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Official and informal tools to embed performance in the design of low carbon buildings. An ethnographic study in England and Wales

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ABSTRACT

The British low carbon policy aims to achieve zero carbon buildings by 2020. This investigation what building designers are doing to embed the low carbon policy aspirations in routine project design, based on a comparative ethnographic study. The researcher documented the design process observed in four non-domestic buildings procured by design and build method. This article documents the tools deployed by building designers to embed energy performance. The analysis of the design tools unveils the low carbon problem-solving process. A number of informal tools and practices were found to be used in the design process to assist the outline of the energy aspirations, understanding and calculation of energy performance. These informal mechanisms supported the adoption of regulations and compliance tools by building designers. The field data suggests that there are pre-existing practices and designers' preferences that are the foreground where the policy requirements are to be incorporated. It is necessary that the policy model is informed by the designers' dimension to overcome the non-technical barriers that hinder the implementation of low carbon policies.

1. Introduction

The United Kingdom is aiming for an 80% reduction of carbon emissions by 2050, in alignment with Kyoto protocol commitments [1]. For the building sector, the carbon reduction roadmap will require new buildings to be 'nearly' zero carbon by 2020. The key statutory instruments vary across the four jurisdictions (England, Wales, Scotland and Northern Ireland) but for England and Wales[1] are the regulatory standard, Approved Document Part L [2], and the National Calculation Methodology (NCM) [3]. The European requirement for a NCM has been met by the Simplified Building Energy Model (SBEM) [4] and there is proprietary software available for designers to determine building energy performance. In 2010, the energy regulations in England and Wales required a 25% reduction of carbon emissions in new non-domestic buildings. Additionally, in 2009 the Welsh Government adopted the Building Research Establishment Environmental Assessment Method (BREEAM) as a planning condition for buildings of an area equal or greater to 1000 sqm [5]. BREEAM is a system that evaluates the building impact on a range of environmental and performance criteria, including carbon emission reduction on the Energy category [6]. The BREEAM threshold required as planning condition was the achievement of a BREEAM Very Good rating plus credits equivalent to Excellent on the Energy category, an Energy Performance Certificate (EPC) of 40. Fig. 1 illustrates the policy model adopted in the 2010 energy regulation transition in England and Wales. The planning application is likely to be submitted in developed design, task 3 according to the Royal Institute of Architects (RIBA) Plan of Work 2013[2] [7] and due to the adoption BREEAM as planning condition in Wales, BREEAM becomes a policy gateway. The submission of documentation for Part L, the energy standard, is likely to occur in technical design (RIBA Plan of Work 2013 task 4). The Part L requirement is common to England and Wales.

The European Council for an Energy Efficient Economy (ECEEE) estimates that the process of developing skills, knowledge and supply for technologies and products to achieve the mandated carbon targets is estimated to take ten to fifteen years [8]. Research conducted in the context of transitional changes to zero carbon buildings suggests that the building industry will have to upscale techniques and gain the understanding of the practical implications of carbon reductions during the transitional periods towards zero carbon [9–12]. Despite the compliance tools available to evaluate the energy performance, there are significant discrepancies between as-designed and actual building performance during operation, probably due to the processes and

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[1] Wales is currently in the process of devolving the energy aspects of the building regulations, but this has yet to occur.

[2] The RIBA Plan of Work is a model used in the UK to organise the building design and delivery process.

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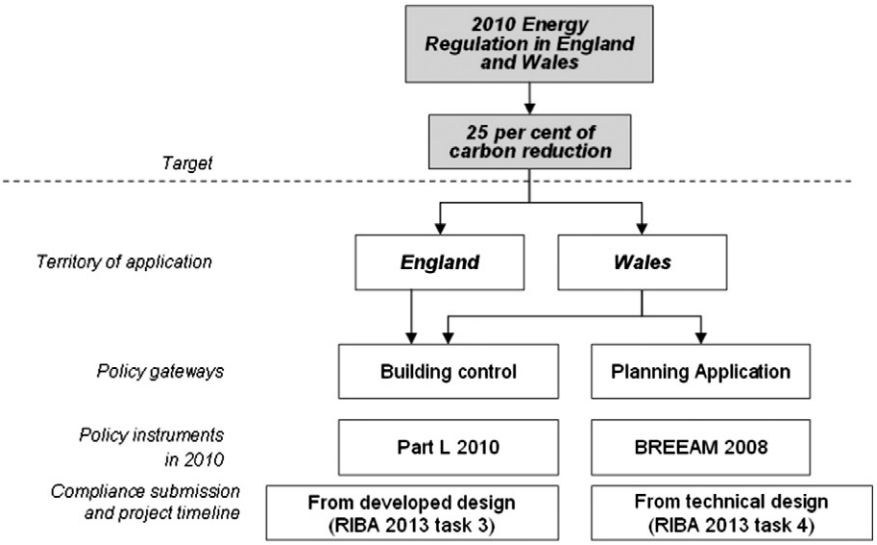

