallaburn and Eyre, 2014; Rosenow, 2012; UK CCC, 2010; DECC, 2012b; OFGEM, 2013; Hamilton et al., 2014).

The greatest challenge for today's EHS is to conceive and accomplish sustainability within housing development that may offer houses with integrated health, economic, social, environmental and institutional benefits (Hulchanski, 2002; Salama and Alshuwaikhat, 2006; Ko and Fenner, 2007; Cooper and Jones, 2008; Olsson et al., 2014; Jerneck et al., 2010; Walker et al., 2004). This suggests that the EHS needs to overcome a series of weaknesses, for example, inconsistent mechanisms of decision-making, incapability to govern, manage and engage strategically with problems of EE&S, non-conformities of regulatory compliance and inability to appreciate multi-dimensional perspectives (Marchand et al., 2015; Wilson et al., 2015; Hayles and Dean, 2015; Turcu, 2012; Boza-kiss et al., 2013; Pan and Garmston, 2012; Pettifor et al., 2015; Leßmann and Masson, 2015). These assumptions are identified to be capable of carrying out scientific inquiries for this research.

The aim of this paper is to understand, explain and interpret the latent reasons for not embracing broader conceptualisation of sustainable transformations considering multiple perspectives of the system-agents, respecting complexity and dynamic relationships in the EHS. The design for this research is an exploratory and interpretive. The knowledge for this research is developed through ambiguous mixed methods research (AMMR) (Holt and Goulding, 2014) evaluating participants' perspectives and determining latent reasons for not embracing broader conceptualisation of sustainable transformations. The paper concludes with suggestions for further research and investigations to contribute to the body of knowledge of local EHS stakeholders in dealing with the housing sustainable transformations.

2 Sustainable transformations

Having recognised the need for sustainable transformations, a number of studies have analysed these processes and provided several explanations: sustainable transformations require systemic change in fundamentals including values and beliefs, behaviour patterns, and governing practices (Clark, 2001; Raskin et al., 2002; Adger and Barnett, 2009; Solomon et al., 2009; Biesbroek et al., 2010; Leach et al., 2010; Ford and Berrang-Ford, 2011; Park et al., 2012; Haasnoot et al., 2013; Olsson et al., 2014; Eakin et al., 2014; Wise et al., 2014; Carter et al., 2015); sustainable transformations are recognised as being interlinked and multi-dimensional; sustainable transformations require both economies and societies to undergo transformations; sustainable transformations are processes that incorporate coevolution of demographic, technological, economic, social, cultural, institutional, informational and ideological developments; sustainable transformations are carried out in order to achieve greater (wider) sustainability and embark on sustainable development pathways (Walker et al., 2004; Gell-Mann, 2010; Olsson et al., 2014).

Of the many explanations given for sustainable transformations, this paper interprets sustainable transformation as ‘long-term and restructuring processes – through intervention techniques – required to articulate multi-dimensional EE&S objectives– in order to effectively overcome development pathways challenges and direct alternative development pathways towards multi-dimensional sustainability (MDS) opportunities’ (Rotmans et al., 2001; Rotmans and Loorbach, 2009; Frantzeskaki and De Haan, 2009; Meadowcroft, 2011; Grin et al., 2010; Frantzeskaki et al., 2012; Rauschmayer et al., 2015; McCormick et al., 2013). When calling for such a transformation, emphases are made on developing capabilities and decision-making strategies to leverage sustainable transformations using the complex adaptive perspective of dynamic societal systems (Avelino, 2011; Loorbach, 2010; Park et al., 2012; Poli, 2015; Mohrman and Shani, 2011; Holland, 2006; Axelrod and Cohen, 1997).

The contributions in the areas of sustainable transformations have increased understanding of these processes; however, the governance and the framing problems in delivering effective sustainable transformations have not yet been addressed (Mohrman and Shani, 2011; Holtz et al., in press; Voß et al., 2009). In response to this, a broader conceptualisation has been advocated to increase the effectiveness of sustainable transformations. Broader conceptualisation of sustainable transformations include a number of factors ranging from integration of multiple contexts through coordination between every processes to simultaneously overcoming barriers and delivering objectives interpreted from stakeholders’ perspectives (Haasnoot et al., 2013; Wise et al., 2014; Leach et al., 2010; Pelling, 2011; Maru et al., 2014). Accordingly, the broader conceptualisation of sustainable transformations not only increases capacity for dealing with temporal transformations, it also allows to view implications of sustainable transformations, in order that entities (including societal systems, organisations and individuals) lacking in capacities for decision-making can be assisted through appropriate interventions and increase opportunities for sustainable transformations (Stafford Smith et al., 2011; Eriksen et al., 2011; Maru et al., 2014).

Given this, identifying and understanding complex processes of societal systems undergoing transformations are prerequisite. These include identifying theoretical underpinnings that contribute to the understanding of constructs of societal systems, different kinds of challenges and opportunities these systems hold, and different kind of attempts and resources go into the processes of sustainable transformations. Theories underpinning ‘systems-thinking’ are applied in order to understand the complexity and multi-perspective dynamics of the societal system undergoing transformation. The systems-thinking is a worldview which allows appreciation of holistic system having interconnections between component-elements, having properties such as drivers, outcomes and feedbacks and can be applied to problems of multiple disciplines (Forrester 1969; Voinov, 2008; Cerar, 2012). Hence, decision-making can be improved by considering characteristics of the system such as dynamism, network, adaptive capacities, and cross-level interconnections (Arnold and Wade, 2015; Plate and Monroe, 2014).

The sustainable transformations literature mainly contributes to two dimensions: scientific understanding of transformational processes of large-scale complex societal systems; and the effectiveness of sustainable transformations (including initiating and driving sustainable interventions and achieving sustainability outcomes) (Holtz et al., in press). However, these contributions have not been able to capture current realities and diversities of sustainability challenges and opportunities that may have an

impact on specific integrated contexts in which the transformational processes take place. The key challenge underpins interpreting theories for societies, economies, politics, organisations and individuals. The current theories are confined to limited contexts and underpin traditional practices or understandings that are based on unsustainable behaviour (UNEP, 2012; Juhola et al., 2011; Bassett and Fogelman, 2013; Meadowcroft, 2011). Therefore, theoretical transformations are required to capture current understanding – realities and dynamics of complex systems, including perspectives of system agents – to facilitate broader conceptualisation of sustainable transformations (Juhola et al., 2011; UNEP, 2012; Voß et al., 2007; Mohrman and Shani, 2011).

Examples of the contexts range from availability of natural resources through advances in information, communication and computational technology to global reach and integration between economic growth and exploitation of natural as well as human resources. Today, there are some new realities associated with development pathways. These realities include factors challenging sustainable development such as limited resources, a need to change economic growth patterns, reduce energy use and decrease carbon emissions. Therefore, it is expected that system-agents accept these new realities, diagnose their problem, assess and plan for adaptation to the new (emerging) contextual realities (Astley, 1985; Gorddard et al., 2012; Moser, 2010). The next section presents the account of transformational processes of the EHS to highlight the realities related to the EHS including different research methods, framing, policy-making processes, decision-making and energy efficiency.

3 The English housing system

Illustrating few examples of how the different EHS sector representations have generally impacted on the EHS development strategies and agenda, this section highlights strategic implications of these representations. The scope of analysis is aimed to the dynamics involved in the EE&S agenda in the existing stock of the EHS. Two reforms have taken central entry points in the EHS: the public service reforms and energy efficiency regulatory reforms. However, these do not exclude other reforms as central to the EHS policy arena in which the EHS system-agents engage. The empirical entry points and relationships between different representations are identified through literature review.

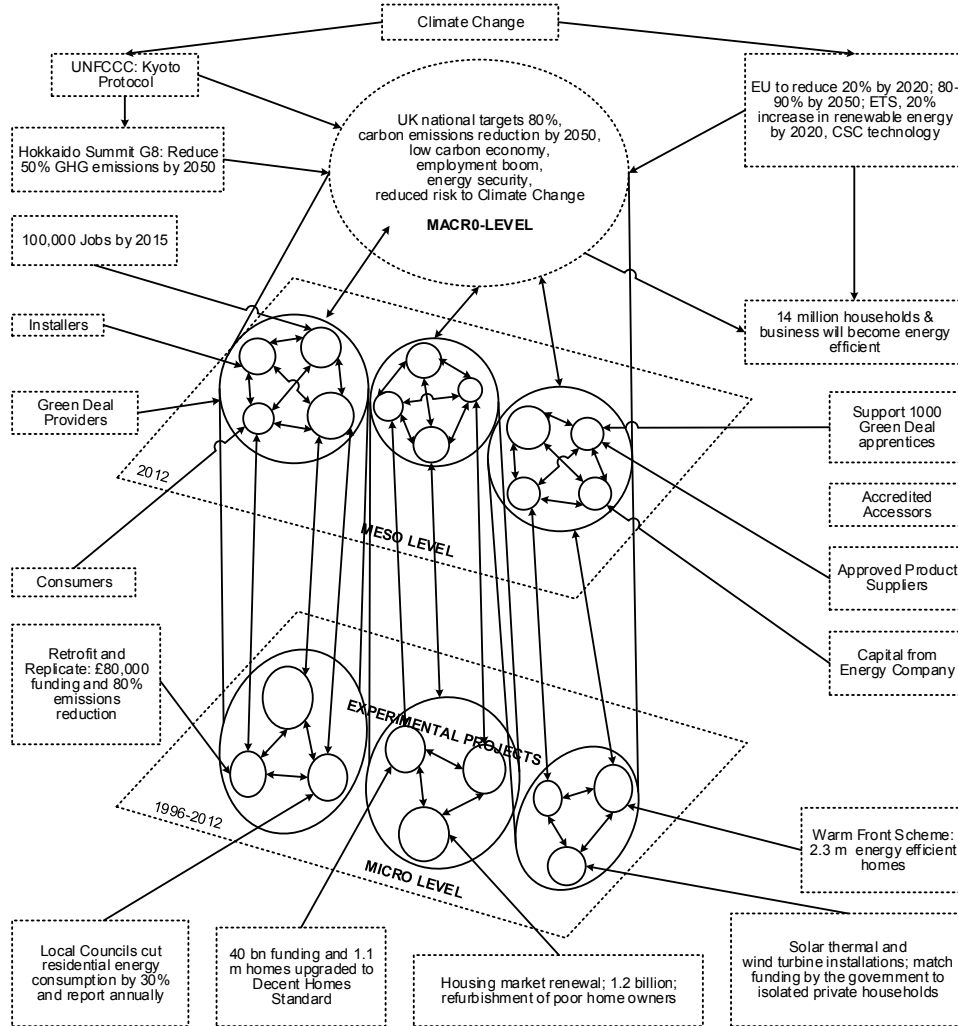
Traditionally, the EHS policies are built on positivist epistemological approach without having apparent theoretical explanation (Pinker, 1971; Kemeny, 1992; Clapham, 1997). Following this, the Fabian-inspired housing research has emerged applying rigorous methodology (see Jacobs and Manzi, 2000) and has influenced the development of housing social policies (Pinker, 1971; Power, 1999). Subsequently, a number of studies have applied ‘constructivist’ epistemologies giving alternative representations (Jacobs and Manzi, 2000; Kemeny, 2004). However, this approach does not fully appreciate complexity of the ‘real world housing system’ (Jacobs et al., 2004; King, 2009). This implies the EHS theories must focus on the relationship of trio: the housing system-agents, the housing system and the societal processes (King, 2009; Kemeny, 1992) integrating alternative approaches such as ‘interpretivism’ (Clapham, 2009).

The planned public service reforms applied through the idea of ‘new public management (NPM)’, ‘managerialism’ and ‘modernisation’ marked the long-term transformation of housing provision from ‘public’ to ‘social’ and contributed towards the governance, strategic management and institutional agenda. These reforms initiated several adaptations in the EHS. For example, increase in privatisation, provision of good quality and affordable housing, development of skilled workforce in housing (Malpass and Victory, 2010); the ‘joined-up’ organisational policies among the associated network to delivery services, association with service-users in order to achieve excellence in service provision, instigation of local accountability, societal learning and values in the organisational culture (Armstrong, 1999; Ferlie et al., 2003; Stewart and Ranson, 1988; Mullins and Murie, 2006, Taylor, 2008); remodelling of both top-down and bottom up approaches (Reid and Hickman, 2002; Mullins and Riseborough, 2000); and provision of ‘customer-focused services’ underpinning managerialism and shifting the control of services from professionals to managers (Mullins and Riseborough, 2000).

