



How market standards affect building design: the case of low energy design in commercial offices

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Abstract

This paper develops existing work on building design through a focus on one important yet understudied form of regulation: market standards. Market standards are agreed upon definitions of ‘necessary’ provision in buildings and are fundamental in ‘formatting’ markets and determining the value of a building in the market. The paper presents a case study of the design of 10 commercial offices in London, UK, the effects of market standards on the designs and on the potential for the development of lower energy buildings. Theoretically, the paper integrates literatures on standards, institutions and markets to argue that market standards do important ‘work’ in design processes that require closer scrutiny. In particular, we show that market standards are an important form of normative and cultural regulation in the field of commercial office design; format and act as calculative devices in property markets and result in forms of knowledge diminution that break the relationship between building design and occupiers’ practices. Together, these effects result in particular designs being legitimised and valued, and lower energy designs being delegitimised, devalued and pushed to the periphery of the attention of commercial office designers.

Keywords

Architecture, cities, offices, energy, markets

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Introduction

This paper develops existing work on design regulation through a focus on the effects on low energy building design of one important, yet understudied, form of private regulation: *market standards*. By market standards we mean ‘agreed-upon rules for the production of (textual or material) objects’ (Bowker and Star, 2000: 150) which, we argue, play an important role in markets and govern product design. In particular, following Timmermans and Epstein (2010: 71), we are interested in how market standards coordinate the building design process and create ‘uniformities across time and space’. We ask the following questions about market standards as a form of regulation: how do market standards affect the practices of building designers and ‘format’ (Callon, 1998) markets for commercial buildings? What are the implications for low energy design? The final question is important given that, as we show through our analysis, the potential for the realisation of low energy design is intimately related to the effects of market standards.

The analysis presented here draws on and extends a now well-developed body of research on, broadly defined, the regulation of design and architecture in cities (Ben-Joseph, 2005; Hamza and Greenwood, 2009; Imrie, 2007). Analysis has particularly focussed on how ‘rules and regulation pervade and influence, or codify, the practices of architecture’ (Imrie and Street, 2009: 2507). In existing literature, this usually manifests itself through a focus on formal regulation such as building design codes, enforced directly or indirectly by the state through legal sanctions. However, as Imrie and Street (2009: 2509) note, ‘Regulation need not necessarily be part of legal principle or codified through state rules’. Reflecting this, Brand (2009: 2670) calls for research to ‘widen the view from governmental or municipal entities’, to recognise industry bodies, such as the British Building Research Establishment (BRE), and how they create and police various design standards through non-legal sanctions. For Jones (2009: 2520), it is the ‘political and economic actors responsible for the commission of architecture’ that are of concern. Property developers, city mayors, financial institutions and asset managers all in different ways concoct and impose standards that regulate building design (Grubbauer, 2015; Guy, 1998). This implies a need to take account of a broader array of forms of private regulation and to explain how they govern the practices of building designers. Our analysis of market standards responds to this need.

Our empirical case is the ‘work’, i.e. exercising of agency and coordinating effects of market standards in the design of one type of city building – the commercial office. Using data relating to a case study of 10 office buildings in London, UK, we examine the ‘work’ of two market standards: ‘Grade A’ and the British Council for Offices guidance. Our analytical approach focuses on the effects of these market standards on the practices, i.e. the routinised ways of doing design – of the building designers involved with the case study offices. For our purposes, ‘building designers’ are not just architects. Engineers, quantity surveyors, master planners, property developers, letting agents and others associated with the design, construction and sale/letting of office buildings are also designers. These actors exert influence by setting specifications that designs must adhere to, reviewing, and accepting or dismissing proposals from architects, and perhaps most importantly adjudicating on whether a design will be financially valuable and tradeable as a good. This relates, as others have noted (Cohen et al., 2005; Larson, 1993; Till, 2009), to the need to move beyond the flawed conception of the heroic architect exercising control over building design. Rather, it is the ecology of different professionals, and interactions between them, that should be the focus of attention.

Our analysis makes three important contributions to understanding market standards, how building designers’ practices are regulated and the implications for low energy design.

First, we show that market standards comprise a powerful part of institutional fields – in our case, this being the field of commercial office design. An institutional field is a ‘recognized area of institutional life’ (DiMaggio and Powell, 1983: 14) and takes the form of a ‘community... whose participants interact more frequently and fatefully with one another than with actors outside of the field’ (Scott, 1994: 207–208). By ‘peer[ing] over the shoulders’ (Guy, 2006: 651) of building designers to see how their practices are influenced by market standards, we highlight how actors respond to and enact market standards in ways which create field-level social and financial sanctions for non-compliance. These responses and enactments are significant because they ‘format’ markets – i.e. organise them in ways that create ‘interrelated calculations in decisions and in the formulation of actions’ (Callon, 1998: 50). This in turn reproduces institutional pressures for compliance. Second, we show that market standards constrain the agency of building designers because they lead to ‘knowledge diminution’. This is when building designers’ knowledge of what people do in offices is diminished in importance and substituted by knowledge of standards and their definitions of ‘quality’ and ‘need’. Knowledge diminution results in standards-led rather than work practice-led office design, something that reproduces market ‘formatting’.

We then, thirdly, reveal the implications of the enactment of market standards and ‘knowledge diminution’ for outcomes in terms of the material design of buildings. Ben-Joseph (2005) outlines the multiple ways that standards become the ‘definers, delineators, and promoters of place’ (p. xiii). He illustrates this through discussion of how infrastructures, public and green space, housing and other buildings are given form through planning codes. Yet, Ben-Joseph has little to say about the role of private standards; his focus being on compliance with codes policed through forms of legal authority. This reflects the wider tendency to neglect the impacts on design of private regulation (Imrie and Street, 2009; Sklair, 2009) – the exception being work focussed on standards targeting sustainability (see Falconbridge and Yalciner, 2015; Schweber, 2013). We, therefore, examine the kinds of commercial office space that market standards promote and the implications for efforts to reduce energy demand in commercial offices. It is now well recognised that, as one of the main sources of energy demand and thus carbon dioxide emissions in cities, buildings and commercial offices in particular need to be focussed on as part of efforts to curb climate change and its effects (Cole and Lorch, 2003; Guy, 1998, 2006). Through our analysis, we further the understanding of the relationships between the valuation of low energy design through ‘instruments and markets’ (Knuth, 2016), building designers practices and the potential to reduce the environmental impact of buildings. We reveal that it is not only the way sustainability standards such as BREEAM (the Building Research Establishment Environmental Assessment Method) and LEED (Leadership in Energy & Environmental Design) (Falconbridge, 2015; Falconbridge and Yalciner, 2015; Schweber, 2013) direct low energy design that should be of concern. Market standards are an institutional barrier to sustainable design (Van Bueren and Priemus, 2002) because of the way they delegitimise, de-value and side-line the proven methods of energy demand reduction. We illustrate this in relation to the way lower energy cooling systems such as natural and displacement ventilation are delegitimised, de-valued and side-lined by market standards. This leads to a preponderance of air-conditioned space with its well-documented energy demand implications (Cooper, 1998; Walker et al., 2014).

