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Jack-in-the-black-box: using Foucault to explore the embeddedness and reach of building level assessment method

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Original research article

Jack-in-the-black-box: Using Foucault to explore the embeddedness and reach of building level assessment methods

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ABSTRACT

Environmental policy in Western countries is marked by extensive reliance on voluntary self-regulation, designed to influence market behavior. In many instances, these policy tools fail to deliver on their promise, while nonetheless influencing professional and user behavior. This paper draws on Foucault's theory of governmentality and the Sociology of Standards to explore the effect of voluntary policy tools. Whereas most research focuses on the effect of tools on either intended outcomes or formal policies, this paper considers their effect on the people who directly engage with them. The paper uses the case of the Building Research Establishments Environmental Assessment Method (BREEAM) to consider the embeddedness and reach of policy tools across communities of practice. The contribution of the paper lies in its focus on the way in which organizational features of BREEAM contribute to its effect on the definition of green building and peoples' engagement with them. Theoretically, the focus on organizational aspects of governing techniques draws attention local variations in the power/knowledge effect of techniques, thereby contributing to a relatively neglected aspect of governmentality. The paper concludes with reflection on the relevance of this approach for research into other types of policy tools and technical standards.

1. Introduction

In the past decades, market oriented policy tools have proliferated [1,2]; their use is particularly pronounced in the areas of energy and the environment where the role of transnational organizations and national ambivalence have privileged voluntary measures. Examples include: fiscal incentives, standards, certification programmes, indices, benchmarks and frameworks [3]. For the most part, these "new policy tools" have been studied in the context of research into democratic institutions and environmental governance. As Sovacool suggests, a key focus of this work is on the inputs or organizing principles such as "clarity of roles and objectives, capacity, autonomy, accountability, transparency, predictability, participation and integrity" ([4], p.22). To the extent that policy tools are discussed, it is in the context of a shift from government by a central state to governance by coalitions of state and civil society actors [1,2]. A parallel political science literature considers the role of instruments in policy formulation, focusing in particular on the use of evidence [5–7].

This paper offers a different perspective on the effect of environmental policy. Instead of starting with the policy makers, it begins from the tools. And instead of focusing on policy formulation, it explores implementation as a process. More specifically, the paper asks about the effect of engagement with these new policy tools on problems, people and their everyday activities. The main contribution of the paper involves the introduction of a new research agenda for the study of environment related policy tools, focused on their embeddedness and reach across distinct communities of practice. Variations along these two dimensions help to account for differences in the strength of Foucauldian power/knowledge effects, including the specification of policy problems and the internalization of norms surrounding them. In terms of theory development, its contribution lies in the otherwise neglected attention which it pays to organizational aspects of Foucauldian power/knowledge technologies and their effect. The paper uses the case of the Building Research Establishment's Environmental Assessment Method (BREEAM) to illustrate the proposed research agenda. While single country case studies are often limited in their contribution, they can be very useful in introducing a new approach. They offer opportunities to explore the processes and mechanisms supporting particular outcomes (the 'how' question) in detail, before moving on to comparative research aimed at documenting variations across different settings. The paper focuses on the effect of policy tools, and more specifically certified standards; however the approach can also be applied to the study of technical standards and socio-technical systems more generally, as illustrated in the conclusion.

A variety of case studies on specific tools attest to the difficulty of saying something definitive about effect. A recent book on the effect of

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LEED, a building level assessment method in the US, noted that LEED has significantly affected certain market segments, including downtown office developers in large cities, but failed to transform the commercial property market overall ([8], pp. 81–82). In an overview of energy policy, Lorch [9] draws similar conclusions. When it comes to the pace of uptake, Yudelson also notes a slow down in the growth in green building certification. Research into the effect of Forest Stewardship Council (FSC) certification suggests a parallel trend [10] along with national and local variations in its effect [11]. Forrer and Mo [12] note the success of the FSC label in transforming construction supply chains, but minimal impact on tropical forest conservation. Similarly, studies of cap and trade underline the difficulty of enforcement with implications for evaluating its effect [13].