The governance theory, importantly, provides references to mechanisms of governing and networking of actors and organisations having stake in the governing process (Kooiman, 2003). The modernisation agenda have impacted the EHS governance arrangements at various levels and three different coordinations, namely, hierarchies, markets and networks are evident (Mullins et al., 2001; Stoker, 1999; Lowndes, 1999). A top-down approach governs the system with vertical communication and reporting procedure in hierarchies (Stoker and Young, 1993). Markets coordination mechanism induced privatisation in housing offering better housing products and services (Levacic, 1993; Williamson, 1985). The ‘networks’ provide goods or services that support the system (Alter and Hage, 1993; Thompson, 2004). Most importantly, these coordinations of governance occur simultaneously, either at one point of interaction or at a number of different points of interactions (Lowndes and Skelcher, 1998). Given this, a number of studies argue that different modes of governance are strategically used to structure coordinations internally within the organisation as well as externally in a multi-organisational system to manage their responsibilities and achieve concrete aims (Pollitt, 1990; Walker, 1998; Lowndes and Skelcher, 1998).

A broader energy agenda originally was introduced in the EHS in response to public health issues [The Building Regulations (Local Enactments) Order 1966, 1966]. The energy agenda was latter used to respond to the international oil crisis in early 1970s (Shove, 1998). Gradually, a series of regulative instruments such as reduced data standard assessment procedure (RdSAP) rating [RdSAP, 2009, Version 9.91; SAP, (2012), version 9.92] have been implemented to improve the energy performance of mass existing buildings. Following social, economic, health and psychological outcomes in addition to contributions to carbon emissions reduction from the initial energy efficiency programs such as warm front (DCLG, 2006a; DEFRA, 2004), several other EE&S initiatives have been introduced in the EHS. Namely, the energy company obligation (ECO), the Green Deal, the carbon emissions reduction target (CERT) and the community energy saving program (CESP) (Guertler, 2012; Mallaburn and Eyre, 2014; DECC, 2011).

Figure 1 Socio-technical representation of the Green Deal

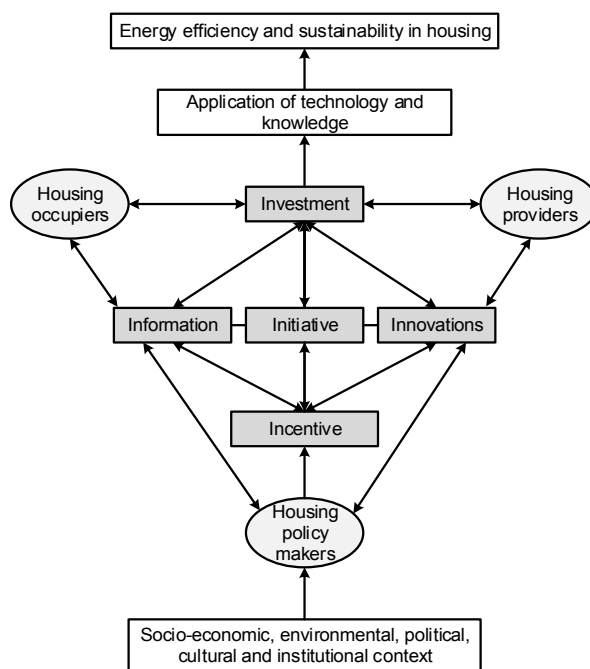


Source: Thakore et al. (2013)

According to several analysts, the Green Deal holds sufficient potential to encourage EE&S in the EHS (for example, Guertler, 2012; Dowson et al., 2012; Marchand et al., 2015). The qualitative analysis of the dynamics of the Green Deal initiative through the lens of ex-ante SNM tool signify that this initiative encourages development of policies, processes and actions in order to expedite EE&S in the EHS (see Figure 1) (further details referred to Thakore et al., 2013). The Green Deal is designed to decrease overall energy consumption, reduced energy bills for end-users and increased comfort (Guertler, 2012; DECC, 2011; Dowson et al., 2012; Thaler and Sunstein, 2008). However, the success of the uptake of the Green Deal depends to a large extent on the willingness of the EHS system-agents (as consumers) to engage with the Green Deal improvements (Gough, 2013).

The account of transformational processes of the EHS development agenda; though not fully investigated, presented in this section demonstrate that in spite of advances in the organisational structures; issues pertaining to complexities, effectiveness, and governance are not attended (Moore, 1995; Benington and Moore, 2010). Further, it highlights that the environmental framing and representations through various energy efficiency programs have constituted to energy savings, resource savings and well-being; however, it has been lower than anticipated because it has not necessarily engaged all relevant EHS householders including householders (Bell and Lowe, 2000; Marchand et al., 2015; Scott et al., 2014; Haines and Mitchell, 2014). Therefore, there are justifiable social, economic and environmental representations (for example, see Petrova et al., 2013; Liddell and Morris, 2010; Brown et al., 2014; Genovese et al., 2013; Gough, 2013) that needs to be embodied into the broader conceptualisation of sustainable transformations.

Figure 2 Five essential conditions approach for housing sector



Source: Adapted from UNECE (2009)

The above account of the EHS, therefore, identifies a need for dynamic and multi-layered governance structure that embodies multiple disciplines and multiple perspectives employed and accepted for framing processes (Mohrman and Shani, 2011; Holtz et al., in press; Voß et al., 2009). To this end, in 2009, the Committee for Housing and Land Management of the United Nations Economic Commission for Europe (UNECE¹) has identified a coherent integrative framework encompassing five 'essential conditions', which serve as prerequisite to effectively leverage a more comprehensive strategy for governance of sustainable transformations in relation to energy efficient housing (see Figure 2). These are investment, information, innovation, incentive, and initiative,

conceptualised as 5-INs (hereafter mentioned as 5-Ins). However, establishment of these prerequisite conditions, according to UNECE (2009, 2011, 2014), is determined by decision-making of various system-agents having influence or being influenced by the process of sustainable transformations. While the establishment of these essential conditions depend on decision-making of the system-agents, these essential conditions depend on specific reality established by their social, technical, economic, political and institutional context as well as cultural and environmental inherited circumstances.

Theoretical underpinnings of 5-INs have practical implications. Investing in energy efficiency is widely acknowledged to be a cost effective measure for reduction of carbon emissions concluding in multiple benefits (Davenport et al., 2004; Rudge and Nicol, 2000, Boardman, 2010; Kuholski et al., 2010; Fuller et al., 2010). Also, it is important because large stocks of the EHS offer immense opportunity for installations of energy efficient measures. Information is generally considered an essential condition for increasing investment in energy efficiency measures (Fuller et al., 2010; Williams, 2010; Dietz, 2010). Innovations in technologies have been successful in promoting energy efficiency on the technical front (Herring and Roy, 2007). Thus, there is a need for innovations for diffusion of these energy efficient technologies.

Incentives within housing energy efficiency policies are required to include adequate financial incentives, strict enforcement of standards, and regulatory structure. This is in order to persuade all system-agents to take responsibility and invest in energy efficiency measures (Baek and Park, 2012; Williams, 2010; Painuly, 2001). Energy efficiency initiatives are required in order to turn expectations of system-agents to realistic objectives (Jacobsson and Johnson, 2000; Makovich, 2011; Wolsink, 2012). Moreover, establishing 5-INs is accepted to provide improved living conditions, affordable housing, savings in energy bills, savings in energy production, job creation, local, regional and national development, decreased inequality, increased integrity, increased resilience against Climate Change, improved landscape and improved environmental conditions (Rudge and Nicol, 2000; Boardman, 2010; Kuholski et al., 2010; Bell et al., 1996; World Bank, 2010).

Given these 5-INs are interrelated and complement each other, no one of 5-INs can be the reason for not embracing broader conceptualisation of sustainable transformations. However, a number of barriers exist to each of 5-INs and challenge their functionality in offering carefully designed governing pathways for housing (UNEP-SBCI, 2009; WBCSD, 2010). A number of evaluation studies which assessed ineffectiveness of EE&S policies within the institutional setting of housing system have identified several barriers, these are compiled under each category of 5-INs (see Annex 1). However, the EHS needs to be more productive and more innovative supported by inclusive and consensus-based processes that recognise worldviews and interests of all EHS system-agents to generate a whole sector representation. Above all, sustainable transformations requires considering implications between various agents (individuals and collectives, humans and non-humans, experts and non-experts, etc.) at multiple levels (Jensen, 2012; Gaziulusoy and Brezet, in press).

4 Methodology

Philosophically, this research is exploring a complex real-world problem. This research's domain fundamentally belongs to the social sciences and draws on dynamic

decision-making in construction management. The research aim is ‘to understand, explain and interpret the latent reasons for not embracing broader conceptualisation of sustainable transformations considering multiple perspectives of the system-agents, respecting complexity and dynamic relationships in the EHS’. The philosophical stance adopted in this research is constructivist/interpretivism (Fellows and Liu, 2013; Smirchich, 1983). This is to allow explore subjectivism and interpretation of understanding of the problem and potential solution from different viewpoints (Klein, 2004) within the context of this research (Boulding, 1956; Reeves and Hedberg, 2003). Given a high consideration to make social integration between multiple realities such as individual, organisation and national-global, and understand several perspectives, combine factual (science) and tacit (latent) knowledge developed through engagement with the EHS agents adoption of such philosophical stance directs this research to consider mixed methods for collecting and analysing research data (Chileshe and Dzisi, 2012; Hughes et al., 2012; Holt and Goulding, 2014).

This research requires developing whole systems knowledge (Hadorn et al., 2008; Hadorn et al., 2006; Rauschmayer et al., 2015). The barriers to 5-INS are abstract and they are interpreted differently by different people. Different dimensions are associated to these barriers and their conception by various EHS system-agents could be in a number of different ways. When a process involves consideration of unobservable concepts, evaluating these concepts is a difficult task. A survey questionnaire is a measuring instrument to evaluating unobservable concepts using variables associated with these concepts (Fowler, 2014; Thomas et al., 2011; Corbin and Strauss, 2015). Structured survey questionnaires and statistical analysis are used in AMMR research designs (Holt and Goulding, 2014). Respondent’s subjective perceptions are captured through tools such as Likert scale and subjective analysis are used to generalise the respondent’s views (Carifio and Perla, 2008; Norman, 2010; Jamieson, 2004; Merriam, 2015). A well designed survey questionnaire was developed and administered after a pilot study (Fink, 2009; Turner and Martin, 1985).

The purpose of the survey questionnaire was to identify correlated commonly agreed perspectives on very important barriers to 5-INS, respecting complexity and dynamic relationships in the EHS. The questionnaire opened with introduction followed by five sections associated with 5-INS (see Annex 2) (Dillman and Smyth, 2007). Each section had eight item-questions. These item-questions were operationalised using barriers identified in Annex 1. These questions were presented in a ‘matrix’ format and respondents were requested to consider only one answer from four options (Check and Schutt, 2011; Dillman, 2011). At the end of each section, an optional open-ended question was provided for participants to express their opinions on the barriers. The common errors such as errors of observation and errors of non-observation were minimised by clear, interesting and well organised survey questionnaire (Groves et al., 2013; Engel and Schutt, 2014; Couper et al., 2001).

In line with the philosophical conception of this research topic, matrix questions were formed using Likert-type response questions. A four-point Likert scale was used for measuring degree of importance of each item from the respondents’ perspective (Likert, 1932; McIver and Carmines, 1981; Alphen et al., 1994). Through the use of Likert scale, it was assumed that the Likert scale allows scientific survey and interpretation of the context specific research results (Göb et al., 2007). Further, response rate being an important factor in online surveys, about 11% lower than other modes of surveys,

(Manfreda et al., 2008); absolute response rate was considered (Denscombe, 2014). The response rate was increased by reaching the right participant and continuously emailing the targeted samples until saturation point was reached (Hewson, 2003; Kittleon, 1997). Ethical approval was obtained in accordance with the university code of conduct for research ethics and ethical issues such as confidentiality were addressed as well as anonymity of the participant was supported (Fowler, 2014; Check and Schutt, 2011; Mangione, 1995). A small-scale intensive pilot was carried out using 10 participants, representatives of the target population and the structure and format of the questionnaire was improved (Aldridge, 2001; Thomas et al., 2011). The empirical analysis of evidence collected through this methodology is discussed next.