The paper proceeds by, firstly, exploring how the ‘work’ of market standards can be better understood through literatures on standards, institutions and markets. After an explanation of the cases and methodology, we then outline the characteristics of market standards, their effects on building design practices and the implications for low energy commercial offices design. The paper concludes by reflecting on the importance of the ‘work’

of market standards, on the value of field-level views of regulation for explaining design practices and on ways of addressing some of the impacts of market standards on low energy commercial office designs.

Market standards and their agency

We frame our analysis in related theoretical perspectives on the agency of standards and their role in institutional fields and markets.

Theories of standardisation

There is a fertile body of work on standards that seeks to understand ‘how contemporary people interact with standardised forms, technologies, and conventions built into infrastructure’ (Leigh and Lampland, 2009: 3). A fundamental starting point for this literature is an analysis of how, as ‘agreed upon rules’ (Bowker and Star, 2000), standards exist in multiple forms and have diverse effects. Timmermans and Epstein (2010: 72), in their review, differentiate between four types of standard and effects. First, *design* standards maintain the compatibility and interoperability of objects and systems through ‘explicit and more or less detailed specifications of individual components’ (Timmermans and Epstein, 2010: 72). Studies of design standards have particularly addressed issues of lock-in and path dependence (David, 1994) and how standards creep into regulation to ensure compatibility (Bowker and Star, 2000). The nomenclature of ‘design’ standard suggests a direct relevance here. The uniformity generated by such standards raises concerns about how standards discourage building designers ‘taking chances, allowing experimentation, and letting professionals use their judgement’ (Ben-Joseph, 2005: 13). Other forms of standards can, though, be equally significant for building design. For instance, Timmermans and Epstein’s (2010) second category of *performance* standards is relevant. These regulate outcomes, such as the maximum ambient temperature allowed in an office when fully occupied in summer. In addition, a third category of *terminological* standards relates to categories and meanings which aggregate complexity into a single standard that is achieved, or not, by any particular object. In our empirical case, this could be applied to the various rankings of offices (for example, their BREEAM rating or Energy Performance Certificates (EPCs)).¹ Finally, a fourth category is *procedural* standards that define how a process should be completed, such as the sequential steps of building design according to the Royal Institute of British Architects’ ‘Plan of Work’.

Building design has, then, the potential to be coordinated by standards in diverse ways relating to the objects/technologies used and issues of performance, classification and process. For commercial offices, this coordination relates to multiple features of the building: from floorplate and core size to net internal area available to occupants, floor to ceiling heights, façade and electrical and mechanical systems (from plug sockets to lighting, air conditioning and lifts). The effects of standards on such features is worthy of investigation because a key concern is that the effects are not always positive. For example, there is a case for considering how the tendency, in world cities especially, towards standardised architectural forms that fail to reflect vernacular design, with implications for energy demand (Cole and Lorch, 2003; King, 2004), might be usefully explained as partly a result of the ‘work’ of market standards. Global design discourses lead to the perpetuation of particular standards of spatial arrangement and provisioning within buildings, not least in the name of corporate productivity and competitiveness (Dale and Burrell, 2007; O’Neill and McGuirk, 2003),

whilst standards of thermal comfort within buildings emerge and lead to the proliferation of air conditioning (Cooper, 1998; Walker et al., 2014).

To fully understand how different standards affect building design requires, however, two further analytical steps which consider (a) the policing mechanisms that make standards powerful forces and (b) the particularities of the ‘work’ of standards in markets.

Standards and institutional fields

Numerous studies highlight the homogeneity that standards generate, adopting an understanding of standards as rigid social structures. For instance, drawing analogies to Weber’s work on bureaucracy, Bowker and Star (2000: 312) suggest that standards hem-in actors as technologies become standardised and ‘a basis is formed for dissent to be viewed as madness or heresy’. This potentially results in ‘a dull sameness, the suppression of individuality in the service of industrial uniformity’ (Timmermans and Epstein, 2010: 71). Indeed, for Bowker and Star (2000: 5), a standard ‘valorizes some point of view and silences another’. This means a standard can limit the potential for the consideration of alternatives, as a form of moral economy (Busch, 2000) and order of worth (Thévenot, 2009) develops around a standard and what it legitimates.

Work on institutional fields explains these effects of standards. In our case, the field comprises actors (engineers, quantity surveyors, master planners, property developers and letting agents) interacting to procure, design and sell commercial offices. Standards are key to maintaining the institutions of a field – i.e. a taken-for-granted set of rules for any given activity. As Scott (2008: 83) notes, an artefact such as an office gains value (financial, symbolic and reputational) when it complies with standards, as compliance is taken to indicate adherence to the ‘rules of the game’ in the field. An artefact that complies with standards also ‘carries’ and reproduces the institutions of the field, as others witness the value conferred by compliance and follow suit. Standards thus matter because they encourage institutional conformity and stability.

The value accrued from compliance with standards relates, in part, to the policing of compliance and non-compliance. This policing takes three different modes, each associated with a ‘pillar’ of the institutional environment of the field (for more on this, see Scott, 2008). *Regulatory* policing involves *legal* sanctions such as fines or even imprisonment. In our empirical case of commercial offices, this category applies to building regulations and planning permissions. Work on the regulation of building design predominantly considers this category. For market standards, the regulatory pillar is, however, only one consideration.

Scott (2008) also identifies the *normative* pillar that defines ‘quality’ provision and practice. Markard and Truffer (2006: 614) similarly identify the role of ‘social standards’, whilst Allen and Sriram (2000: 173) highlight how normative prescriptions of quality become ‘de facto’ standards. The policing of normative standards occurs through *social* mechanisms; the risk of disapproval by peers or the labelling of a design as sub-standard are powerful means of enforcement, given that, as we outline below, such labels have the potential to destroy value. Scott (2008) additionally identifies the *cultural-cognitive* pillar. This pillar is associated with mental models, perceptions and views of the world that form beliefs about appropriateness. The cultural-cognitive pillar relates to what Allen and Sriram (2000: 173) call ‘consensus’ standards, these being policed through judgements of *legitimacy*. For instance, a building may be viewed as illegitimate and thus devalued if it is based on presumptions about the world, and thus offers provision that does not correspond with dominant *cultural* conceptions of what is appropriate.

The institutional perspective is important because, as we argue below, market standards are inextricably tied to regulation and policing by legal sanction but are also simultaneously policed by normative and cultural conceptions of, respectively, quality and legitimacy in the field of commercial office design. This tri-partite policing affects the practices of building designers in ways that impact on possibilities for and forms of low energy design. Moreover, this policing and its effects relates to the way market standards ‘format’ markets. To explain why this is the case, one further analytical step is required. This involves consideration of the links between standards and markets.

Standards and markets

Commercial offices are not only places for work. They are also investment vehicles, most notably for pension funds and other institutional investors. In the UK context, approximately 93% of rented commercial office space is owned by some kind of financial institution (Henneberry and Roberts, 2008: 1424). This reflects a wider global trend, such as in Australia (O’Neill and McGuirk, 2003) and the USA (Weber, 2015; Willis, 1995). This might be labelled the financialisation of commercial offices (c.f. Harvey, 1982). This is a process which involves attention switching away from the specifics of the office and its use, and onto financial yield (return on investment measured using various metrics) and methods of ensuring an office performs acceptably as an investment good. Acceptable performance is usually defined in terms of percentage return on capital invested (Crosby and Henneberry, 2016; D’Arcy and Keogh, 1997). Consequently, for commercial office designers, prioritising the demands of financial institutions for a yielding and tradeable good is a constant concern. Amongst other things, this means translating the concept of a yield-bearing and tradeable office into a design and then a material form. This effects the amount of office space constructed (Weber, 2015), the plot size, shape and height of buildings (Willis, 1995), and the likelihood of low energy designs being adopted (Guy, 1998; Van Bueren and Priemus, 2002) as a delicate balance is struck between design and build cost, attractiveness to potential tenants and rental value.