The challenge in studying the effect of policy tools can partly be attributed to the 'over-determination' of any outcome, such that it is difficult to isolate the effect of a particular tool (overall carbon emissions are never the result of a single policy tool). However it can also be attributed to the lack of a theory or set of concepts directed at systematically exploring variations in the effect of different types of policy tool on different types of actors and objects. This paper offers one way of studying effect by combining Foucault's theory of governmentality with insights from the Sociology of Classification and Standards. The relevance of these approaches lies in their focus on the effect of policy tools on taken for granted ways of thinking and moral judgments. This contrasts with the interest of most studies in the formal characteristics of tools and their outcomes. It involves a shift from the "what" of governance to the "how" ([4], p.22). Whereas most interpretivist studies of policy tools position their work against a rational, mechanistic approach, this paper begins from a strong reading of Foucault and pushes back against it. The theoretical contribution of the paper lies in an exploration of 'weak' forms of governmentality.

Section 2 begins with a brief introduction to Foucault's theory of governmentality and more specifically to the effect of (governmental) techniques. The theory draws attention to the indirect and often invisible effect of such techniques through their role in the constitution of problem areas (and the institutions and practices which constitute them, referred to as territories), subjects and populations. Foucauldian scholars trace these effects to a number of shared characteristics, including: calculation, differentiation and adjudication. From the perspective of market-oriented policy tools, the importance of these characteristics lies in their role in the constitution of market commodities (what things are similar and different and the values at which they can be exchanged) and in the specification of quality. They also impact on individual's sense of responsibility towards those objects.

Following this introduction, the paper moves on to the application of the theory of governmentality to the study of environmental policy. The discussion notes the limitations of a descriptive reading of Foucault's work and proposes a more heuristic use of the theory focused on the exploration of variations. This is followed by the introduction of Social Worlds Theory and its application to the study of classifications and standards. Section 2 concludes with a call for a systematic study of variations in the effect of neo liberal market oriented policy tools, focused on variations in embeddedness and reach.

To illustrate this approach, the paper combines research into the effect of BREEAM on construction professionals with other primary and secondary sources (Section 3). More specifically, the research builds on a foucaldian analysis of the effect of BEAMs on visibilities, knowledge, techniques and professional identities amongst construction professionals [14]. Whereas that earlier study focused exclusively on construction professionals as individuals, this paper extends reflection to the travel of policy tools across different professional communities and its implications for the effect of BEAM's on markets and the built environment. This move relies on secondary literature into BEAMs and informal discussions on blogs and they serve to identify the type of issues which a more extensive research programme might raise.

The interest of Building Environmental Assessment Methods (BEAM)'s lies in their widespread adoption as drivers of sustainable construction. As a method they combine many of the characteristics which Foucault identified as central to governmentality, including a framework, benchmarks, classifications, standards and certification. The inclusion of mandatory energy credits and predominance of energy in the public's understanding of green building makes them relevant for scholars interested in energy policy and the built environment. Individual case studies have illustrated the role of BEAMs in introducing and keeping energy efficiency on the agenda in building projects [15,16]. As such, BEAM's are part of the "the social system surrounding energy technology and hardware" ([4], p.25). The paper uses the empirical case study to discuss the type of effects which a focus on embeddedness and reach reveals (Section 4). It concludes with a reflection on the application of the proposed research agenda to other policy tools and technical standards.

2. The effect of policy tools

2.1. Governmentality

Foucault's work on governmentality is one of the least well developed themes in his corpus. The topic was introduced in a series of public lectures which he delivered at the *College de France* in 1979 and subsequently developed by other scholars [17–19]. Foucault's reflections on the topic have supported a vast empirical literature. For the purposes of this paper, work on governmentality in organizations [20–23] and accounting (e.g. [24–28]) is the most relevant. At the core of the concept is a focus on what Foucault refers to as power/knowledge. The term refers to the way in which knowledge at the level of basic assumptions, assertions and claims, as well as the rationalities through which they are produced and the formal disciplines which inform them, are tied up with the exercise of power. As this suggests, Foucault's focus is not on power in the sense of the imposition of one person's will or interests on others, but rather on indirect power or 'control of control' [29,30].