5 Results

The data, however, was required to undergo analysis and identify principal components underlying the complex, multivariate and ambiguous perspectives (Cattell, 1988) represented through responses of the EHS multi-disciplinary system-agents. The number of responses ($N = 108$) was adequate for analysis (Costello and Osborne, 2005; Tabachnick and Fidell, 2013). In addition, Cronbach's alpha was .938 (see Table 1), which confirmed internal consistency of the data. The Kaiser-Meyer-Okin (Kaiser, 1960) was 0.807, which was considered acceptable (see Table 2) (Field, 2009). The Bartlett's test of sphericity (see Table 2) demonstrated correlation between responses and their suitability for analysis.

Table 1 Reliability statistics

<i>Cronbach's alpha</i>	<i>Cronbach's alpha based on standardised items</i>	<i>No. of items</i>
.938	.938	40

Table 2 Kaiser-Meyer-Olkin measure of sampling adequacy

<i>KMO and Bartlett's test</i>		
Kaiser-Meyer-Olkin measure of sampling adequacy		.807
Bartlett's test of sphericity	Approx. chi-square	2,608.851
	df	780
	Sig.	.000

Applying principal component analysis (PCA), ten factors were identified based on the value of eigenvalue = 1 (Kaiser, 1960). The scree plot (Cattell, 1966) showed two principal components. The first principal component with the eigenvalue = 12.174 accounted for total variance = 30.436%. The second principal component with the eigenvalue = 2.949 accounted for total variance = 7.372%. Thus the first two components accounted for 38.807%, which were significantly greater than remaining eight components. Finally, as these variables were assumed to be correlated, these variables were subjected to oblique rotation, direct oblimin (Jones and Johnston, 1999). The pattern matrix for direct oblimin reported factor loadings for each variable that were greater than 0.50, highlighting two components and gave the best possibility to interpret the hidden continuum (see Table 3) (Rietveld and Van Hout, 1993; Field, 2009; Rattray and Jones,

2007). The component 1 consisted of nine variables. These were lack of priority for energy efficiency, lack of leadership, lack of management, lack of innovation, lack of capacities, lack of accountability, lack of responsibilities to reduce environmental impacts and lack of culture to embrace innovation. The component 2 consisted of six variables. These included lack of subsidies systems/grants, lack of funds or high cost, lack of tax exemptions/reductions/credits on investment related to housing energy efficiency, lack of support from intermediary agencies, high upfront costs or lack of investment and use of exclusively 'high technology'.

In addition to above, a number of measures for reliability and validation were applied for empirical data collection (Campbell and Fiske, 1959; Eby et al., 2009). These included reliability test to identify internal consistency of online survey responses using Cronbach's alpha and sampling adequacy using Kaiser-Meyer-Olkin measure (Field, 2009). The validity of the responses was determined by face validity and criterion validity (Brewer and Hunter, 1989). Face validity was determined by eyeballing for missing values and entry errors, and identifying outliers and central tendency through descriptive analysis using SPSS (Boone and Boone, 2012). Criterion validity was determined by Kaiser's criterion (Kaiser, 1960, Ferguson and Cox, 1993) including scree plot (Cattell, 1966). Construction and interpretation of qualitative constructs identified by online survey analysis were validated by anonymous built and environment researchers (Campbell and Fiske, 1959; Eby et al., 2009). In this manner, combining qualitative and quantitative research methods (Moffatt et al., 2006) have offered opportunity to develop theory with balanced objectivity and subjectivity in addition to conducting an effective valid research (Denzin, 1978).

Table 3 Results of principal component analysis

<i>Barriers</i>	<i>Components</i>	
	<i>Component 1</i>	<i>Component 2</i>
1 Lack of priority for energy efficiency	0.86	
2 Lack of leadership	0.824	
3 Lack of management	0.754	
4 Lack of priority for energy efficiency	0.752	
5 Low priority given to energy issues or lack of innovation	0.669	
6 Lack of capacities	0.616	
7 Lack of accountability	0.593	
8 Lack of responsibilities to reduce environmental impacts	0.55	
9 Lack of culture to embrace innovation	0.504	
10 Lack of subsidies systems/grants		0.82
11 Lack of funds (public or provided on a competitive base) or high cost		0.712
12 Lack of tax exemptions/reductions/credits on investment related to housing energy efficiency		0.643
13 Lack of support from intermediary agencies		0.595
14 High upfront costs or lack of investment		0.581
15 Use of exclusively 'high technology'		0.579

6 Discussion

A coherent integrative framework encompassing 5-INs has been proposed to provide effective comprehensive governance strategy for sustainable transformations in housing system (UNECE, 2009, 2011, 2014). Accordingly, 5-INs are considered as prerequisite conditions for the EHS to process broader conceptualisation of sustainable transformations. However, a number of barriers exist to these 5-INs and challenge their functionality in offering carefully designed pathways for housing (UNEP-SBCI, 2009; WBCSD, 2010). A number of evaluation studies which assessed ineffectiveness of EE&S policies within the institutional setting of housing system have identified several barriers (see Annex 1). Further, the coherent integrative framework emphasises that these essential conditions depend on decision-making of the system-agents and on specific reality established by these system-agents' social, technical, economic, political and institutional contexts as well as cultural and environmental inherited circumstances (Golubchikov and Deda, 2012). Therefore, it was required to identify barriers to 5-INs that were common from multiple perspectives held by relevant system-agents in the EHS (Schneider and Rist, 2014; Aeberhard and Rist, 2009).

In order to identify common valued perspectives, an online survey questionnaire was administered throughout the EHS demographics involving multiple housing developers, housing end-users and housing regulators or policy-makers. A logical, systematic and structured approach to the design and development of the survey questionnaire fetched appropriate results for descriptive analysis and factor analysis. The internal consistency was high which provided reliability and validity to the questionnaire. This provided confidence in the results. Results revealed some engrossing facts. It was interesting to note that many of the same barriers which were flagged up as important barriers in past years still existed in the EHS. Reflecting on the important barriers the descriptive analysis of the online survey highlighted that the EHS faced difficulties in establishing 5-INs. These barriers included variables such as arranging for upfront cost, funds and grants. Other important barriers include getting support and exemption on investment. Nevertheless, there existed a good level of knowledge and awareness of energy efficiency issues in the EHS.

Exploratory factor analysis (Corbin and Strauss, 2015; Thomas et al., 2011; Check and Schutt, 2011; Kim, 2008; Tabachnick and Fidell, 2013) was carried out to retain two components which had positive loadings. The items within these components were very important from a composite common correlated multi-perspective (Morrison and Shortt, 2008; Nardo et al., 2005; Rietveld and Van Hout, 1993; Kim, 2008; Tabachnick and Fidell, 2013; Gorsuch, 2003) of the EHS. The online survey results contributed towards research aim and development of systems knowledge (Hadorn et al., 2008; Hadorn et al., 2006; Rauschmayer et al., 2015). Collating an overall picture of these barriers to 5-INs experienced by the EHS, it was required to delve into details to identify how these barriers can be addressed. Based on literature review, the very important barriers were linked to strategic capabilities. It was posited that specific capabilities are needed to recognise and effectively intervene to overcome these barriers to 5-INs, which are assumed to delivery MDS (Schäpke and Rauschmayer, 2014; Leßmann and Rauschmayer, 2013; Shove et al., 2012; Sen, 2013) in the EHS. However, before operationalising these barriers for further investigation, the list of barriers identified through PCA were required to be compiled. For example, the barriers that had more or less same meaning and appeared more than once were compiled into one barrier to reduce

anonymity. Each barrier was then associated to strategic capability criteria as shown in Table 4. These changes and operationalisation were reviewed and validated by two independent reviewers.

There is, therefore, a need to invest in strategic capabilities. Perhaps more importantly, it cannot be assumed that investing in strategic capabilities for EE&S will lead to MDS. Assumptions around the possible MDS impacts need to be empirically tested through evaluations which assess changes in strategic outcomes following strategic interventions developed through investing in strategic capabilities. At the same time, empirical evidences need to ensure strategic interventions are in relation to 5-INs allowing strategic governance of EE&S for sustainable transformations in the contexts of specific reality of the EHS. According to Engle (2011), when a number of strategic capabilities are needed to overcome critical barriers, perspective and pragmatic differences in decision-making and prioritisation of relevant interventions may occur. Also, these strategic capabilities are latent and rarely possessed uniformly by any given population (Engle, 2011).

Table 4 Strategic capabilities criteria

<i>No.</i>	<i>Very important barriers</i>	<i>Strategic capabilities</i>
1	Lack of priority for energy efficiency/lack of responsibilities to reduce environmental impacts	Strategic ownership (SO)
2	Lack of leadership	Strategic leadership (SL)
3	Lack of management/capacities	Strategic management (SM)
4	Lack of accountability	Strategic accountability (SA)
5	Lack of culture to embrace innovation	Strategic cultural awareness (SCA)
6	Lack of priority for energy efficiency	Intermediate energy policies (IEP)
7	High upfront costs or lack of subsidies systems/grants/funds	Targeted energy policies (TEP)
8	Lack of tax exemptions/reductions/credits on investment related to housing energy efficiency	Technology-specific policies (TSSP)
9	Lack of support from intermediary agencies	Building specific codes, standards, regulations (BSCSR)
10	Use of exclusively 'high technology'	Policies supporting supply chains in making technology easy to implement

Little is known about the interventions, challenges and impacts of strategic capabilities for housing EE&S programs which can lead sustainable transformations and contribute to the MDS objectives of the EHS (Jaffe et al., 2004, Howarth et al., 2000, Golove and Eto, 1996; Stern, 2011; Martinot and McDoom, 2000). Therefore, there is a need to explore further details of 10 strategic capabilities linked to very important barriers identified by the respondents of the online survey (see Table 4). Possibly, research methods such as the Delphi study can ensure wide participation of the organisational stakeholders across multiple levels and multiple disciplines. The views of these EHS expert system-agents are required to be collected for in-depth evaluation of strategic capabilities. Such evaluation requires capturing insights of a broad spectrum of strategic interventions, challenges and impacts implementation at any level for EE&S. In addition, the evaluation

requires capturing core values of the participants by evaluating the importance of aligning EE&S strategies with business strategies. Such data can provide a broad spectrum of knowledge and experience in terms of emerging properties of the EHS.

7 Conclusions

An important feature of transforming theoretical framing relates to accommodating inter-related multiple societal theories. The degree of contextual complexity in a societal system needs to be explicit of considering such framing of decision-making process in order to increase the effectiveness of the broader conceptualisation of sustainable transformations (Voß et al., 2007; Smith et al., 2011; Eriksen et al., 2011; van Vuuren et al., 2011; Wise et al., 2014). This research applied triangulation in the research process (Webb et al., 1966; Greene, 2008; Johnson et al., 2007) in order to increase the trustworthiness of the data and its inferences. Initially, a number of theories have been drawn from integration of concepts (Denzin, 1978) of sustainable transformation, theoretical underpinnings of systems-thinking and empirical systems knowledge of the EHS.

Further, constructivist/interpretivism philosophical stance (Fellows and Liu, 2013; Smirchich, 1983) adopted in this research for knowledge inquiry and development has attempted to consider multiple viewpoints, perspectives and disciplines offered acknowledgement of appreciative and inclusive local and broader contextual realities (Greene, 2008; Johnson et al., 2007). Furthermore, grounded theory was applied to identify theory implications based on synthesis or integration of multiple perspectives (Denzin, 1978; Jick, 1979). Such triangulation of multiple theories acknowledges the comprehensiveness of this research (Jick, 1979). In addition to these, between- or a cross-method triangulation has been applied using AMMR (Webb et al., 1966; Denzin, 1978; Holt and Goulding, 2014), namely, literature review, survey and statistical analysis. These research methods have been used in support or compliment to one another in order to establish methodological rigour (Denzin, 1978).

The broader conceptualisation of sustainable transformations requires identifying barriers to all parameters involved in driving EE&S (Amundsen et al., 2010; Burch, 2010). A comprehensive review of barriers to 5-INS illustrated that a single perspective or dimension was insufficient in representing them. Therefore, understanding these barriers is a multi-perspective or multi-dimensional issue. Latent composite constructs have ability to summarise such issues, thus easing the process of identifying areas that need to be targeted (Morrison and Shortt, 2008; Nardo et al., 2005; Rietveld and Van Hout, 1993; Kim, 2008; Tabachnick and Fidell, 2013; Gorsuch, 2003). Here, the composite common correlated multi-perspectives held by the respondents were represented by finding latent constructs that underpinned combinations of contextual and interrelated (composite) 'very important' agreed barriers (Max-Neef, 2005; Nicolescu, 1998, 2008).