Illustrating these dynamics, the work of Weber (2015) on the building of the ‘new Chicago’ that emerged in the 2000s sets out the way building designers and their embroilment in the financialisation of property created markets with particular dynamics which ultimately led to over-building in the city. Weber (2015: 9) identifies the ‘local practices’ that made markets in Chicago and which drove development in a particular direction, with demolition and new construction gaining pre-eminence over refurbishment and particular forms of building being valued and in turn others devalued. Weber (2015: 156) blames real estate actors and their financial incentives for the boom and bust in the property market, for her, these actors being responsible for ‘Making the market for Chicago’s new skyscrapers’. Here, we extend and further develop the work of Weber (2015) and others on the financialisation of commercial office space and the making of markets for it. We consider the role of market standards, but also the importance of the ecology of professionals and the way they together ‘format’ markets through their responses to standards.

Specifically, to understand the role of standards in the context of the financialisation of commercial offices, we find it useful to consider theoretical explanations of the nature of markets. As Fourcade (2007) notes, there are a number of distinctly different ways of conceiving of markets, and standards appear in all of them to varying degrees. Particularly relevant is the observation that standards ‘stabilize the world around certain understandings’ (Fourcade, 2007: 1019), creating dominant modes of valuation. Work on the role of ‘calculative devices’ (Callon and Muniesa, 2005) is relevant here, wherein standards are one

part of the ‘assemblage of people, things, method and mechanisms of calculation’ (Lovell and Smith, 2010: 457). Calculative devices are important in markets in two ways. First, a device defines value because of the way it ‘performs, shapes and "formats" the economy rather than observing how it functions’ (Callon, 1998: 2). Underlying this observation is recognition in the social studies of finance literature that the way agents use calculative tools is fundamental in defining the characteristics of a market. The most well-known example of this phenomenon is the Black-Scholes model in derivatives trading. MacKenzie and Millo (2003) demonstrate that this model, whilst often assumed to represent derivatives markets, actually ‘formats’ these markets in particular ways, because traders use it as a guide to direct their trading activity. Such effects are referred to theoretically as agencement. For Callon (2007: 142), agencement is a result of the way human agency is ‘distributed agency’, being constituted by non-human materials that contribute to outcomes. As one type of non-human, standards matter, therefore, because they affect how building professionals act. The ‘compound’ (Muniesa et al., 2007: 2) of a calculative tool, such as a standard, and human agency and the way this configures what is involved with a practice, such as building design, actively determines the dynamics of markets. That is, building design practices that are configured by standards are not outside of and reacting to the market, but are actively constituting the market. Like the ‘economists in the wild’ (accountants, consultants, etc.) that Callon (2005) talks of, the effects of the distributed agency of architects, engineers, quantity surveyors and property developers is, therefore, only understandable if the role of standards as calculative tool in *defining the characteristics of property markets* is considered.

Relatedly, second, as Callon and Muniesa (2005) outline, because calculative devices ‘format’ markets, they also *assign value and transform an object into a tradeable good*. Specifically, an object that complies with a standard gains certain qualities (such as eminence, worth and legitimacy) which enables classification, comparison, and thus trade as a good in the market created by the very same standard (Callon et al., 2002). Actors in markets ‘use the calculative tools that are more or less explicitly proposed to – if not imposed on – them’ to make decisions about which goods to purchase and their financial value (Callon and Muniesa, 2005: 1239), this reinforcing the distributed agency effects outlined above.

In light of these insights into the role of standards in markets, we address our first research question – how do market standards affect the practices of building designers and ‘format’ (Callon, 1998) markets for commercial buildings – by considering two inter-related issues. First, the institutional pressures on building designers to comply with market standards. Second, the way these pressures recursively enact the ‘formatting’ of markets for commercial buildings. We then address our second research question – what are the implications for low energy design? – by tracing the effects of market standards on what is (and what is not) considered a legitimate and valuable design, and in turn on the agency of building designers when decisions are made that impact on energy demand.

Methodology

London as an illustrative case

To address the research questions set out above, London is used as an illustrative case – i.e. a case that reveals with particularly clarity the phenomena of concern. We choose London for a number of reasons. First, because a high proportion of the city’s office stock is a result of speculative development for the rental market using funds from institutional investors. That is, like Chicago is for Weber (2015), London is a prime example of the financialisation

of commercial offices. Demonstrating this point, whilst one-third of the UK office stock (in floor space) is found in London, two-thirds of UK speculatively developed floor space is in the city (Crosby and Henneberry, 2016: 1427). The rationale for focussing on speculative development is that offices are predominantly (c. 80%: Deloitte, 2014: 28) developed in this way in the UK, being rented rather than owner-occupied. Hence, most are designed without a specific tenant in mind, meaning their performance in the market is crucial.

Second, we chose London because it provided the possibility to study a range of commercial office typologies. Whilst it is tempting to assume that there is a 'typical' urban office type, multiple variants exist. Putting aside variation caused by plot size and orientation, which might be described as a factor that leads to variations within a typology, it is possible to identify four distinct typologies, all of which can be studied within London: Finance-trading (in particular offices accommodating the trading floors of banks); professional service (accommodating corporate service activities); technology–media–telecommunications (TMT – accommodating digital industries) and alternative commercial (sometimes called 'funky' or in London the 'Shoreditch' model – offices defined by the 'Google' approach, disregarding traditional layouts and appearances, targeted at a range of sectors). Each has a particular set of configurations in terms of space provision, and we wanted to examine whether the influences on low energy design varied between the typologies.

London acts, then, as a useful illustrative case. However, like any city, it also has its specificities. Consideration of the relevance of our findings outside of London is, therefore, important. We return to this in the conclusion section of the paper.

Data collection

The original empirical analysis is based on 49 interviews with different actors in the field of commercial office design. Data collection took place in two related stages, beginning with eight exploratory interviews with four key actors: *architects* who provide the designs for the main structures, spaces and aesthetics of the building; *engineers* who design the various mechanical (e.g. lifts, ventilation) and electrical systems (e.g. lighting); *property developers* who manage the funds of investors, make decisions about where to locate a new development, what to develop and then commission architects and engineers; and *planners* who review, set requirements for, and ultimately approve designs. These interviews considered a multitude of influences on building design practices, and in particular on the incorporation of low energy technologies such as displacement ventilation. The influence of standards on the practices of architects and engineers stood out as a recurrent theme. We therefore decided to follow-up the 'hunch' that standards play a significant role in determining possibilities for low energy office design.