Much of Foucault's work in this area involves a historical analysis of shifting power/knowledge regimes, characterized by changes in the domains of knowledge, specific (governmental) techniques[1] and associated rationalities [31,32]. A key development is the increasing use of instrumentation, as indirect forms of control replace more traditional forms [33]. Foucault refers to these different historical forms as *dispositifs*, which has been translated as 'network', 'nexus' or 'regimes'. The important point for this discussion is that the exercise of power/knowledge involves the embedding of techniques in a nexus of institutions, formal knowledge domains (disciplines) and practices and that these vary historically [34].

'Governmentality' refers to a particular power/knowledge nexus which has been gaining prominence since the 1980s and is associated with neo-liberalism. The term 'neo-liberalism' generally refers to an explicit political ideology associated with the spread of market principles and the decentering of the state [35–37]. Foucault's work shifts attention from the philosophy to the techniques by which it (re-)shapes everyday life [38].

Governmental techniques share a number of epistemological characteristics. These include: calculation, differentiation and adjudication or the assignment of responsibility. Whereas in earlier power/knowledge regimes these were associated with the exercise of power by specific actors in specific types of institution (e.g. the courts, prison, the military, schools), under neoliberalism they have (also) permeated other aspects of everyday life. Another effect of governmental techniques involves the specification of policy objects or territorialization.

[1] Foucault uses the terms technology and technique interchangeably, although some scholars argue that techniques are more specific and localized [96]. This paper adopts 'technique' to avoid confusion with physical technologies, such as air source heat pumps or batteries.

Whereas political scientists have long talked about the importance of framing, the contribution of governmentality is to underline the way in which techniques, by rendering spaces calculable, also constitute the problems, institutions, practices and subjects which inhabit them [25].

The case of the British secondary examination system serves to illustrate the role of techniques in the exercise of neo-liberal modes of control. It also provides a basis for the analysis of weak governmental techniques later in the paper. In the British secondary school system, final year national exams (A-levels) reduce individuals to a set of numbers (scores). Pupils internalize these numbers as evidence of their intellectual achievement and, potentially, their self-worth. These numbers are then ranked and used to control access to a wide variety of other spaces. Universities use exam scores to decide who to accept; school heads use them to evaluate teachers; parents supposedly use aggregated scores (in the form of league tables) to select schools and the UK government uses them to determine school funding and the national government uses them as grounds for direct state intervention into 'failing' schools. While individuals may and do challenge these assumptions, their resistance is shaped by this nexus.

In this example, techniques (in this instance, exams, classifications and scores) play a central role both in the specification of what counts as educational performance or achievement, who is involved and how. A key mechanism involves the way in which the normative value attached to exam scores is internalized, impacting both on individuals' and others' perception of pupils' "intelligence" and rendering them responsible for their own achievements. As Clegg argues in a study of project management in the construction sector, the "constant injunction to improve may itself be an integral part of the governmental method" ([39], p. 317).

Foucault's concept of governmentality has generated a large and growing empirical literature which is beyond the scope of this paper. In many studies, the focus of the analysis is on the way in which neo-liberal techniques constitute responsible subjects. As Sauder and Espeland explain "disciplinary practice simultaneously create kinds of people, knowledge about those people, and types of interventions appropriate for those people" ([40], p.69). While environmental and energy policy techniques share many features with other neo-liberal techniques, such as a reliance on calculation, differentiation and adjudication, it is difficult to imagine anyone making a similar argument for their impact. This raises the question of why some (neo-liberal) techniques exert more effect on the specification of problems and people than others. Instead of assuming that techniques are constitutive of entire nexuses and subjects, this paper begins with the empirical question of what effect do particular techniques exert and how? As such it joins a small but growing body of scholarship on variations in the local implementation of governing technologies in general and standards in particular [41].