In addition, this analysis described how complex (multi-perspective, multi-dimensional, multi-level) issues such as EE&S can be problematic in evaluation and offers an explanation by describing how respondent's subjective perceptions can be captured. The Likert-type item response format survey questionnaire was instrumental in capturing such perceptions as illustrated in this research. In addition, identification of latent constructs was enabled by the statistical PCA technique (Carifio and Perla, 2008; Norman, 2010; Holt and Goulding, 2014). For example, respondents were asked to

indicate their level of agreement by choosing one of four given number of ordered response categories ranging from ‘unimportant’ to ‘very important’. This is an important contribution to the literature since issues of EE&S have ranged from being discounted to being explicitly focused but with slow success rate (Hamilton et al., 2014; Nalau et al., 2015; Gibbs and O’Neil, 2015).

Given the complexity of the research problem and need to interrelate the systems knowledge to the target knowledge to get a comprehensive understanding of the research problem, this simplistic rating scales used in the survey are not capable of providing rich and detailed data that would offer valuable insights in the complex processes involved in the real situations (Merriam, 2015). The further research design therefore needs to combine qualitative and quantitative methods to yield rich and detailed analysis and support the survey findings (Creswell, 2013).

References

- Adger, W. and Barnett, J. (2009) ‘Four reasons for concern about adaptation to climate change’, *Environment and Planning A*, Vol. 41, No. 12, pp.2800–2805.
- Aeberhard, A. and Rist, S. (2009) ‘Transdisciplinary co-production of knowledge in the development of organic agriculture’, *Ecological Economics*, Vol. 68, No. 4, pp.1171–1181.
- Aldridge, A. (2001) *Surveying the Social World: Principles and Practice in Survey Research*, Open University Press, UK.
- Allcott, H. and Greenstone, M. (2012) *Is there an Energy Efficiency Gap?*, National Bureau of Economic Research, Working Paper No. 17766.
- Allen, S., Hammond, G. and McManus, M. (2008) ‘Prospects for and barriers to domestic micro-generation: a United Kingdom perspective’, *Applied Energy*, Vol. 85, No. 6, pp.528–544.
- Allman, L., Fleming, P. and Wallace, A. (2004) *The Progress of English and Welsh Local Authorities in Addressing Climate Change*, Local Environment, UK, Vol. 9, No. 3, pp.271–283.
- Alphen, A., Halfens, R., Hasman, A. and Imbos, T. (1994) ‘Likert or Rasch? Nothing is more applicable than good theory’, *Journal of Advanced Nursing*, Vol. 20, No. 1, pp.196–201.
- Alter, C. and Hage, J. (1993) *Organizations Working Together*, SAGE Publications Ltd., Thousand Oaks, CA, USA.
- Amundsen, H., Berglund, F. and Westskog, H. (2010) ‘Overcoming barriers to climate change adaptation – a question of multilevel governance?’, *Environment Planning C*, Vol. 28, No. 2, pp.276–289.
- Armstrong, M. (1999) *Human Resource Management Practice*, KoganPage, London, UK.
- Arnold, R. and Wade, J. (2015) ‘A definition of systems thinking: a systems approach’, *Procedia Computer Science*, Vol. 44, pp.669–678.
- Astley, W. (1985) ‘Administrative science as socially constructed truth’, *Administrative Science Quarterly*, Vol. 30, No. 4, pp.497–513.
- Avelino, F. (2011) *Power in Transition. Empowering Discourses on Sustainability Transitions*, Erasmus Universiteit Rotterdam, Netherlands.
- Axelrod, R. and Cohen, E. (1997) *The Complexity of Cooperation: Agent-based Models of Competition and Collaboration*, Princeton University Press, Princeton, NJ, USA.
- Baek, C. and Park, S. (2012) ‘Changes in renovation policies in the era of sustainability’, *Energy and Buildings*, Vol. 47, pp.485–496.
- Bahaj, A. and James, P. (2007) *Future Energy Solutions*, Sustainable Energy Research Group, UK.

- Banfi, S., Farsi, M., Filippini, M. and Jakob, M. (2008) 'Willingness to pay for energy-saving measures in residential buildings', *Energy Economics*, Vol. 30, No. 2, pp.503–516.
- Bassett, T. and Fogelman, C. (2013) 'De ja vu or something new? The adaptation concept in the climate change literature', *Geoforum*, Vol. 48, pp.42–53.
- Bell, M. and Lowe, R. (2000) 'Building regulation and sustainable housing. Part 1: a critique of Part L of the building regulations, 1995 for England and Wales', *Structural Survey*, Vol. 18, No. 1, pp.28–37.
- Bell, M., Lowe, R. and Roberts, P. (1996) *Energy Efficiency in Housing*, Aldershot, UK.
- Bell, S., Chaytor, S., Crawford, K., Davies, F., Johnson, C. and JooJoo, S. (2014) *Making Decisions on the Demolition or Refurbishment of Social Housing*, UCL Policy Briefing, June, UCL, London, UK.
- Benington, J. (2001) 'Partnerships as networked governance? Legitimation, innovation, problem solving and coordination', in Benington, J. (Ed.): *Local Partnerships and Social Exclusion in the European Union*, p.198, Routledge, London, UK.
- Benington, J. and Moore, M. (Eds.) (2010) *Public Value: Theory and Practice*, Palgrave Macmillan, Basingstoke, Hampshire, UK.
- Biesbroek, G., Swart, R., Carter, T., Cowan, C., Henrichs, T., Mela, H., Morecroft, M. and Rey, D. (2010) 'Europe adapts to climate change: comparing national adaptation strategies', *Global Environmental Change*, Vol. 20, pp.440–450.
- Boardman, B. (1993) 'Energy efficiency incentives', *Energy and Environment*, Vol. 4, No. 4, pp.316–334.
- Boardman, B. (2010) *Fixing Fuel Poverty: Challenges and Solutions*, Earthscan, UK.
- Boardman, B., Friends of the Earth and Co-operative Bank. (2007) *Home Truths: A Low-Carbon Strategy to Reduce UK Housing Emissions by 80% by 2050*, Environmental Change Institute, University of Oxford, UK, Vol. 34.
- Boone, H. and Boone, D. (2012) 'Analyzing Likert data', *Journal of Extension*, Vol. 50, No. 2, pp.1–5.
- Boulding, K. (1956) 'General systems theory-the skeleton of science', *Management Science*, Vol. 2, No. 3, pp.197–208.
- Boza-Kiss, B., Moles-Grueso, S. and Urge-Vorsatz, D. (2014) 'Evaluating policy instruments to foster energy efficiency for the sustainable transformation of buildings', *Current Opinion in Environmental Sustainability*, Vol. 5, No. 2, pp.163–176.
- Brewer, J. and Hunter, A. (1989) *Multimethod Research: A Synthesis of Styles*, Sage Library of Social Research, Vol. 175, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Brown, J., Burger, J., Burnside, W., Chang, M., Davidson, A., Fristoe, T. and Okie, J. (2014) 'Macroecology meets macroeconomics: resource scarcity and global sustainability', *Ecological Engineering*, Vol. 65, pp.24–32.
- Bulkeley, H. and Kern, K. (2006) 'Local government and the governing of climate change in Germany and the UK', *Urban Studies* (Routledge), Vol. 43, No. 12, pp.2237–2259.
- Burch, S. (2010) 'Transforming barriers into enablers of action on climate change: insights from three municipal case studies in British Columbia, Canada', *Global Environmental Change*, Vol. 20, No. 2, pp.287–297.
- Caird, S., Roy, R. and Herring, H. (2008) 'Improving the energy performance of UK households: Results from surveys of consumer adoption and use of low-and zero-carbon technologies', *Energy Efficiency*, Vol. 1, No. 2, pp.149–166.
- Campbell, D. and Fiske, D. (1959) 'Convergent and discriminant validation by the multitrait-multimethod matrix', *Psychological Bulletin*, Vol. 56, pp.81–105.
- Carifio, J. and Perla, R. (2008) 'Resolving the 50-year debate around using and misusing Likert scales', *Medical Education*, Vol. 42, No. 12, pp.1150–1152.

- Carter, J.G., Cavan, G., Connelly, A., Guy, S., Handley, J. and Kazmierczak, A. (2015) 'Climate change and the city: Building capacity for urban adaptation', *Progress in Planning*, Vol. 95, pp.1–66.
- Cattell, R. (1966) 'The scree test for the number of factors', *Multivariate Behavioral Research*, Vol. 1, No. 2, pp.245–276.
- Cattell, R. (1988) 'The meaning and strategic use of factor analysis', in Nesselrode, J. and Cattell, R. (Eds.): *Handbook of Multivariate Experimental Psychology*, pp.131–201, Plenum Press, New York.
- CCC (2013) *Reducing the UK's Carbon Footprint and Managing Competitiveness Risks*, Committee on Climate Change, London, UK, April.
- Cerar, J. (2012) *Transdisciplinary Sustainable Development*, Master thesis, University of Ljubljana.
- Check, J. and Schutt, R. (2011) *Research Methods in Education*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Chileshe, N. and Dzisi, E. (2012) 'Benefits and barriers of construction health and safety management (HSM): perceptions of practitioners within design organisations', *Journal of Engineering, Design and Technology*, Vol. 10, No. 2, pp.276–298.
- Clapham, D. (1997) 'The social construction of housing management research', *Urban Studies*, Vol. 34, Nos. 5–6, pp.761–774.
- Clapham, D. (2009) 'Introduction to the special issue – a theory of housing. Problems and potential', *Housing, Theory & Society*, Vol. 26, No. 1, pp.1–9.
- Clark, W. (2003) 'Research systems for a transition toward sustainability', in Steffen, W., Jäger, J., Carson, D. and Bradshaw, C. (Eds.): *Challenges of a Changing Earth, Proceedings of the Global Change Open Science Conference*, Amsterdam, NL, Springer-Verlag, Berlin, 10–13 July.
- Cooper, J. and Jones, K. (2008) 'Routine maintenance and sustainability of existing social housing', *Proceedings from CIB W070 Conference in Facilities Management*, Heriot Watt University, Edinburgh, pp.361–368.
- Corbin, J. and Strauss, A. (2015) *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 4th ed., SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Costello, A. and Osborne, J. (2005) 'Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis', *Practical Assessment, Research and Evaluation*, Vol. 10, No. 7, pp.1–9.
- Couper, M., Traugott, M. and Lamias, M. (2001) 'Web survey design and administration', *Public Opinion Quarterly*, Vol. 65, No. 2, pp.230–253.
- Creswell, J. (2013) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 4th ed., SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Czaja, R. and Blair, J. (1996) *Designing Surveys: A Guide to Decision and Evaluation*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Davenport, T., Harris, J. and Cantrell, S. (2004) 'Enterprise systems and ongoing process change', *Business Process Management Journal*, Vol. 10, No. 1, pp.16–26.
- DCLG (2006a) *A Decent Home: Definition and Guidance for Implementation*, The Stationery Office, London, UK.
- DCLG (2006b) *Review of the Sustainability of Existing Buildings: The Energy Efficiency of Dwellings – Initial Analysis*, Department for Communities and Local Government, London, UK.
- DCLG (2013) *English Housing Survey 2011–12: Headline Report*, Department for Communities and Local Government, London, UK.