Stage two thus sought to focus on the different standards relevant to commercial office design. To do this, 10 office buildings, either newly constructed (6 cases) or refurbished (4 cases) since 2010, were used as cases for empirical analysis. A post-2010 sample was used to ensure some consistency in the standards of concern, given that standards change over time. The cases were selected to reflect the four different categories of commercial office buildings. All were built or refurbished speculatively. Semi-structured interviews with actors involved in the design of the case study offices were used to unpack the influences on practices (the same actors as in stage one of the research but with the addition of *letting agents* who mediate between property developers and potential tenants, finding the latter for the former and helping the latter negotiate terms and rates with the former). Interviews were conducted with at least three building design actors per case study. Table 1 provides anonymised details

Table 1. Case study buildings.

Case study	Year of construction/ refurbishment	Key features	Interviewees
1	2013	New building. City of London/West End CBD location.	Architects (×3), Engineer, Developer, Letting Agent
2	2011	New building. City of London/West End CBD location.	Architects (×2), Engineer
3	2013	New building. Mid-town edge of CBD location.	Architect, Engineer
4	2014	New building. Mid-town edge of CBD location.	Architects (×2), Engineer, Developer
5	2014	New building. Mid-town edge of CBD location.	Architect, Engineers (×2)
6	2014	New building on old building's foundations. City of London/West End CBD location.	Architects (×2), Engineer, Letting Agent
7	2013	1960s Refurbishment (previously refurbished once in 1980s). City of London/West End CBD location.	Architect, Engineer
8	2014	1980s Refurbishment. City of London/West End CBD location.	Architect, Engineers (×2), Letting Agent
9	2014	1980s Refurbishment. City of London/West End CBD location.	Architects (×2), Engineer, Developer, Letting Agent
10	2010	1980s Refurbishment. Mid-town edge of CBD location.	Architect, Engineer, Developers (×2)

of the case study buildings and interviewees. Interviews were also completed with members of associations representing actors in the field of commercial office design.

Data analysis involved two members of the research team reading all of the transcripts and coding the data. Coding was then compared, with discussions used to identify consistencies in interpretation and, where inconsistencies emerged, to further explore the data and agree on interpretations. A coding structure was developed in an iterative and inductive manner, initially as part of analysis of the exploratory interviews. NVIVO computer software was used to facilitate coding. It quickly became clear to both members of the team coding data that one of the most important stories related to the effects of market standards on the agency of building designers, and the tensions that existed within the field of commercial office design about the role and effects of market standards. The analysis presented below is drawn from the most significant high-level (parent) codes that relate to these themes, with the data presented in a way that draws attention to the key mechanisms underlying the 'work' and effects of market standards. Anonymous quotations are used throughout to illustrate these mechanisms and effects.

The role of market standards in commercial office design

Interviewees highlighted a range of regulations influencing commercial office design. Obligatory compliance with building regulations (design and performance standards) was flagged as a fundamental starting point, with compulsory EPCs (terminological standards) forcing early consideration of energy consumption. The desire of the client, and often the insistence by planning codes, to achieve a particular (usually Excellent) rating in BREEAM assessments also featured. This corresponds with the existing literature on the effects of legally backed regulations (Imrie, 2007; Imrie and Street, 2009) and the role of private sustainability standards (Faulconbridge, 2015; Faulconbridge and Yalciner, 2015; Schweber, 2013). Less well documented in the literature, however, is a set of market standards that interviewees suggested were of utmost significance when designing commercial offices. These consider features of a building included in building regulations and sustainability standards, and as such connect to the four types of standard (design, performance, terminological and procedural) that Timmermans and Epstein (2010) describe. However, market standards synthesise and extend these standards in terms of the levels of specification and performance they demand. For instance, whilst building regulations in the UK stipulate an airflow rate into the building of 10 litres per second per person, the British Council for Offices (BCO) guidance which we discuss below suggests that there should be 12–16 litres per second per person. This is indicative of the significance of market standards: there is often an assumption that meeting market standards will exceed regulatory and other standards, and hence become the focus of attention.

Market standards do not, then, exist in isolation from the regulatory pillar of the institutional field and state-led building controls, or other private governance initiatives such as BREEAM. In some ways, they are benchmarked and have their characteristics established by their relationships to state-backed regulations and other private standards. For example, if building regulations increased or decreased their requirements for a particular feature, such as airflow, market standards would likely respond. Nonetheless, as we show below, market standards have their own distinct role and effects in commercial office design and property markets.

Two examples of ‘market standards’

In the analysis below, we discuss two examples of market standards revealed by our research to be crucial in commercial office design. The first is represented by the term ‘Grade A’. This is a widely recognised term in the field of commercial office design, and some organisations have sought to codify what is meant by Grade A. For example, the Building Owners and Managers Association International (BOMA) describes Grade A as being the ‘Most prestigious buildings competing for premier office users with rents above average for the area. Buildings have high quality standard finishes, state of the art systems, exceptional accessibility and a definite market presence’ (BOMA, 2017). The vagueness of this definition – without clarity about what terms like ‘state of the art’ and ‘definitive market presence’ might mean, is a reflection of the way Grade A is perceived by building designers. Those we interviewed presented Grade A as a conception based on experience and collective beliefs about marketable offices. As such, what they described is something that is not formally codified or easy to describe. Rather, it is something taken for granted and recognised by members of the field of commercial office design, akin to what Polanyi (1966) describes as tacit knowledge. Indeed, those we interviewed were not aware of attempts such as those by

BOMA to provide a specific definition. For instance, when asked about Grade A offices one architect replied:

I'm never quite sure what the difference is between Grade A and grade B. . .it was always like loos, views and something else, the mantra, there was more to it. I suppose big windows deliver the views and obviously upper level roof terraces etc. (Architect, case study 2)

Nonetheless, as the final parts of the quote imply, those socialised through experience can when prompted outline the 'Grade A' standard with a degree of precision – and more precision that is offered in the BOMA definition. Table 2 provides examples of how 'Grade A' was described by different respondents. Importantly, these responses illustrate the way 'Grade A' focuses on material-aesthetic features. These include the types of façade, walls, visible cooling system etc., with certain forms being considered essential for meeting any tenant's aesthetic 'needs'. Hence when a design conforms to the 'Grade A' standard, the expectation is that:

when we [letting agents] show people round the building. . .they're going to see an open plan, open floor. . .it will be the same as the last one they just looked at. So if we can make an

Table 2. Key understandings of the 'Grade A' variant of market standard.