2.2. Foucault and environmentalism

Environmentalism is one of the topics where the neo-liberal preference for voluntary self-regulation is particularly pronounced [42,43,35]. The overlay of transnational, national and local policies, along with private voluntary guidelines and certification schemes all point to a highly directed area of activity. In keeping with the principles of neo-liberalism, a number of these techniques are designed to construct markets, as in the case of carbon trading [44,45] or stream mitigation banking [46]; others, such as timber certification [47,48] are directed at producing exchangeable commodities and influencing consumer choice, while others such as ISO 14001 are designed to specify and support good practice [49–52]. Many of these voluntary mechanisms are associated with some kind of formally specified standard, certification and associated label, be it at the level of the firm, as in the case of ISO14001, or of products, as in the case of FSC timber.

Bebbington et al. [53–56] have used Foucauldian concepts to explore the effect of sustainable accounting in general and environmental assessment more specifically. Their research begins from the premise that the concept of sustainable development is underspecified. In the absence of agreed upon definitions or even commitments, policy makers use accounting techniques to give content to the placeholders which these terms create ([53,54]). These then serve as territories on which governments, industry and civil society actors are directed to act. Building on Foucault, their paper also draws attention to the way in which issues which are amenable to quantification tend to be incorporated, while those which are less easily operationalized often fall by the wayside.

In a parallel development, environmental scholars have also engaged in a Foucauldian analysis of social movement, NGO and government policy initiatives around sustainability [57–59]. Luke [60] has coined the term 'environmentality' to underline the way in which policy tools specify environmental problems, shape programmes to act on them and constitute subjects to deliver them. However, empirical studies of specific environmental techniques have begun to challenge the extent of these effects. For example, a study of the impact of UK energy indicators on policy reporting reported relatively little impact [61].

In a Foucauldian analysis of policy implementation, Rydin examined the local development of community-based sustainability indicators. In the paper she asks about the ability of indicators to objectify sustainability, the scope for altered subjectivities, the positioning of indicators within central – local government relations and the construction and responsibilization of communities. Indicators, she notes, provide information, they use calculation to specify governable objects (representation) and "they make such performance the object of scrutiny and avowedly aim to influence behaviour through 'naming and shaming' (that is, the publication of indicator trends) in order to 'improve' performance" ([62], p. 612). At the same time, they do not fully construct identities. As she explains, for sustainability indicators to function in this way, "institutional actors would then self-govern their behaviour in line with the prioritisation and rationalities inherent in the SI set. It would be assumed appropriate to follow the target set by a SI" ([62], p.619). In her discussion, Rydin questions whether this actually happens.

In a parallel study of community based environmental management programmes in the Ecuadorian Amazon, Cepek [63] pushes back against a descriptive use of governmentality. As he explains: "In the language of text, table, and diagram, individuals' environmental practices become available to the surveillance of both community members and distant officials, including government bureaucrats, Western academics, and NGO agents" ([63], p.502). At the same time, he argues, these mechanisms had relatively little effect on the local Cofán peoples' sense of themselves, their desires, goals or identity. Thus while the local community helped to deliver the programme, local participants retained a critical distance, rejecting the programme's environmental perspective and their ascribed role in it. Observing the failure of techniques to produce the predicted effects, Cepek rejects Foucauldian analysis as irrelevant. An alternative is to reconsider how else it might be used.

2.3. For a hueuristic use of theory

A comparison of how Rydin and Cepek mobilized the theory of governmentality illustrates two distinct approaches to the use of theory in general and governmentality in particular. Cepek takes the theory as a prediction of the effect which a set of techniques would have on the local population. The theory points to the potential of (governmental) techniques to subjectify and responsibilize individuals who engage with them. Based on this, Cepek asks: did the community environmental management programme work (that way)? His main finding is that it did not. Instead, he finds that the inhabitants retained a "critical consciousness". They did not accept the programmes' definition of the environmental problems which they faced or its proposal of how to address them. They did participate in the programme for the social and

economic benefits which it also provided.