- DCLG (2015) *Policy Paper: 2010 to 2015 Government Policy: Energy Efficiency in Buildings*, Department for Communities and Local Government, London, UK, Updated 8 May 2015 [online] <https://www.gov.uk/government/publications/2010-to-2015-government-policy-energy-efficiency-in-buildings/2010-to-2015-government-policy-energy-efficiency-in-buildings> (accessed 15 August 2015).
- De Young, R. (2000) 'New ways to promote proenvironmental behavior: expanding and evaluating motives for environmentally responsible behaviour', *Journal of Social Issues*, Vol. 56, No. 3, pp.509–526.
- DECC (2011) *The Green Deal: A Summary of the Government's Proposals*, Department of Energy and Climate Change, London, UK [online] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47978/1010-green-deal-summary-proposals.pdf (accessed 14 August 2015).
- DECC (2012a) *The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK*, Department of Energy and Climate Change, London, UK.
- DECC (2012b) *Digest of United Kingdom Energy Statistics 2012: Long-term Trends*, Department of Energy and Climate Change, London, UK.
- DECC (2013) *Energy Efficiency Strategy, 2013 Update*, Department of Energy and Climate Change, London, UK.
- DEFRA (2004) *Fuel Poverty in England: The government's plan for action*, Department for Environment, Food and Rural Affairs, London, UK.
- Denscombe, M. (2014) *The Good Research Guide: for Small-scale Social Research Projects*, McGraw-Hill Education, UK.
- Denzin, N. (1978) *The Research Act: A Theoretical Introduction to Sociological Methods*, Praeger, New York, USA.
- Devine-Wright, P. (2013) 'Think global, act local? The relevance of place attachments and place identities in a climate changed world', *Global Environmental Change*, Vol. 23, No. 1, pp.61–69.
- Dietz, T. (2010) 'Narrowing the US energy efficiency gap', *Proceedings of the National Academy of Sciences*, Vol. 107, No. 37, pp.16007–16008.
- Dillman, D. (2011) *Mail and Internet Surveys: The Tailored Design Method – 2007 Update with New Internet, Visual, and Mixed-Mode Guide*, John Wiley & Sons, New Jersey and Canada.
- Dillman, D. and Smyth, J. (2007) 'Design effects in the transition to web-based surveys', *American Journal of Preventive Medicine*, Vol. 32, No. 5, pp.S90–S96.
- Dowson, M., Poole, A., Harrison, D. and Susman, G. (2012) 'Domestic UK retrofit challenge: barriers, incentives and current performance leading into the Green Deal', *Energy Policy*, Vol. 50, pp.294–305.
- Druckman, A. and Jackson, T. (2008) 'Household energy consumption in the UK: a highly geographically and socio-economically disaggregated model', *Energy Policy*, Vol. 36, No. 8, pp.3177–3192.
- Eakin, H., Lemos, M. and Nelson, D. (2014) 'Differentiating capacities as a means to sustainable climate change adaptation', *Global Environmental Change*, Vol. 27, pp.1–8.
- Eby, L., Hurst, C. and Butts, M. (2009) 'Qualitative research: the redheaded stepchild in organisational and social science research', in Lance, C. and Vandenberg R. (Eds.): *Statistical and Methodological Myths and Urban Legends: Doctrine, Verity and Fable in Organisational and Social Sciences*, Routledge, New York, pp.219–246.
- EC (2011) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – A Roadmap for Moving to a Competitive Low Carbon Economy in 2050, SEC (2011) 287 Final, SEC (2011) 288 Final, SEC (2011) 289 Final*, European Commission, Brussels, 8.3.2011, COM (2011) 112 Final.
- ECOFYS (2005) *Cost-Effective Climate Protection in the EU Building Stock*, Report for EURIMA, European Insulation Manufacturers Association, Belgium.

- Engel, R. and Schutt, R. (2014) *Fundamentals of Social Work Research*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Engle, N. (2011) 'Adaptive capacity and its assessment', *Global Environmental Change*, Vol. 21, No. 2, pp.647–656.
- Eriksen, S., Aldunce, P., Bahinipati, S., Martins, R., Molefe, J., Nhemachena, C., O'Brien, K., Olorunfemi, F., Park, J., Sygna, L. and Ulsrud, K. (2011) 'When not every response to climate change is a good one: identifying principles for sustainable adaptation', *Climate and Development*, Vol. 3, No. 1, pp.7–20.
- Fellows, R. and Liu, A. (2013) 'Use and misuse of the concept of culture', *Construction Management and Economics*, Vol. 31, No. 5, pp.401–422.
- Ferguson, E. and Cox, T. (1993) 'Exploratory factor analysis. A users' guide', *International Journal of Selection and Assessment*, Vol. 1, No. 2, pp.84–94.
- Ferlie, E., Hartley, J. and Martin, S. (2003) 'Changing public service organizations: current perspectives and future prospects', *British Journal of Management*, Vol. 14, pp.S1–S14.
- Field, A. (2009) *Discovering Statistics using SPSS*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Fink, A. (2009) *How to Conduct Surveys: A Step-by-step Guide*, 4th ed., SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Fleiter, T. and Plötz, P. (2013) 'Diffusion of energy-efficient technologies. Encyclopaedia of energy', *Natural Resource and Environmental Economics*, Vol. 1, pp.63–73.
- Ford, J. and Berrang-Ford, L. (2011) 'Introduction', in Ford, J.D. and Berrang-Ford, L. (Eds.): *Climate Change Adaptation in Developed Nations*, pp.3–20, Springer, Netherlands.
- Forrester, J.W. (1969) *Principles of systems*, MIT Press, Cambridge, MA.
- Fowler, F. (2014) *Survey Research Methods*, 5th ed., SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Frantzeskaki, N. and De Haan, H. (2009) 'Transitions: two steps from theory to policy', *Futures*, Vol. 41, No. 9, pp.593–606.
- Frantzeskaki, N., Loorbach, D. and Meadowcroft, J. (2012) 'Governing societal transitions to sustainability', *International Journal of Sustainable Development*, Vol. 15, Nos. 1–2, pp.19–36.
- Fuller, M., Kunkel, C., Zimring, M., Hoffman, I., Soroye, K. and Goldman, C. (2010) *Driving Demand for Home Energy Improvements*, Environmental Energy Technologies Division, Berkeley, CA, USA.
- Fuller, R. and Crawford, R. (2011) 'Impact of past and future residential housing development patterns on energy demand and related emissions', *Journal of Housing and the Built Environment*, Vol. 26, No. 2, pp.165–183.
- Gann, D., Wang, Y. and Hawkins, R. (1998) 'Do regulations encourage innovation? The case of energy efficiency in housing', *Building Research & Information*, Vol. 26, No. 5, pp.280–296.
- Gaziulusoy, A. and Brezet, H. (in press) 'Design for system innovations and transitions: a conceptual framework integrating insights from sustainability science and theories of system innovations and transitions', *Journal of Cleaner Production*, pp.1–11.
- Gell-Mann, M. (2010) 'Transformations of the twenty-first century: transitions to greater sustainability', in Schellnhuber, J., Molina, M., Stern, N., Huber, V. and Kadner, S. (Eds.): *Global Sustainability: A Nobel Cause*, Cambridge University Press, Cambridge, Massachusetts, USA.
- Genovese, A., Lenny Koh, S. and Acquaye, A. (2013) Energy efficiency retrofitting services supply chains: evidence about stakeholders and configurations from the Yorkshire and Humber region case', *International Journal of Production Economics*, Vol. 144, No. 1, pp.20–43.
- Gibbs, D. and O'Neill, K. (2015) 'Building a green economy? Sustainability transitions in the UK building sector', *Geoforum*, Vol. 59, pp.133–141.

- Göb, R., McCollin, C. and Ramalhoto, M.F. (2007) 'Ordinal methodology in the analysis of Likert scales', *Quality & Quantity*, Vol. 41, No. 5, pp.601–626.
- Golove, W. and Eto, J. (1996) *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency*, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, LBL-38059.
- Golubchikov, O. and Deda, P. (2012) 'Governance, technology, and equity: an integrated policy framework for energy efficient housing', *Energy Policy*, Vol. 41, pp.733–741.
- Gorddard, R., Wise, R., Alexander, K., Langston, A., Leitch, A., Dunlop, M., Ryan, A. and Langridge, J. (2012) *Striking the Balance: Coastal Development and Ecosystem Values*, Report prepared for the Australian Department of Climate Change and Energy Efficiency and the CSIRO Climate Adaptation National Research Flagship CSIRO.
- Gorsuch, R. (2003) 'Factor analysis', *Handbook of Psychology*, Vol. 1, No. 6, pp.143–164.
- Gough, I. (2013) 'Carbon mitigation policies, distributional dilemmas and social policies', *Journal of Social Policy*, Vol. 42, No. 2, pp.191–213.
- Greene, J. (2008) 'Is mixed methods social inquiry a distinctive methodology?', *Journal of Mixed Methods Research*, Vol. 2, No. 1, pp.7–22.
- Grin, J., Rotmans, J. and Schot, J. (2010) *Transitions to Sustainable Development: New Directions in the Study of Long-term Transformative Change*, Routledge, New York, New York, USA.
- Groves, R., Fowler Jr, F., Couper, M., Lepkowski, J., Singer, E. and Tourangeau, R. (2013) *Survey Methodology*, 2nd ed., John Wiley & Sons, Inc., Publications, New Jersey, USA.
- Guertler, P. (2012) 'Can the Green Deal be fair too? Exploring new possibilities for alleviating fuel poverty', *Energy Policy*, Vol. 49, pp.91–97.
- Haasnoot, M., Kwakkel, J., Walker, W. and Ter Maat, J. (2013) 'Dynamic adaptive policy pathways: a method for crafting robust decisions for a deeply uncertain world', *Global Environmental Change*, Vol. 23, No. 2, pp.485–498.
- Hadorn, G., Biber-Klemm, S., Grossenbacher-Mansuy, W., Hoffmann-Riem, H., Joye, D., Pohl, C., Wiesmann, U. and Zemp, E. (2008) 'The emergence of transdisciplinarity as a form of research', in *Handbook of Transdisciplinary Research*, Springer, Netherlands, Ch. 2, pp.19–39.
- Hadorn, G., Bradley, D., Pohl, C., Rist, S. and Wiesmann, U. (2006) 'Implications of transdisciplinarity for sustainability research', *Ecological Economics*, Vol. 60, No. 1, pp.119–128.
- Haines, V. and Mitchell, V. (2014) 'A persona-based approach to domestic energy retrofit', *Building Research & Information*, Vol. 42, No. 4, pp.462–476.
- Hamilton, I.G., Shipworth, D., Summerfield, A. J., Steadman, P., Oreszczyn, T. and Lowe, R. (2014) 'Uptake of energy efficiency interventions in English dwellings', *Building Research & Information*, Vol. 42, No. 3, pp.255–275.
- Hayles, C. and Dean, M. (2015) 'Social housing tenants, climate change and sustainable living: a study of awareness, behaviours and willingness to adapt', *Sustainable Cities and Society*, Vol. 17, pp.35–45.
- HCA (2013) *Statistical Data Return dataset 2013 of Private Registered Providers*, Homes and Communities Agency, London, UK.
- Herring, H. and Roy, R. (2007) 'Technological innovation, energy efficient design and the rebound effect', *Technovation*, Vol. 27, No. 4, pp.194–203.
- Hewson, C. (2003) *Internet Research Methods: A Practical Guide for the Social and Behavioural Sciences*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Hitchin, R. (2008) *Can Building Codes Deliver Energy Efficiency? Defining a Best Practice Approach*, from Building Research Establishment Ltd, BRE, The Royal Institution of Chartered Surveyors (RICS), London, UK.
- HM Government (2011) *Government response to the Low Carbon Construction Innovation & Growth Team Report*, Department for Business, Innovation & Skills, London, UK.