Fig. 1. Energy regulation in England and Wales in 2010.

cultures in the industry [12]. The implementation of low carbon regulations by practitioners is likely to be affected by pre-existing design practices. The challenges for, and the inertia in, the industry are often underestimated by policy makers and legislators. A key objective of this research has been to determine how practitioners cope with the regulatory changes in routine building design process. Therefore, this work investigates the designers' enactment of the policy agenda by examining the use of tools in real-time design process. Section 2 presents the theoretical foundations that informed this research. Section 3 outlines the research design based on ethnographic methods and the case studies. Section 4 documents and discusses the field observations concerning the tools and enactment of the policy agenda. Section 5 presents the discussion and conclusion of the study.

2. Tools in the design process, a socially-informed perspective

This research adopted a socially-led perspective to investigate the use of tools in the design process. Social theories reveal the experience, meanings and behaviours emerging from the ways that social groups act. Social theories argue that reality is influenced by the environment where it is embedded and it is subject to interpretation in relation to the social context. The social context is the physical and social location where people interact and develop as part of the group. It comprises the beliefs, paradigms, motivations, attitudes, habits, and repeated patterns of action that unfold during the interactions between individuals. The social theories are focused on 'the relationship between human thought and the social context within which it arises' [13]. Berger and Luckmann claim that the individuals who are part of a social group create common frames of reference and meanings in their daily interactions [13]. As a result, interpretation that entails common meanings is engendered and repeated patterns of action are enacted. In the context of low carbon design, social perspectives are relevant to reveal the adoption and enactment of the policy model by designers in relation to the pre-existing structures and practices of design. If design teams are considered as social groups possessing pre-existing meanings, understandings, motivations, patterns of action and frames of reference, imposing new requirements may demand the designers to reconfigure the process and the relationships within the process to achieve the policy aspirations.

In order to account for the possible differences between the frames of reference and understandings of the policy level and those of the design practice, this investigation makes a distinction between the 'official' and the 'informal'. The official is defined as what it is derived from the policy to achieve the carbon reduction targets i.e. regulations and compliance model. The informal is defined as what is created within the social context, outside the mainstream of the official. For the purpose of this work, the notion of 'informal' mirrors the connotation of 'dirt' by Douglas who defines dirt as 'the patterns that emerge from the social context and do not fit into the official structures' [14]. Thus, the informal is a form of 'dirt' that arises from the existing social structures, preferences and habits in comparison to what it is expected or prescribed by the official (the policy intentions and model to achieve carbon reduction).

This work is a socially-led analysis of the use of tools in the process as an analytical resource to infer about the designers' enactment of the policy agenda. The definition of tools by the American Philosopher John Dewey has been adopted to broaden the notion of 'means to ends' in the social context. According to Dewey, tools help to configure meanings; they are means to consequences in a broad sense that is not limited to their physicality [15–17]. Dewey's notion of the term tool comprises more than its direct physical properties; it includes linguistic symbols and concepts whose purposes could precede their material conditions (physicality), for example, expert advice delivered verbally could be a tool to solve a problem. Therefore, the term 'tool' embodies the broad concept of means to end; whether the tool is physical or conceptual.

The analysis of tools requires the consideration of the context of use and the human praxis; in other words, the examination of the tools within the patterns of practice. This approach prevents the bias of assuming that the tools fit immediately in the process regardless of the features of the context where they are deployed. This has been advocated by the fields of human–computer interaction and Philosophy of Technology. The social context where technologies are to be incorporated should be consider to understand the relationships between activities and technologies [18,19]. Disregarding the social context may lead to a limited conventional thinking about technology [18] that ignores the latent affordances of objects. While technologies provide a framework for action; they are defined by existing use-pattern intentions and preferences [20]. Tools are multidimensional and part of a network engendered within the community of users [21,22]. As Wenger claims, 'understanding the technology of practice is more than learning to use tools; it is a way to connect with the history of the practice and to participate more directly in its cultural life' [23]. Latour and Woolgar argue that the technical artefacts are embedded