	Understanding of Grade A or key component of it
Architects	<p>'Reception spaces might be double height to get more light in but, and create a feeling of space and quality . . . modern buildings we're looking at the majority of them have a highly glazed, penthouse upper floor, terraces that kind of thing . . . starting point is four pipe fan coil, suspended ceilings, that's what the city wants, that's what we should be giving them. Maximum flexibility so it can be a cellular or open plan space layout, the façade on 1500 grid and you have these kind of set rules' (Architect, case study 8)</p> <p>'An image for the building I suppose, making it marketable . . . Once you're inside a standard spec A, Grade A office space that you let on the market has got white ceilings, raised access floors, white walls' (Architect, case study 3)</p> <p>'Developers still like full to ceiling glass, they really are wedded to it' (Architect, case study 1)</p>
Letting agent	<p>'Central plants installed, all the services, on floor services, mechanical services in the ceiling. It would be air conditioned and there could be a number of different systems. You would have your suspended ceiling with recessed lighting and you would have your full accessible raised floor installed on the floor' (Letting Agent, case study 8)</p>
Marketing	<p>'Typically, office buildings within this bracket are brand new or have been recently redeveloped/experienced a thorough refurbishment within the last 15 years. They will be finished in order to compete for premier office users and will usually demand rents that are above average for the area . . . Full complement specification to contain: Raised floors and suspended ceilings . . . Lift . . . Air conditioning or similar' (http://www.yorkmeansbusiness.co.uk/media/33765/definitions_of_office_grades.pdf)</p>
Owners/ building managers	<p>'Most prestigious buildings competing for premier office users with rents above average for the area. Buildings have high quality standard finishes, state of the art systems, exceptional accessibility and a definite market presence.' 'BOMA, 2017</p>

impression in terms of the lobby, the lift experience is great, go in the loos and they think ‘we can allow our clients to go in there and they won’t feel embarrassed!’ (Developer, exploratory interview)

The second market standard we focus on is associated with more formalised definitions of ‘need’ and ‘quality’ which have emerged as a result of the work of the BCO. The BCO was founded in the 1990s as part of efforts to tame an ‘arms race’ that had arisen between developers in relation to office specifications. The BCO provides guidance about provision that meets most if not all users’ ‘needs’, the aim being to help developers make sufficient but not excessive provision at the design stage. The BCO *Guide to Specification* is based on extensive research about the level of technical provision considered ‘necessary’ in a high ‘quality’ office. Various committees – seven in total – both synthesise existing and commission new research relating to all aspects of building design and specification. Committees are chaired and staffed by individuals representing the different actors in the field of commercial office design, on many occasions the individuals being drawn from large firms in the relevant sectors. For example, committee members at the time of writing are drawn from architecture firms (e.g. JM Architects, 5Plus Architects), engineers (e.g. Arup, Aecom), developers (e.g. Aberdeen Property Investors, Land Securities), letting agents (e.g. Savills) and the investor community (e.g. Legal and General, Schroders). Committees provide inputs for the editors of the *Guide to Specification*. Whilst not intended to be a standard – the BCO issues guidance – the Guides published periodically, most recently in, 2014 (BCO, 2014), form a powerful market standard in the field of commercial office design in the UK. As such, whilst they may not intend to be, those on the BCO committees and editing the *Guide to Specification* are important lead actors in setting market standards. Table 3 provides a

Table 3. Summary of key components of the BCO Guide to office specification, which are the basis for the normative standard of the acceptable office.

Key parameters	Key elements of Guide 2014 specification
Occupational densities (<i>how many people the building can accommodate</i>)	1 person per 8–13 m ²
Lifts	Lifts: Waiting time – up – peak: <25 seconds; Time to destination: <90 seconds – up to 15 floors
Raised floors	100 mm: typical floors/refurbishment 300–500 mm (trading floors)
Thermal criteria	Air Conditioned: Summer, 24°C ±2°C; Winter, 20°C ±2°C Mixed mode and naturally ventilated offices: summer, not to exceed 25°C for more than 5% of occupied hours, not to exceed 28°C for more than 1% of occupied hours; winter, 20°C (±2°C)
Fresh air (litres/second/person)	12–15 l/s/person (It is recommended that at least 10% more air is added to account for meeting rooms and areas of high occupation density)
Lighting	Average maintained illuminance: VDU/general use: 300–500 lux; paper based tasks: 500 lux. Electrical load allowance: 10 W/m ²
Small power consumption (<i>the availability of electrical circuitry to power equipment, from computers to fridges</i>)	Small power: 20–25 W/m ² (on floor distribution). For an area 1000 m ² , 13–15 W/m ² (diversified load).

Source: Taken from BCO (2014).

summary of some of the key features of the BCO Guide and the technical definitions of ‘quality’ provision provided.

Most important for our argument here is how the BCO Guide creates clear, technically defined understandings of what *ought* to be provided, and what performance levels *ought* to be achieved in a ‘quality’ office. The guidance covers virtually all elements of design; in addition to the criteria summarised in Table 3, there is also guidance for, amongst other things, plan efficiency (net internal area as a proportion of overall floor area), floor to ceiling heights, maximum distance from a window, numbers of toilets, the façade and lifts (including maximum wait time for a lift). Hence, whilst BCO guidance does not tell building designers exactly *how* to design a building, and although different land plot sizes and shapes and occupants (e.g. investment banking versus media) generate a number of building typologies, the guidance sets parameters within which building designers are recommended in all scenarios to operate, and reduces variability between buildings. Consequently, interviewees made comments such as ‘the BCO criteria is where we start’ (Architect, case study 8), and ‘we base everything on the BCO guide and for any development we do that’s the base’ (Letting Agent, case study 8). Another noted that:

The tick box is very much... is it BCO standard?... Tick, tick, tick, tick, tick. And then you go ‘right, you can value that quite easily’. Whereas if it doesn’t tick those boxes all of a sudden the value is becoming eroded, could be less attractive as to who you can sell it. (Architect, case study 9)

Grade A and BCO are, therefore, distinctive given their respective aesthetic and technical focus. However, these differences are not our main concern here. Rather, we are interested in the ways that the two variants illustrate the ‘work’ of market standards.

Standardised and institutionalised: The ‘work’ of market standards

Standards as calculative devices and market ‘formatters’

Market standards powerfully structure both design practices and the assessment of designs. Capturing their power, one interviewee described how ‘any consultant will move from them [Grade A and BCO market standards] at their peril’ (Letting Agent, exploratory interview). Other interviewees confirmed this with observations such as the following: ‘You wouldn’t design a building to less than BCO standards... it’s a huge cross if your building doesn’t meet BCO standards’ (Engineer, case study 8); and, ‘I can’t be too bothered to go and challenge the establishment’ (Developer, case study 4). In referencing ‘the establishment’ this interviewee is referring to the institutionalised norm of the field – the ‘rules of the game’ for how things are done and which all of the key actors in the field of commercial office design subscribe, even if reluctantly. In various ways, then, all the actors in the field felt that market standards constrain their agency, creating structured parameters within which they must work. One interviewee, with reference to features associated with a Grade A building, described the iterative and mutually reinforcing process through which market standards have such effects:

Yes there is an explicit request from agents, they’re like ‘buildings with floor to ceiling glass will let better, you’ll get higher rent for them, you’ll get prestige’, [so] that’s what you do. And so that’s what, in their mind that’s what sells... most of the time we... just go ‘ok’ and we pass that brief on to our architects. (Developer, exploratory interview)

Market standards differ, then, from standards such as building regulations and EPCs which are policed through regulatory means. Adherence to market standards first and foremost ensures that within the field the design of an office will be deemed marketable – i.e. in line with potential occupiers’ ‘needs’ for high ‘quality’ space, thus being legitimate and tradeable in property markets. In part, this means ensuring an office is able to accommodate a range of unknown future demands from occupiers. This is important because in speculatively developed commercial offices occupiers are often unknown during the design phase, and will change several times during the lifetime of a building. Consequently, as one interviewee put it: ‘you have these standards and those standards are seen to be acceptable and appropriate and adaptable’ (Architect, case study 2). Forms of approval or disdain and judgements of legitimacy or illegitimacy by other actors within the field of commercial office design are thus powerful. That is, the normative and cultural-cognitive pillars of the institutional environment are as important as the regulatory pillar.