- Holdren, J. (2008) 'Science and technology for sustainable well-being', *Science*, Vol. 319, No. 5862, pp.424–434.
- Holland, J. (2006) 'Studying complex adaptive systems', *Journal of Systems Science and Complexity*, Vol. 19, No. 1, pp.1–8.
- Holt, G. and Goulding, J. (2014) 'Conceptualisation of ambiguous-mixed-methods within building and construction research', *Journal of Engineering, Design and Technology*, Vol. 12, No. 2, pp.244–262.
- Holtz, G., Alkemade, F., de Haan, F., Köhler, J., Trutnevyte, E., Luthe, T., Halbe, J., Papachristosi, G., Chappin, E., Kwakkeli, J. and Ruutu, S. (in press) 'Prospects of modelling societal transitions: position paper of an emerging community', *Environmental Innovation and Societal Transitions*.
- Hoogma, R., Kemp, R., Schot, J. and Truffer, B. (2005) *Experimenting for Sustainable Transport: The Approach of Strategic Niche Management*, Spon Press, London and New York.
- Howarth, B., Haddad, B. and Paton, B. (2000) 'The economics of energy efficiency: insights from voluntary participation programs', *Energy Policy*, Vol. 28, No. 6, pp.477–486.
- Hughes, D., Williams, T. and Ren, Z. (2012) 'Differing perspectives on collaboration in construction', *Construction Innovation*, Vol. 12, No. 3, pp.355–368.
- Hulchanski, J. (2002) *Housing Policy for Tomorrow's Cities*, Canadian Policy Research Networks, Ottawa, Discussion Paper F|27 Family Network.
- Jacobs, K. and Manzi, T. (2000) 'Evaluating the social constructionist paradigm in housing research', *Housing, Theory & Society*, Vol. 17, No. 1, pp.35–42.
- Jacobs, K., Kemeny, J. and Manzi, T. (2004) *Social Constructionism in Housing Research*, Ashgate, Aldershot.
- Jacobsson, S. and Johnson, A. (2000) 'The diffusion of renewable energy technology: an analytical framework and key issues for research', *Energy Policy*, Vol. 28, No. 9, pp.625–640.
- Jaffe, A.B., Newell, R.G. and Stavins, R.N. (1999) 'Energy-efficient technologies and climate change policies: issues and evidence', *SSRN Electronic Journal*, Climate Issues Working Paper No. 19, KSG Working Paper.
- Jaffe, A.B., Newell, R.G. and Stavins, R.N. (2004) 'Technology policy for energy and the environment', in *Innovation Policy and the Economy*, Vol. 4, The National Bureau of Economic Research, The MIT Press, pp.35–68.
- Jamieson, S. (2004) 'Likert scales: how to (ab)use them', *Medical Education*, Vol. 38, No. 12, pp.1217–1218.
- Jensen, J. (2012) 'Framing of regimes and transition strategies: an application to housing construction in Denmark', *Environmental Innovation and Societal Transitions*, Vol. 4, pp.51–62.
- Jerneck, A., Olsson, L., Ness, B., anderberg, S., Baier, M., Clark, E., Hickler, T., Hornborg, A., Kronsell, A., Lövbrand, E. and Persson, J. (2010) 'Structuring sustainability science', *Sustainability Science*, Vol. 6, No. 1, pp.69–82.
- Jick, T.D. (1992) *Managing Change*, Burr Ridge, Irwin, IL, USA.
- Johnson, R., Onwuegbuzie, A. and Turner, L. (2007) 'Toward a definition of mixed methods research', *Journal of Mixed Methods Research*, Vol. 1, No. 2, pp.112–133.
- Jones, M. and Johnston, D. (1999) 'The derivation of a brief student nurse stress index', *Work & Stress: An International Journal of Work, Health & Organisations*, Vol. 13, No. 2, pp.162–181.
- Juhola, S., Keskitalo, E. and Westerhoff, L. (2011) 'Understanding the framings of climate change adaptation across multiple scales of governance in Europe', *Environmental Politics*, Vol. 20, No. 4, pp.445–463.
- Kaiser, H. (1960) 'The application of electronic computers to factor analysis', *Educational and Psychological Measurement*, Vol. 20, No. 1, pp.141–151.

- Kemeny, J. (1992) *Housing and Social Theory*, Routledge, London, UK.
- Kemeny, J. (2004) 'Extending constructionist social problems to the study of housing problems', in Jacobs, K., Kemeny, J. and Manzi, T. (Eds.): *Social Constructionism in Housing Research*, Ashgate, Aldershot.
- Killip, G. (2013) 'Products, practices and processes: exploring the innovation potential for low-carbon housing refurbishment among small and medium-sized enterprises (SMEs) in the UK construction industry', *Energy Policy*, Vol. 62, pp.522–530.
- Kim, H. (2008) 'Common factor analysis versus principal component analysis: choice for symptom cluster research', *Asian Nursing Research*, Vol. 2, No. 1, pp.17–24.
- King, P. (2009) 'Using theory or making theory: can there be theories of housing?', *Housing, Theory and Society*, Vol. 26, No. 1, pp.41–52.
- Kittleson, M. (1997) 'Determining effective follow-up of e-mail surveys', *American Journal of Health Behavior*, Vol. 21, No. 3, pp., 193–196.
- Klein, J. (2004) 'Prospects for transdisciplinarity', *Futures*, Vol. 36, No. 4, pp.515–526.
- Ko, J. and Fenner, R. (2007) 'Adoption of energy efficiency innovations in new UK housing', *Proceedings of the ICE-Energy*, Vol. 160, No. 4, pp.151–163.
- Kok, N., McGraw, M. and Quigley, J.M. (2011) 'The diffusion of energy efficiency in building', *The American Economic Review*, Vol. 101, No. 3, pp.77–82.
- Kooiman, J. (2003) 'Societal governance', in Katenhusen, I. and Lamping, W (Eds.): *Demokratien in Europa*, VS Verlag für Sozialwissenschaften, Springer.
- Krause, F., Bach, W. and Koomey, J. (2013) *Energy Policy in the Greenhouse: From Warming Fate to Warming Limit*, Earthscan.
- Kuholski, K., Tohn, E. and Morley, R. (2010) 'Healthy energy-efficient housing: using a one-touch approach to maximize public health, energy, and housing programs and policies', *Journal of Public Health Management Practice*, Vol. 16, No. 5, pp.S68–74.
- Leach, M., Scoones, I. and Stirling, A. (2010) *Dynamic Sustainabilities. Technology, Environment, Social Justice*, Earthscan, London, UK.
- Lechtenböhmer, S., Grimm, V., Mitze, D., Thomas, S. and Wissner, M. (2005) *Target 2020: Policies and Measures to Reduce Greenhouse Gas Emissions in the EU*, Wuppertal Institut für Klima, Umwelt, Energie, A report on behalf of WWF European Policy Office.
- Leßmann, O. and Masson, T. (2015) 'Sustainable consumption in capability perspective: Operationalization and empirical illustration', *Journal of Behavioral and Experimental Economics*, Vol. 57, pp.64–72.
- Leßmann, O. and Rauschmayer, F. (2013) 'Re-conceptualizing sustainable development on the basis of the capability approach: a model and its difficulties', *Journal of Human Development and Capabilities*, Vol. 14, No. 1, pp.95–114.
- Levacic, R. (1993) 'Markets as coordinative devices', in Maidment, R. and Thompson, G. (Eds.): *Managing the UK: An Introduction to its Political Economy and Public Policy*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Liddell, C. and Morris, C. (2010) 'Fuel poverty and human health: a review of recent evidence', *Energy Policy*, Vol. 38, No. 6, pp.2987–2997.
- Likert, R. (1932) 'A technique for the measurement of attitudes', *Archives of Psychology*, Vol. 22, No. 140, p.S55.
- Lohr, S. (2009) *Sampling: Design and Analysis*, Cengage Learning, Boston, USA.
- Loorbach, D. (2010) 'Transition management for sustainable development: a prescriptive, complexity-based governance framework', *Governance: An International Journal of Policy, Administration, and Institutions*, Vol. 23, No. 1, pp.161–183.
- Lowe, R. (2000) 'Defining and meeting the carbon constraints of the 21st century', *Building Research & Information*, Vol. 28, No. 3, pp.159–175.

- Lowe, R. and Oreszczyn, T. (2008) 'Regulatory standards and barriers to improved performance for housing', *Energy Policy*, Vol. 36, No. 12, pp.4475–4481.
- Lowndes, V. (1999) 'Management change in local governance', in Stoker (Ed.): *The New Management of British Local Governance*, pp.22–39, Palgrave Macmillan, Basingstoke, UK.
- Lowndes, V. and Skelcher, C. (1998) 'The dynamics of multi-organisational partnerships: an analysis of changing modes of governance', *Public Administration*, Vol. 76, No. 2, pp.313–333.
- Macey, S. and Brown, M. (1990) 'Demonstrations as a policy instrument with energy technology examples', *Science Communication*, Vol. 11, No. 3, pp.219–236.
- Makovich, L. (2011) 'The smart grid: separating perception from reality', *Issues in Science and Technology*, Vol. 27, No. 3, pp.61–70.
- Mallaburn, P. and Eyre, N. (2014) 'Lessons from energy efficiency policy and programmes in the UK from 1973 to 2013', *Energy Efficiency*, Vol. 7, No. 1, pp.23–41.
- Malpass, P. and Victory, C. (2010) 'The modernisation of social housing in England', *International Journal of Housing Policy*, Vol. 10, No. 1, pp.3–18.
- Manfreda, K., Bosnjak, M., Berzelak, J., Haas, I. and Vehovar, V. (2008) 'Web surveys versus other survey modes. A meta-analysis comparing response rates', *International Journal of the Market Research*, Vol. 50, No. 1, p.79.
- Mangione, T. (1995) *Mail Surveys: Improving the Quality*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Marchand, R., Koh, S. and Morris, J. (2015) 'Delivering energy efficiency and carbon reduction schemes in England: lessons from Green Deal pioneer places', *Energy Policy*, Vol. 84, pp.96–106.
- Martinot, E. and McDoom, O. (2000) *Promoting Energy Efficiency and Renewable Energy: GEF Climate Change Projects and Impacts*, Global Environment Facility, Washington, DC, USA.
- Maru, Y., Stafford Smith, M., Sparrow, A., Pinhoc, P. and Dube, O. (2014) 'A linked resilience and vulnerability framework for adaptation pathways in remote disadvantaged communities', *Global Environmental Change*, Vol. 28, pp.337–350.
- Max-Neef, M. (2005) 'Foundations of transdisciplinarity', *Ecological Economics*, Vol. 53, No. 1, pp.5–16.
- McCormick, K., anderberg, S., Coenen, L. and Neij, L. (2013) 'Advancing sustainable urban transformation', *Journal of Cleaner Production*, Vol. 50, pp.1–11.
- McIver, J. and Carmines, E. (1981) *Unidimensional Scaling*, SAGE University Paper Series on Quantitative Applications in the Social Sciences, No. 07-024, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- McMichael, M. and Shipworth, D. (2013) 'The value of social networks in the diffusion of energy-efficiency innovations in UK households', *Energy Policy*, Vol. 53, pp.159–168.
- Meadowcroft, J. (2011) 'Engaging with the politics of sustainability transitions', *Environmental Innovation and Societal Transitions*, Vol. 1, No. 1, pp.70–75.
- Merriam, S. and Tisdell, E. (2015) *Qualitative Research: A Guide to Design and Implementation*, 4th ed., Jossey-Bass, CA, USA.
- Moffatt, S., White, M., Mackintosh, J. and Howel, D. (2006) 'Using quantitative and qualitative data in health services research—what happens when mixed method findings conflict?', *BMC Health Services Research*, Vol. 6, No. 1, p.28.
- Mohrman, S. and Shani, A. (2011) 'Organizing for sustainable effectiveness: taking stock and moving forward', in Mohrman, S.A., Shani, A.B., Docherty, P. and Worley, C.G. (Eds.): *Organizing for Sustainable Effectiveness*, Ch. 1, Vol. 1, pp.1–40.