In contrast, Rydin adopts a more heuristic use of Foucault's model. Instead of taking it as a predictive model, she uses it as a set of concepts to explore an empirical phenomenon. The concept of governmentality draws attention to the 'how' of local environmental policy. She asks about the effects of a particular technology (local sustainability indicators) on the specification of a policy object (the environment) and on local participants' sense of themselves and their responsibility (subjectification). Discussions around the indicators, she finds, were informed by multiple rationalities, rendering the 'territory' which the indicators specified more of a contested space than a stable policy object. Instead of rejecting governmentality out of hand, Rydin takes Foucault's focus on techniques at the level of everyday mundane activity as an invitation to explore those issues in a particular empirical case.

Nor is this approach at odds with Foucault's own intentions. In contrast to the common presentation of governmentality, Foucault does not treat his approach as a grand narrative or overarching set of explanations; instead he insists on the potential for resistance and multiplicity of rationalities at play in a given situation ([17,64]). Moreover, Foucault himself noted the limited effect of neo-liberal techniques on individual identities ([65], p.261) As Ball explains: "Foucault's point is not that we should take for granted the relations entwining power and knowledge but rather that those relations need to be explored in every case" ([66], p.15).

From the perspective of environmental policy, a governmentality focus on techniques explores the introduction of specific techniques into existing nexuses of institutions and practices. By focusing on problematiztion and responsibilization, rather than the stronger concepts of territorialization and subjectification, the proposed approach leaves open the possibility that their influence may be weaker than the theory predicts. By starting with the formal techniques and their position in a nexus, it draws attention to the way in which organizational features contribute to or detract from their effects. Instead of seeking evidence of a 'strong' form of governmentality, the proposal herein calls for an exploration of the strength or effect of different techniques. The sociology of Classification and Standards is used to develop this call.

2.4. Standards, labels and classifications

The Sociology of Classification and Standards takes as its starting point Foucault's observations concerning the power/knowledge effect of techniques and combines it with Social Worlds Theory, as introduced by the Chicago School of Sociology in the 1930s and developed under the umbrella of Science and Technology Studies (STS) in the 1980s [67]. Calculation and differentiation produce classifications, such as A versus D level pupils or green versus non-green buildings; while adjudication uses these differentiations to coordinate, filter and rank people and things. A "social world" or "community of practice"[2] is a group of people engaged in a shared set of activities with a shared set of understandings. To the extent that a particular activity, such as the production of scientific knowledge or the design and construction of a building, involves multiple social worlds, they are referred to as an arena.

In their various publications, Bowker and Star [68,67,69] highlight the calculative nature of most standards and their normative valence.[3] Classification and standards, they argue, provide an information infrastructure which makes such coordination possible. Membership in a community of practice depends largely on familiarity with a shared set of classifications and standards. In some instances, they also serve as boundary objects which link distinct communities of practice, without requiring consensus over the meaning of particular activities. As they explain:

> Drawing from earlier studies of interdisciplinary scientific cooperation, we define boundary objects as those objects that both inhabit several communities of practice and satisfy the informational requirements of each of them. In working practice, they are objects that are able both to travel across borders and maintain some sort of constant identity. They can be tailored to meet the needs of any one community (they are plastic in this sense or customizable). At the same time, they have common identities across settings. This is achieved by allowing the objects to be weakly structured in common use, imposing stronger structures in the individual-site tailored use. They are thus both ambiguous and constant, they may be abstract or concrete ([68], pp. 15–16).

For the purposes of this discussion, the idea that a standard may serve as a boundary object, linking communities of practice who do not necessarily share the same set of taken for granted classifications, introduces the notion of reach. More specifically it points to the ability of standards, or at least the labels associated with them, to travel across communities of practice.