The need for adaptability demonstrates the significance of the relationships between different actors in the field of commercial office design. The work of architects and engineers needs to be seen as legitimate by property developers and letting agents who are concerned with meeting the needs of a range of potential occupiers. If this is not achieved reputations, but also financial rewards are at risk. Of course, the additional construction cost associated with adherence to market standards, that exceed minimum levels for regulatory compliance, could affect an assessment of investment return (typically referred to as the ‘yield’ in property investment – see Isaac et al., 2010: 54–58) by increasing the gap between investment costs and rental income. However, in a field in which adherence to market standards is the norm, non-compliance has too many risks. A building may be seen as low quality and illegitimate in the market, meaning investors find it difficult to let the property (it may take longer to rent at prevailing rates, or the rent may need to be discounted to attract tenants). This will have an adverse effect on the overall yield. Property valuation professionals are also likely to place a lower financial value on the building. This in turn would make it less attractive to institutional investors such as pension funds who require investments that will retain their high value over the long term.

Furthermore, in the UK property valuations are usually made by assessing yields calculated using likely rent per square metre of floor area data, rather than using a more explicit assessment of all investment cost and rental income. Crosby and Henneberry (2016) describe this as the ‘comparative method’ of property valuation in which the yield is derived mainly from an analysis of similar transactions in the market rather than from a more detailed aggregation of costs and income for a specific building. The significance here is that this involves valuers seeking comparable examples and ‘differences in perceived risk between comparable property transactions and subject properties . . . applied intuitively by adjusting the yield’ (Crosby and Henneberry (2016: 1430). It is, then, hardly surprising that in this context, the risks associated with not adhering to market standards significantly influence the practices of building designers. Adhering to market standards is a simple way for all in the field of commercial office design to satisfy each other that the building is adaptable and thus valuable and tradable in property markets, this rendering it high quality and legitimate in the eyes of field members. That is, market standards are important calculative devices.

Intriguingly, to some extent, the different actors blame one another for the power and constraining effect of market standards and are cynical about their utility. Architects blame engineers for slavishly following market standards when designing mechanical and electrical systems (‘I think that, there are certain industry norms assumed for, kind of driven by BCO guidance about anticipated, small power electrical loads, etc.’). This creates constant tensions in the design process and further explains observations in existing research, statements

such as ‘Remember I’m the bloody architect!’ (Cohen et al., 2005), which reflect in part the frustration architects feel when their design practices become subservient to the demands of other actors in the field of commercial office design. Engineers blame developers who they perceive as relying on standards to compensate for a lack of understanding of building systems (‘we didn’t necessarily design anything to the BCO but [the developer] was keen to show that we could meet BCO’). Developers blame letting agents who they feel represent occupiers’ expectations through market standards rather than through careful research into occupant needs (‘I think it’s a general thing, whatever the BCO guide says, the agents ideally are trying to push’).

Yet in making such comments, and in the discussions noted earlier of the ‘compulsions’ to follow market standards, the different actors miss the fact that all of their actions in particular ways contribute to the institutional pressures faced. We can explain this in relation to the way market standards act as calculative devices (Callon and Muniesa, 2005): a building that complies with market standards is assigned qualities (high quality and meeting occupants ‘needs’), becomes comparable, and is thus tradeable, and hence standards are used as tools to navigate markets. But, this situation only exists if we accept that, as noted above, standards also *define the characteristics of property markets*. In responding in particular ways to what market standards propose, architects, engineers, quantity surveyors and developers enact the market and give it particular characteristics. Every time design decisions are influenced by standards, markets are ‘(re)formatted’ and a recursive cycle reproduced whereby the standards define the characteristics of property markets *and* assign value and transform a building into a tradeable good. What, then, are the specific effects of the distributed agency of market standards on the practices of building designers and the ‘formatting’ of markets (our first research question)?

Knowledge diminution: The standards-practice disconnect

Market standards ‘black-box’ (Latour, 1987) many aspects of building design. In particular, consideration of the relationship between a design and the likely office work practices of occupants – something that should be a fundamental determinant of design – is replaced with consideration of how to meet market standard defined ‘needs’ and ‘quality’ thresholds. This aligns with what Hogle (2009) refers to as the ‘objectivity’ of standards. Standards become the focus of attention, rather than the object that is ultimately of concern: what people do in offices. As an occupier interviewee articulated:

people [actors in the field of commercial office design] go by those standards and I think most of the time they don’t really know what they mean. It’s a kind of a bit of a catch all...you’re not looking at what it means and you’re not necessarily thinking ‘but is some of that relevant to what you want? Is there something else better than that?’ (Occupier, case study 4).

Market standards need not, however, break the link between design and what people do in offices. Latour (1999: 38) argues that through black-boxing standards should amplify knowledge of what they represent. Using a standard should allow uncertainties and complexities to be taken account of that would otherwise have to be ignored (see also Timmermans and Almeling, 2009: 23–24). Market standards do fulfil such a function in that they translate many aspects of the complexity of a commercial office design into a series of specifications. However, they also lead to highly significant forms of knowledge *diminution* because of a failure to amplify knowledge of *variety in what people do* in offices. Market standards reduce the input of ‘experts’ such as architects and mechanical and engineering

consultants into decisions about the alignment of office designs with work practices. They promote a ‘one size fits all’ approach to office design. For instance, in our research all of the buildings studied were designed to be able to accommodate people at 1 person per 10 square metres or denser, in conformity to the BCO Guide. But the BCO’s own research shows that 92% of office buildings are typically occupied below this level (see BCO, 2013). This means buildings designed, for instance, to provide volumes of fresh cool air that is not essential in most cases.

Through their ‘objectivity’, market standards render the judgement of experts important in meeting standards, but not in interpreting fundamental questions of ‘need’. As Stinchcombe (2001: 34) suggests, this is possible because ‘a gap in one’s own abstractions [can] be filled by others’ competent formal government, without having to go behind the certificate’. Or, put another way, trust is placed in the standard as a substitute for knowledge of the object it represents and the making of judgements using this knowledge. Market standards are, therefore, a crucial part of a distributed agency, playing a central ‘formatting’ role in markets.