- Moore, M. (1995) *Creating Public Value: Strategic Management in Government*, Harvard University Press, USA.
- Morrison, C. and Shortt, N. (2008) 'Fuel poverty in Scotland: refining spatial resolution in the Scottish fuel poverty indicator using a GIS-based multiple risk index', *Health & Place*, Vol. 14, No. 4, pp.702–17.
- Moser, S. (2010) 'Now more than ever: the need for more societally relevant research on vulnerability and adaptation to climate change', *Applied Geography*, Vol. 30, No. 4, pp.464–474.
- Mullins, D. and Murie, A. (2006) *Housing Policy in the UK*, Palgrave Macmillan, Basingstoke, UK.
- Mullins, D. and Riseborough, M. (1997) *Changing with the Times: Critical Interpretations of the Repositioning of Housing Associations*, School of Public Policy, University of Birmingham, UK.
- Mullins, D., Reid, B. and Walker, R. (2001) 'Modernization and change in social housing: the case for an organisational perspective', *Public Administration*, Vol. 79, No. 3, pp.599–623.
- Munn, P. and Drever, E. (1990) *Using Questionnaires in Small-Scale Research. A Teachers' Guide*, Scottish Council for Research in Education, Edinburgh, Scotland.
- Nalau, J., Preston, B.L. and Maloney, M.C. (2015) 'Is adaptation a local responsibility?', *Environmental Science and Policy*, Vol. 48, pp.89–98.
- Nardo, M., Saisana, M., Satelli, A. and Tarantola, S. (2005) *Tools for Composite Indicators Building*, Joint Research Centre, European Commission Directorate General Joint Research Centre, European Communities, EUR 21682 EN.
- Nicolescu, B. (2008) 'The idea of levels of reality and its relevance for non-reduction and personhood', *Transdisciplinarity in Science and Religion*, Vol. 4, pp.11–26.
- Nicolescu, B. (1998) 'The transdisciplinary evolution of learning', in Altmann, G. and Koch, W. (Eds.): *Systems: New Paradigms for the Human Sciences*, pp.385–403, de Gruyter Verlag, Berlin and New York, (translated from French by Karen-Claire Voss).
- Norman, G. (2010) 'Likert scales, levels of measurement and the 'laws' of statistics', *Advances in Health Sciences Education: theory and practice*, Vol. 15, No. 5, pp.625–632.
- OFGEM (2013) *Energy Companies Obligation (ECO): Guidance for Suppliers (Vol. 2012)*, Office of Gas and Electricity Markets, London, UK.
- Olsson, P., Galaz, V. and Boonstra, W. (2014) 'Sustainability transformations: a resilience perspective', *Ecology and Society*, Vol. 19, No. 4, p.1.
- Osmani, M. and O'Reilly, A. (2009) 'Feasibility of zero carbon homes in England by 2016: a house builder's perspective', *Bulding and Environment*, Vol. 44, No. 9, pp.1917–1924.
- Ott, L. and Longnecker, M. (2015) *An Introduction to Statistical Methods and Data Analysis*, 7th ed., Cengage Learning, Boston, USA.
- Painuly, J. (2001) 'Barriers to renewable energy penetration; a framework for analysis', *Renewable Energy*, Vol. 24, No. 1, pp.73–89.
- Palmer, J. and Cooper, I. (2011) *Great Britain's Housing Energy Fact File: 2011*, Department of Energy and Climate Change, London, UK.
- Palmer, J. and Cooper, I. (2014) *UK Housing Energy Fact File 2013*, Department of Energy and Climate Change, London, UK [online] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/345141/uk_housing_fact_file_2013.pdf (accessed 20 May 2015).
- Pan, W. and Garmston, H. (2012) 'Building regulations in energy efficiency: compliance in England and Wales', *Energy Policy*, Vol. 45, pp.594–605.

- Park, S., Marshall, N., Jakku, E., Dowd, A., Howden, S., Mendham, E. and Fleming, A. (2012) 'Informing adaptation responses to climate change through theories of transformation', *Global Environmental Change*, Vol. 22, No. 1, pp.115–126.
- Pelling, M. (2011) *Adaptation to Climate Change: From Resilience to Transformation*, Routledge, New York.
- Petrova, S., Gentile, M., Mäkinen, I. and Bouzarovski, S. (2013) 'Perceptions of thermal comfort and housing quality: exploring the microgeographies of energy poverty in Stakhanov, Ukraine', *Environment and Planning A*, Vol. 45, No. 5, pp.1240–1257.
- Pettifor, H., Wilson, C. and Chrysochoidis, G. (2015) 'The appeal of the Green Deal: empirical evidence for the influence of energy efficiency policy on renovating homeowners', *Energy Policy*, Vol. 79, pp.161–176.
- Pinker, R. (1971) *Social Theory & Social Policy*, Heinemann Educational, London, UK.
- Plate, R. and Monroe, M. (2014) 'A structure for assessing systems thinking', in *The 2014 Creative Learning Exchange*, Vol. 26, pp.1–12.
- Poli, R. (2015) 'The implicit future orientation of the capability approach', *Futures*, Vol. 71, pp.105–113.
- Pollitt, C. (1990) *Managerialism and the Public Services: The Anglo-American Experience*, Basil Blackwell, Oxford, UK.
- Power, A. (1999) *Estates on the Edge*, Palgrave Macmillan [online] <http://www.palgraveconnect.com/pc/doi/10.1057/9780230389915> (accessed 13 January 2015).
- Power, A. (2008) 'Does demolition or refurbishment of old and inefficient homes help to increase our environmental, social and economic viability?', *Energy Policy*, Vol. 36, No. 12, pp.4487–4501.
- Preston, I., White, V., Thumin, J. and Bridgeman, T. (2013) *Distribution of Carbon emissions in the UK: Implications for Domestic Energy Policy*, Joseph Rowntree Foundation, UK.
- Raskin, P., Banuri, T., Gallopin, G., Gutman, P., Al Hammond, Robert, K. and Swart, R. (2002) *Great Transition: The Promise and Lure of the Times Ahead*, Boston, Stockholm Environment Institute, Boston, MA, USA.
- Rattray, J. and Jones, M. (2007) 'Essential elements of questionnaire design and development', *Journal of Clinical Nursing*, Vol. 16, No. 2, pp.234–243.
- Rauschmayer, F., Bauler, T. and Schöpke, N. (2015) 'Towards a thick understanding of sustainability transitions – linking transition management, capabilities and social practices', *Ecological Economics*, Vol. 109, pp.211–221.
- Ravetz, J. (2008) 'State of the stock – what do we know about existing buildings and their future prospects?', *Energy Policy*, Vol. 36, No. 12, pp.4462–4470.
- RdSAP (2009) *Appendix S: Reduced Data SAP for Existing Dwellings*, Version 9.91 BRE, UK, January.
- Reeves, T. and Hedberg, J. (2003) *Interactive Learning Systems Evaluation*, Educational Technology, New Jersey, USA.
- Reid, B. and Hickman, P. (2002) 'Are housing organisations becoming learning organisations? Some lessons from the management of tenant participation', *Housing Studies*, Vol. 17, No. 6, p.895.
- Rietveld, T. and Van Hout, R. (1993) *Statistical Techniques for the Study of Language and Language Behaviour*, Mouton de Gruyter, Berlin, Germany.
- Rogers, E. (2003) *Diffusion of Innovations*, 5th ed., Free Press, New York, USA.
- Rosenow, J. (2012) 'Energy savings obligations in the UK – a history of change', *Energy Policy*, Vol. 49, pp.373–382.

- Rotmans, J. and Loorbach, D. (2009) 'Complexity and transition management', *Journal of Industrial Ecology*, Vol. 13, No. 2, pp.184–196.
- Rotmans, J., Kemp, R. and Asselt, M. (2001) 'More evolution than revolution: transition management in public policy', *Foresight*, Vol. 3, No. 1, pp.15–31.
- Rudge, J. and Nicol, F. (Eds.) (2000) *Cutting the Cost of Cold: Affordable Warmth for Healthier Homes*, E & FN Spon, London, UK.
- Salama, A. and Alshuwaikhat, H. (2006) 'A trans-disciplinary approach for a comprehensive understanding of sustainable affordable housing', *Global Built Environment Review*, Vol. 5, No. 3, pp.35–50.
- SAP (2012) *The Government's Standard Assessment Procedure for Energy Rating of Dwellings*, BRE, Published on behalf of Department of Energy and Climate Change, London, UK, Version 9.92.
- Schäpke, N. and Rauschmayer, F. (2014) 'Going beyond efficiency: including altruistic motives in behavioral models for sustainability transitions to address sufficiency', *Sustainability: Science, Practice, & Policy*, Vol. 10, No. 1, pp.29–44.
- Schneider, F. and Rist, S. (2014) 'Envisioning sustainable water futures in a transdisciplinary learning process: combining normative, explorative, and participatory scenario approaches', *Sustainability Science*, Vol. 9, No. 4, pp.463–481.
- Scott, F., Jones, C. and Webb, T. (2014) 'What do people living in deprived communities in the UK think about household energy efficiency interventions?', *Energy Policy*, Vol. 66, pp.335–349.
- Self, A. and Zealey, L. (Eds.) (2007) *Social Trends 37*, Office for National Statistics, Palgrave Macmillan, Basingstoke, New York, USA.
- Sen, A. (2013) 'The ends and means of sustainability', *Journal of Human Development and Capabilities*, Vol. 14, No. 1, pp.6–20.
- Shorrocks, L. and Utley, J. (2003) *Domestic Energy Fact File 2003*, Building Research Establishment Housing Centre, BRE Publications, Watford, UK.
- Shove, E. (1998) 'Gaps, barriers and conceptual chasms: theories of technology transfer and energy in buildings', *Energy Policy*, Vol. 26, No. 15, pp.1105–1112.
- Shove, E., Pantzar, M. and Watson, M. (2012) *The Dynamics of Social Practice: Everyday Life and How it Changes*, SAGE Publications Ltd, Thousand Oaks, CA, USA.
- Smirchich, L. (1983) 'Concepts of culture and organizational analysis', *Administrative Science Quarterly*, Vol. 28, No. 3, pp.339–58.
- Smith, M.S., Horrocks, L., Harvey, A. and Hamilton, C. (2011) 'Rethinking adaptation for a 4°C World', *Philosophical Transactions of the Royal Society A*, No. 369, pp.196–216.
- Solomon, S., Plattner, G., Knutti, R. and Friedlingstein, P. (2009) 'Irreversible climate change due to carbon dioxide emissions', *Proceedings of National Academy of Sciences*, Vol. 106, No. 6, pp.1704–1709.
- Stern, P. (2011) 'Contributions of psychology to limiting climate change', *American Psychologist*, Vol. 66, No. 4, pp.303–314.
- Stewart, J. and Ranson, S. (1988) 'Management in the public domain', *Public Money & Management*, Vol. 8, Nos. 1–2, pp.13–19.
- Stoker, G. (1999) *The New Management of British Local Governance*, Palgrave Macmillan, London, UK.
- Stoker, G. and Young, S. (1993) *Cities in the 1990s*, Longman, Harlow, UK.
- Sullivan, H. and Skelcher, C. (2002) *Working Across Boundaries: Collaboration in Public Services*, Palgrave Macmillan, Basingstoke, UK.
- Tabachnick, B. and Fidell, L. (2013) *Using Multivariate Statistics*, 6th ed., Pearson Publishing, UK.
- Takim, R., Akintoye, A. and Kelly, J. (2004) 'Analysis of measures of construction project success in Malaysia', in *Proceedings of the 20th Annual ARCOM Conference in Heriot Watt University*, Association of Researchers in Construction Management, Edinburgh, Scotland, Vol. 2, pp.1–3.

- Taylor, C. (1997) 'Capital market development in the emerging markets: time to teach an old dog some new tricks', *The American Journal of Comparative Law*, Vol. 45, No. 1, pp.71–107.
- Taylor, F. (2008) *The Principles of Scientific Management*, A Digireads.com Publishing, KS, USA.
- Thakore, R., Goulding, J. and Toogood, M. (2013) 'Fostering energy efficiency dynamics through ex-ante strategic niche management: the UK perspective', *ALAM CIPTA Journal*, Vol. 6, No. 1, pp.3–16.
- Thaler, R. and Sunstein, C. (2008) *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Yale University Press, New Haven, London, UK.
- The Building Regulations (Local Enactments) Order (1966) *The Building Regulations (Local Enactments) Order 1966*, The Stationery Office, London, UK, SI 1966/563.
- The Climate Change Act (2008) *Climate Change Act 2008*, The Stationery Office, London, UK, Ch. 27.
- The Energy Act (2011) *The Energy Act 2013, Chapter 16*, The Stationery Office, London, UK.
- Thomas, J., Nelson, J. and Silverman, S. (2011) *Research Methods in Physical Activity*, 6th ed., Human Kinetics, USA.
- Thompson, G. (2004) 'Is all the world a complex network?', *Economy and Society*, Vol. 33, No. 3, pp.411–424.
- Trotter, R. (2012) 'Qualitative research sample design and sample size: Resolving and unresolved issues and inferential imperatives', *Preventive Medicine*, Vol. 55, No. 5, pp.398–400.
- Turcu, C. (2012) 'Local experiences of urban sustainability: researching housing market renewal interventions in three English neighbourhoods', *Progress in Planning*, Vol. 78, No. 3, pp.101–150.
- Turner, C. and Martin, E. (1985) *Surveying Subjective Phenomena*, Russell SAGE Publications Ltd, Thousand Oaks, CA, USA.
- UK CCC (2010) *Fourth Carbon Budget*, p.375, UK Committee on Climate Change, London, UK.
- UKGBC (2008) *Low Carbon Existing Homes*, UK Green Building Council, London, UK.
- UNECE (2009) *Green Homes: Towards Energy-Efficient Housing in the United Nations Economic Commission for Europe Region*, Economic Commission for Europe, United Nations, Geneva and New York.
- UNECE (2011) *Action Plan for Energy-efficient Housing in the UNECE Region*, United Nations Economic Commission for Europe, Geneva and New York.
- UNECE (2014) *The Future of Social Housing Environmental and Social Challenges and the Way Forward*, Workshop Report, Economic Commission for Europe, United Nations, Geneva, 4–5 February.
- UNEP (2012) *PROVIA Guidance on Assessing Vulnerability, Impacts and Adaptation (VIA)*, The Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA), United Nations Environment Programme.
- UNEP-SBCI (2009) *Buildings and Climate Change: Summary for Decision-Makers*, Sustainable Buildings and Climate Initiative, United Nations Environmental Programme, Paris, France.
- UNFCCC (1998) *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, United Nations, Kyoto, Japan.
- UNFCCC (2012) *Report of the Conference of the Parties on its Seventeenth Session*, Durban from 28 November to 11 December 2011, United Nations Framework Convention on Climate Change, FCCC/CP/2011/9/Add.1.
- van Vuuren, D., Isaac, M., Kundzewicz, Z., Arnell, N., Barker, T., Criqui, P., Berkhout, F., Hilderink, H., Hinkel, J., Hof, A., Kitous, A., Kram, T., Mechler, R. and Scricciu, S. (2011) 'The use of scenarios as the basis for combined assessment of climate change mitigation and adaptation', *Global Environmental Change*, Vol. 21, No. 2, pp.575–591.