The effects of standards on the agency of building designers do not go unnoticed. There is a widespread feeling that the homogenous over-provision that market standards encourage should be avoided, and that in many cases, all of the likely occupants can be accommodated without adhering to market standards-imposed over specification. As one interviewee noted: ‘[with] the BCO Guide it becomes much more plug-and-play for a tenant. . . Everything that they could ever need is there. There’s a lot of redundancy built in’ (Architect, case study 3). Indeed, as illustrated by the quotation below, many argued that there are risks associated with the one-size fits all approach of market standards (with clear implications for energy consumption as well as occupant wellbeing):

the whole building was 1:10 but the fifth floor in particular you could fit 39 people on there if you did it 1:10. There are only seven people that are based there. . . So there were issues . . . they were too cold because they had too much air coming in. . . in the summer time they were heating the space. (Engineer, case study 2)

Building designers are, then, reflexive about the effects of standards. However, the way these individuals respond to standards does not always reflect this reflexivity. Illustrating this point is the way that designing-in provision and performance that *exceeds* market standards is increasingly common. For instance, one interviewee noted how ‘[Developer x] are BCO+’ (Architect, case study 9), referring to the specification of BCO guidance levels of provision and performance, plus an extra allowance (often 10%). Others observed that

it tends to be BCO-and-add-a-bit. And then it’s partly driven by agents and partly driven by tenants and then developers trying to predict the future, it’s how much do you add and where do you add it? (Developer, case study 4)

We always design so the building can be operated slightly better than the average on all of that. . . We definitely talk about [our properties, that] they’re better than, they beat the BCO Guide, better than the BCO Guide. (Developer, exploratory interview)

The question raised in the first quotation about ‘how much to add’ is particularly pertinent. Because of the black-boxing effect of standards, when adopting an exceedance strategy (e.g. BCO+) it is often unclear why exceedance is beneficial and which groups of occupiers and associated work practices require additional provision. However, exceedance is a risk

minimisation strategy and design practices have thus evolved in ways that normalise particular levels of exceedance, in turn inscribing this into the operation of markets. As two interviewees noted:

in actual fact representing your client [an occupier] you're probably perceived to be doing them a disservice if you're not screwing as much out of the selling party [a developer] as possible. And in those terms 600 [lux of lighting] is better than 500, even if you don't need it. (Architect, case study 1)

you've got a potential client [an occupier] and you can say 'oh but we've got extra air, it's a better quality, it's a better environment, your workers will be not falling asleep' and that kind of thing. And they may choose you over another building which has only got the bare minimum [to meet building regulations]. (Engineer, case study 2)

For the 'Grade A' variant, further examples would include bigger atria, more lights and enhanced kitchenette provision. Underlying this, as one interviewee observed, is the following strategy:

we don't say to the architects 'we want...', because there's not a formula, we don't say 'because the building is 50,000 square foot we need 40 bike spaces'. We really set them a challenge of 'how much can we fit in?'. (Developer, case study 9)

Hence, as the quote above, discussing the 'disservice' to clients of not following exceedance strategies highlights, *markets are 'formatted' by the way building designers respond to standards* so as to ingrain the assumption that an exceedance approach will be taken. As such, exceedance strategies provide a good example of the agency of standards to create particular models of commercial office markets. The responses they trigger from building designers are crucial – in Callon's (2007) terms, it is the agencement that matters. It is, then, unsurprising that Beamish and Biggart (2012: 63) suggest that standards act as social heuristics, ensuring compliance with 'widely accepted performance criteria' and helping building designers understand 'whether they are making acceptable decisions and performing their role appropriately given industry standards and expectations'. The result, however, is an ever diminishing role for 'expert' judgements in the building design process and ever diminishing knowledge of how to design varieties of commercial office that respond to different types of occupant. This is important as it has implications for the characteristics of markets and in turn low energy design (the focus of our second research question).

'Formatted' markets and the legitimising and delegitimising of building designs: Implications for energy demand

The role of market standards as calculative tools that produce a distributed agency and in turn 'format' markets is especially clear in relation to considerations in the design process about energy demand. To achieve the provision and performance specified in market standards there are a limited range of spatial configurations and, particularly important for questions of energy, heating and cooling systems that can be used. For instance, the BCO guidance on thermal comfort is often difficult to achieve using lower energy systems such as heat pumps, displacement or natural ventilation or chilled beams or ceilings. However, if building designers' responses to market standards are redefined slightly these lower energy

options become more viable and much easier to achieve. Hence, if lower energy technologies are to be incorporated into designs ‘the first step is to get an acceptance that you can do something lesser as a base provision’ (Engineer, case study 10). This is feasible, given that regulatory standards are, as noted above, often much lower than market standards, and could be met with significantly reduced levels of provision. However, because markets are ‘formatted’ in the ways outlined above, with exceedance strategies moving in the opposite direction to what is required for lower energy design, the concessions required are deemed illegitimate and in most cases building designers are not willing to break with market-conforming and reproducing practice. This means that systems such as displacement ventilation are written-off at an early stage. One interviewee complained about how:

their understanding of a new building is ‘everyone’s got their own air conditioning, everyone’s got their own kitchen’... But some of the people’s faces, their jaws were dropping when I was saying that we’re going to have a commitment to not heat or cool the building between 19c and 24c. They were like ‘hang on a minute we’re normally switching the air conditioning on at 21c. You can’t do that!’ (Occupier, case study 4)

It is not only the provision and performance associated with the BCO that has such an effect. ‘Grade A’ standards have similar effects. For instance, one interviewee suggested that ‘even if it was a naturally ventilated building they [developers] would seal up the building and put mechanical cooling and mechanical heating in anyway’ (Engineer, case study 2). We again see in this quotation the tensions between different actors. In this case, the engineer wants to deliver a naturally ventilated solution but recognises that the way market standards are usually responded to by engineers, and how markets are ‘formatted’ by this, makes the preferred solution illegitimate. Underlying this is the way specific technologies and associated aesthetics become taken for granted and locked-in, something exemplified by the insistence on suspended ceilings. These are the taken for granted methods of hiding cooling, heating, ventilating, and lighting systems in a Grade A office. Markets are ‘formatted’ to recognise and place a high value on them. Specifically, the suspended ceiling should be visible (and of a standard ‘quality’) to hide systems of provision. However, for low energy cooling this is often problematic. For instance, mixed use and passive ventilation and cooling often rely on ‘thermal mass’ to regulate the temperature of the building across 24 hours. This involves exposed soffits: essentially the concrete ceiling must be visible and accessible to the circulating air, which requires some lighting and ducting to be exposed and visible. This is incompatible with ‘Grade A’ standards. As an interviewee noted:

It comes down to the image of the building... it’s moving away from the typical corporate... what we call a Grade A specification... So exposed concrete ceilings where you can see all the mechanical and electrical services generally, polished concrete and a different finish in the reception. So it’s all to do with image. (Letting Agent, case study 8)

Another interviewee noted his frustration at how: ‘moving away from fully air conditioned buildings [is possible]... There are lots of clever techniques that can be used which are hardly ever adopted’ (Architect, case study 2). This non-adoption tendency is explained by how actors (letting agents/developers/engineers) insist on/are shackled by accepted ways of following market standards.

In addition, building designers, because of the knowledge diminution effects discussed above, often respond more slowly than they might to the evolution of office work practices. Office work has been characterised over the past 20 years by constant change: the

substitution of desktop PCs with laptops and tablets, formal meeting rooms with informal break-out spaces, 9–5 presence at the desk with flexible working, often at home or on the move. DEGW (no date) suggests that less than 40% of workers' time is spent at their desks; 30–40% of work now being done out of the office, and 30–40% being done in the office but not at the desk. All of these trends reduce requirements in terms of the provision of small power, occupational densities to be accommodated, and in turn cooling requirements (to deal with heat gain). Market standards, because of their 'black-boxing' role, encourage designers to ignore such developments. Instead, offices adhering to market standards but with limited variety in terms of design, performance capabilities and in turn energy consuming systems are encouraged by how standards are used as calculative devices and markets are 'formatted'. This occurs even when market standards themselves change – as the BCO guidance does with each edition. Building designers do adjust their approaches, but in often small and incremental ways. Markets also change slowly as they are only 're-formatted' when a critical mass of designers and buildings adhere to alternative approaches and their value becomes accepted. This creates a significant lag between changes in work practices and office designs, given that not only standards but also their effects on designers' practices and in turn market 'formats' need to change.

As a result, provision and performance embedded in offices may result in energy consumption well above that which could be achieved if spaces were designed in ways more attuned to contemporary work practices. Put simply, alternatives are unknown due to black-boxing effects and/or viewed as sub-standard and illegitimate in the field of commercial office design. Hence, design practices are structured and markets 'formatted' by market standards in ways that inhibit lower energy design.

Conclusions

This paper set out to address two questions: how do market standards affect the practices of building designers and 'format' (Callon, 1998) markets for commercial buildings? What are the implications for low energy building design? In relation to the first question, the analysis demonstrates that in the world of commercial offices, market standards act as a category of standard that straddles well-documented design, performance, terminological and procedural standards (see Timmermans and Epstein, 2010). They integrate elements of each of these into a new assemblage that plays a central role in 'formatting' and the operation of markets. Market standards are, in line with institutional perspectives (Markard and Truffer, 2006; Scott, 2008), also tied to various pillars of institutional fields. They are tied to regulation – being a means to achieve regulatory requirements and benchmarked in relation to these requirements. As such, the state and its legal policing role is not totally absent in market standards. But equally, and arguably more importantly, market standards are tied to normative and cultural pressures. Normative and cultural pressures lead, in particular, to what Thévenot (2009: 795) calls 'the "quietude" of conforming' whereby compliance with market standards is the route of least resistance, a source of legitimacy, and a risk minimisation tactic. These normative and cultural pressures are paramount in the moulding of practices. They direct building designers to deliver designs that comply and even exceed with market standards. This renders market standards an important part of the 'distributed agency' (Callon, 2007) that 'formats' markets, given that as calculative devices they guide the practices of building designers and thus create markets as well as representing norms within them.

In particular, the analysis shows that institutional pressures to adhere to market standards are produced in part by building designers themselves, given that it is the way they use

market standards as a calculative device. This 'formats' markets and then creates normative and cultural logics of 'quality' and legitimacy. The knowledge diminution effects discussed highlight this process. Knowledge of standards replaces knowledge of work practices and ways of tailoring designs to them. What people do in offices, what might be appropriate space, and how this can be provided get at best side-lined and at worst lost as provision and performance defined in relation to market standards become the focus of attention and thus inscribed into markets. The analysis also shows that in turn 'exceedance strategies' are adopted by building designers, this further 'formatting' the market in particular ways; ways that the professionals themselves complain about but are complicit in producing. Building designers are not outside of the market, but are implicated in its constitution in ways that are often difficult to recognise and challenge. Once market standards are created they form a distributed agency, influencing the practices of building designers in ways which 'format' markets according to standards and professionals interpretations of them.

In relation to the second question, the analysis shows that the 'work' of market standards results in convergent and 'standard' building designs in which the role of particular technologies are stabilised, whilst alternative low energy designs and technologies are delegitimised, de-valued and pushed to the periphery of designers' attentions. Market standards hem-in those seeking to incorporate low energy technologies and potentially over time limit awareness of how to design in lower energy, non-market standard compliant ways. In particular, those seeking to develop alternative designs and incorporate low energy technologies face the question 'what does it mean to be nonstandard in a world where standards reign?' (Timmermans and Epstein, 2010: 70). The answer relates to issues of value. Non-standard designs are de-valued financially and in reputational terms because of the way market standards as calculative devices shape building designers' practices, 'format' markets and ultimately assign qualities to office designs. A non-compliant office risks being difficult to trade as a good in property markets, thus generating reduced yield for investors, because it is not assigned qualities that make it easily comparable to other offices. Until markets are '(re)formatted' by an aggregation of design practices that respond to market standards in ways that achieve lower energy design, low energy designs run the risk of being deemed low 'quality, illegitimate, and less valuable. Few building designers are willing to take this risk.

The powerful effects of private regulation through standards on building design and more broadly on the cities we inhabit seem, therefore, to be a crucial area of future research and policy concern. Theoretically, the building design field, as a community of interacting professionals, is shown by this paper to be an important unit of analysis in such work. We extend Weber's (2015) insights into the role of a range of building designers in urban property markets by showing the importance of the way multiple actors in the ecology respond to standards as calculative devices, 'format' markets and generate demand for particular types of building. This de-centres the role of property developers and financiers, highlighting market standards as a particular technology that affects the 'agencement' or distributed agency (Callon, 2007) of a range of actors in the building design ecology. These effects produce the markets that financial capital flows in and through.

We also advance studies of the regulation of building design by highlighting how institutions in fields play a crucial role in governing building design practices and determining the characteristics of urban space. Standards through their normative and cultural-cognitive policing and market 'formatting' lead to buildings conforming with and carrying the status quo. In particular, we show that market standards are a hereto undocumented dimension of the institutional barriers known to affect sustainable building design (Guy, 2006;

Van Bueren and Priemus, 2002). There is, then, a need to focus on field-level processes and their effects on building design more fully to tease out opportunities and constraints when addressing concerns such as low energy and sustainable design. This means research should continue to ‘peer over the shoulders’ (Guy, 2006: 651) of building designers to understand the social fields in which they work, the powerful standards in those fields, and their implications for practices.

Following Ben-Joseph (2005), we therefore argue that policy makers in the widest sense (a range of actors including regulators, government departments, energy and sustainability associations, etc.) should be concerned with non-regulatory private standards specific to any building design field, in terms of identifying the standards that matter, the more or less formally organised groups behind them, and the forms of provision and performance they institutionalise. Furthermore, possibilities for ‘breaking out’ of the constraints imposed by market standards deserve greater consideration. Do some building designers manage to circumvent the constraints imposed by market standards, and how? Can non-standard designs be rendered valuable, financially and in terms of reputation, and if so how? How might the tensions between different building designers documented here, but also the shared recognition of the flaws of market standards, be used to develop new social heuristics (Beamish and Biggart, 2012) or calculative devices (Callon and Muniesa, 2005) which do not have problematic knowledge diminution effects and which create potential for alternative low energy designs that are deemed tradable? Or, put another way, could the documented shared frustrations be a way to resist the undesirable effects of market standards?

In considering such issues, it is important to recognise that the discussion here is constructed through data dealing with commercial offices in the UK, and even more specifically London. This implies some limitations. The applicability of the ideas presented here to other cities in the UK, or outside of similar contexts such as Chicago (Weber, 2015), New York (Willis, 1995) or Sydney (O’Neill and McGuirk, 2003), needs to be considered. There are, nonetheless, suggestions that the discussion does have wider relevance. Interviewees with experience of working outside of London told us that the market standards we have discussed are applied in financial institution-owned offices in other UK cities such as Birmingham, Manchester and Leeds. The applicability to offices that are not speculatively developed also needs to be considered. Again, though, interviewees told us the issues remain relevant. Market standards are also used in the design of privately owned offices, because compliance allows the office to be valued as a business asset that could be sold in commercial property markets if necessary. There are, then, indications that the issues discussed in this paper have wider relevance, although empirical testing would be required to confirm this.

Authors’ note

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Note

1. EPCs are legally required assessments of the energy consumption of a building, assigned an A-G rating (A being the least energy demanding design).

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