- Voinov, A. (2008) *Systems Science and Modeling for Ecological Economics*, Academic Press, London, UK.
- Voß, J., Newig, J., Kastens, B., Monstadt, J. and Nölting, B. (2007) 'Steering for sustainable development: a typology of problems and strategies with respect to ambivalence, uncertainty and distributed power', *Journal of Environmental Policy and Planning*, Vol. 9, No. 3, pp.193–212.
- Voß, J., Smith, A. and Grin, J. (2009) 'Designing long-term policy: rethinking transition management', *Policy Sciences*, Vol. 42, No. 4, pp.275–302.
- Walker, B., Holling, C., Carpenter, S. and Kinzig, A. (2004) 'Resilience, adaptability and transformability in social-ecological systems', *Ecology and Society*, Vol. 9, No. 2, p.5.
- Walker, R. (1998) 'New public management and housing associations: from comfort to competition', *Policy & Politics*, Vol. 26, No. 1, pp.71–87.
- WBCSD (2010) *Vision 2050: the New Agenda for Business*, World Business Council for Sustainable Development, Switzerland.
- Webb, E., Campbell, D., Schwartz, R. and Sechrest, L. (1966) *Unobtrusive Measures*, Rand McNally, Chicago, USA.
- Williams, J. (2008) 'Greenhouses for the growth region', *Journal of Environmental Planning and Management*, Vol. 51, No. 1, pp.1–34.
- Williams, J. (2010) 'The deployment of decentralised energy systems as part of the housing growth programme in the UK', *Energy Policy*, Vol. 38, No. 12, pp.7604–7613.
- Williamson, O. (1985) *The Economic Institutions of Capitalism*, Free Press, New York, USA.
- Wilson, C., Crane, L. and Chryssochoidis, G. (2015) 'Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy', *Energy Research & Social Science*, Vol. 7, pp.12–22.
- Wise, R., Fazey, I., Smith, M., Park, S., Eakin, H., Van Garderen, E. and Campbell, B. (2014) 'Reconceptualising adaptation to climate change as part of pathways of change and response', *Global Environmental Change*, Vol. 28, pp.325–336.
- Wolsink, M. (2012) 'The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources', *Renewable and Sustainable Energy Reviews*, Vol. 16, No. 1, pp.822–835.
- World Bank (2010) *Cities and Climate Change: An Urgent Agenda*, Urban Development Series Knowledge Papers, The International Bank for Reconstruction and Development, the World Bank, Washington DC, USA, Vol. 10.

Notes

- 1 UNECE was set up in 1947 by ECOSOC. It is one of five regional commissions of the United Nations. UNECE's major aim is to promote pan-European economic integration. To do so, it brings together 56 countries located in the European Union, non-EU Western and Eastern Europe, South-East Europe and Commonwealth of Independent States (CIS) and North America (<http://www.unece.org>, 2015).

Appendix

Annex 1: barriers to five essential conditions

<i>Essential condition</i>	<i>Sr. no.</i>	<i>Barriers</i>	<i>Author/s</i>
Investment	1	High upfront costs or lack of investment	Fuller et al. (2009), Caird et al. (2008), Allen et al. (2008), Ravetz (2008) and Williams (2008)
	2	Lack of incentive	Taylor (1997, p.123), Boardman (1993) and Dowson et al. (2012)
	3	Low priority given to energy issues or lack of innovation	Osmani and O'Reilly (2009), Gann et al. (1998), Allen et al. (2008), Ravetz (2008) and Wolsink (2012)
	4	High energy prices	Banfi et al. (2008)
	5	Inability to visualise financial returns in any form of value gain	Bahaj and James (2006) and Power (2008)
	6	Lack of time or effort	Ravetz (2008)
	7	Lack of information and awareness	Allen et al. (2008)
	8	Lack of 'regulatory capacity' or explicit statutory duty	Allman et al. (2004)
Information	9	Information asymmetries/monopoly (one party knows better than others)	Golove and Eto (1996) and UKGBC (2008)
	10	Lack of information	Fuller et al. (2010), Allen et al. (2008), Fuller et al. (2009), Baek and Park (2012) and William (2010)
	11	Lack of awareness	Baek and Park (2012) and William (2010)
	12	Lack of knowledge	Dietz (2010) and UKGBC (2008)
	13	Lack of expertise	William (2010)
	14	Lack of effective communication	William (2010)
	15	Lack of time	Ravetz (2008)
	16	Lack of transparency (ability to win the trust of other stakeholders)	William (2010)

Annex 1: barriers to five essential conditions (continued)

<i>Essential condition</i>	<i>Sr. no.</i>	<i>Barriers</i>	<i>Author/s</i>	
Innovation	17	Lack of funds (public or provided on a competitive base) or high cost	Baek and Park (2012), Power (2008) and Williams (2010)	
	18	Lack of support from intermediary agencies	Williams (2010)	
	19	Use of exclusively 'high technology'	Wolsink (2012)	
	20	Lack of skills	Dowson et al. (2012)	
	21	Lack of availability in local proximity	Devine-Wright (2013)	
	22	Lack of market for efficient technology	Williams (2008)	
	23	Lack of culture to embrace innovation	Ravetz (2008) and Wolsink (2012)	
	24	Lack of policy support	Williams (2010)	
	Incentive	25	Lack of subsidies systems/grants	Baek and Park (2012) and Williams (2008)
		26	Lack of tax exemptions/reduction/credits on investment related to housing energy efficiency	Baek and Park (2012), Clarke et al. (2008) and Power (2008)
27		Lack of strict enforcement of standards; lack of regulatory capacity	Williams (2010)	
28		Lack of information on financial incentives	Baek and Park (2012) and Painuly (2001)	
29		Lack of higher energy prices	Druckman and Jackson (2008)	
30		Lack of responsibilities to reduce environmental impacts	DCLG (2006b) and UKGBC (2008)	
31		Lack of reward (token or real)	De Young (2000)	
32		Lack of priority for energy efficiency	Ravetz (2008), Osmani and O'Reilly (2009), Gann et al. (1998) and Allen et al. (2008)	
Initiative		33	Lack of management	Williams (2010) and Wolsink (2012)
		34	Lack of leadership	Williams (2010)
	35	Fragmentation of the housing sector	Williams (2010)	
	36	Lack of coordination (internal or external)	Bulkeley and Kern (2006) and Williams (2010)	
	37	Lack of communication	UKGBC (2008)	
	38	Lack of capacities	Williams (2010)	
	39	Lack of accountability	Clarke et al. (2008) and Wolsink (2012)	
	40	Lack of priority for energy efficiency	Osmani and O'Reilly (2009), Gann et al. (1998), Allen et al. (2008) and Ravetz (2008)	

Annex 2: Online survey questionnaire

How important are these barriers for energy efficiency in housing?

Introduction

The houses in their use phase are very energy intensive. They are required to become energy efficient by implementing energy efficiency measures/installations/products. Examples of energy efficiency measures in housing include roof and loft insulation, wall insulation, floor insulation, draught-proofing, double glazed windows, energy performance certificates, etc. This survey is to identify important barriers to installing energy efficiency measures in housing.

Housing stakeholder

For simplicity, housing stakeholders are grouped into three major categories.

- a Regulator: representing regulators and policy-makers.
- b Provider: representing housing provider.
- c Consumer: representing end-users: tenants or owner-occupier.

-
- 1 With reference to above, please choose the category that best suits you (or your organisation).

Investment

In order to achieve benefits from energy efficiency, *investment* is needed.

-
- 2 Please identify the main factors which prevent you (or your organisation) from *investing* in energy efficiency measures.
'Check one response on each row'.

	<i>Unimportant</i>	<i>Moderately important</i>	<i>Important</i>	<i>Very important</i>
a High upfront costs or lack of investment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Lack of incentive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Low priority given to energy issues or lack of innovation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d High energy prices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Inability to visualise financial returns in any form of value gain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Lack of time or effort	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g Lack of information and awareness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Lack of 'regulatory capacity' or explicit statutory duty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

-
- 3 Please mention any other factor which you (or your organisation) have identified as a barrier to investment in energy efficiency measures. (*Optional*)

Information

The implementation of energy efficiency measures is affected/hampered due to lack of *information*.

-
- 4 Please identify the main factors which prevent you (or your organisation) from gaining the *information* for energy efficiency measures? 'Check one response on each row'.

	<i>Unimportant</i>	<i>Moderately important</i>	<i>Important</i>	<i>Very important</i>
a Information asymmetry/monopoly (one party knows better than others)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Lack of information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Lack of awareness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Lack of knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Lack of expertise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Lack of effective communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g Lack of time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Lack of transparency (ability to win the trust of other stakeholders)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 5 Please mention any other factor which you (or your organisation) have identified as a barrier to information for energy efficiency measures. (*Optional*)

Innovations

Innovations means stimulating best practices and new techniques that would contribute towards housing energy-efficiency.

- 6 Please identify the main factors which prevent you (or your organisation) from contributing towards innovation?
'Check one response on each row'.

	<i>Unimportant</i>	<i>Moderately important</i>	<i>Important</i>	<i>Very important</i>
a Lack of funds (public or provided on a competitive base) or high cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Lack of support from intermediary agencies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Use of exclusively 'high technology'	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Lack of skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Lack of availability in local proximity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Lack of market for efficient technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g Lack of culture to embrace innovation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Lack of policy support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 7 Please mention any other factor which you (or your organisation) have identified as a barrier to innovations in energy efficiency measures. (*Optional*)

Incentives

Incentives can stimulate stakeholders to invest in energy efficiency measures.

- 8 Please identify the main factors which prevent you (or your organisation) from investing in energy efficiency measures?
'Check one response on each row'.

	<i>Unimportant</i>	<i>Moderately important</i>	<i>Important</i>	<i>Very important</i>
a Lack of subsidies systems/grants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Lack of tax exemptions/reductions/credits on investment related to housing energy efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Lack of strict enforcement of standards	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Lack of information on financial incentives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Lack of higher energy prices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

f	Lack of responsibilities to reduce environmental impacts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g	Lack of reward (token or real)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h	Lack of priority for energy efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 9 Please mention any other factor which you (or your organisation) have identified as a barrier to incentives for energy efficiency measures. (*Optional*)

Initiatives

Initiatives need to be developed urgently to address the challenge of energy efficiency.

- 10 Please identify the main factors which prevent you (or your organisation) from promoting *initiatives* for energy efficiency 'Check one response on each row'.

		<i>Unimportant</i>	<i>Moderately important</i>	<i>Important</i>	<i>Very important</i>
a	Lack of management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b	Lack of leadership	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c	Fragmentation of the housing sector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d	Lack of coordination (internal or external)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e	Lack of communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f	Lack of capacities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g	Lack of accountability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h	Lack of priority for energy efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 11 Please mention any other factor which you (or your organisation) have identified as a barrier to initiatives for energy efficiency measures. (*Optional*)

Follow up

Invitation to participate in the follow up interview.

-
- 12 Are you able to participate in a follow-up questionnaire via the telephone (not more than 20 mins) or interested to receive results compiled as part of this survey? If so, please enter your interest and contact details in the box below. (*Optional*)

Thank you.

Thank you for taking part in the survey.