In sum, the contribution of the Sociology of Classification and Standards to this paper lies in its ecological approach, which draws attention to the form which a particular technique takes within different communities of practice, to the way in which people in different communities of praxis engage with it and to how it travels. Returning to the problem of how to evaluate the effect of environmental policy tools, the proposed research agenda calls for a systematic analysis of the way in which a particular policy tool is both embedded within specific communities of practice and travels across them. The example of the exam systems, suggests that strong techniques are both deeply embedded – dominating the constitution of problems and people and regulating access to resources – and far reaching – linking together multiple communities. The example of environmental policy techniques suggests that the embeddedness and reach of techniques varies across techniques and empirical cases.

The discussion of BREEAM which follows draws on a variety of sources to illustrate this approach and to begin to characterize one type of widely used environmental tool, namely certified multi-criteria assessments. Section 3 begins with a brief overview of the empirical research informing the discussion and an introduction to BREEAM. This is followed by an exploration of the embeddedness of BREEAM in three distinct communities of practice: policy makers (including local authorities and planners), design and construction professionals involved in the production of new buildings and finally market actors. The findings combine insights into the effect of BEAMs with indications of the research agenda which a focus on governmentality suggests. The contribution of the paper to the governmentality literature lies in its focus on the organizational features of techniques and their implications for the delivery of power/knowledge effects, including problematization and responsibilization.

3. Embedding BREEAM in communities of practice

The discussion of BREEAM draws on a variety of different sources, including empirical research carried out by the author into the effect of BREEAM, additional published case studies into the use of BEAM's and sustainability indicators, a report from a workshop on the use of BREEAM with academics and industry professionals in 2013 and comments from blogs and trade journals. The primary research, which has been reported elsewhere, involved 49 interviews across eight commercial building projects. For each case, 5–8 key members of the project team were interviewed including: the architect, project manager, design manager, electrical, mechanical and structural engineers. Interviews were transcribed, anonymized and analyzed using thematic

[2] The authors use the terms social world and community of practice interchangeably. The concept of practice is central to the Chicago School and should not be confused with Social Practice Theory.

[3] The role of calculation in the specification of standards and construction of markets is similarly developed by Callon and his colleagues in their work on qualculation [97,98].

coding based on Foucauldian concepts. The aim of the research was to explore the effect of the assessment process on the design and building process. A second round of analysis was conducted to identify and account for systematic differences across cases [70]. The workshop was video-taped and a full transcript was made of the panel discussion which included four industry speakers. The workshop transcripts were coded by hand. The analysis and arguments presented build on, but go beyond material published previously.

The relatively widespread uptake of BEAMs and their dominant role in the certification of green buildings means that there is a large literature on the topic (for general overviews, see: [71–76]). While most of this work focuses on either recipes for the development of a better tool, comparisons between tools or its technical effects, there are a small but growing number of qualitative studies examining the use of BREEAM in specific local contexts, many of which are cited below.

3.1. BREEAM as a tool

BREEAM was the first building level assessment method to be introduced. It was launched in 1990. Since then many countries have created their own national tools, including LEED in the US, Green Star in Australia, SBAT in South Africa and CASBEE in Japan. A key premise of this paper is that to evaluate the effect of a policy tool, researchers need to engage with the details of how it works in different settings. Like other BEAMs, BREEAM is a multi-criteria building level assessment method. The method itself consists of a number of credits each of which is worth a number of points. To get a BREEAM rating, a building project needs to provide evidence of performance against these different credits. The values are then aggregated according to a number of categories, weighted according to category weightings and added up for a total score. If the application is approved, the building is given a rating of either: Pass, Good, Very Good, Excellent or Outstanding. For example, in BREEAM New Construction, which was issued in 2014, there are nine weighted categories including: management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, pollution and innovation. The scoring system had five ratings: unclassified (< 30%), pass (30%), good (45%), very good (55%), excellent (70%), and outstanding (85%). BREEAM assessment was initially limited to the building design, but since 2011 a post occupancy stage has been added.

To submit an application, the client must hire an accredited independent BREEAM assessor who helps to prepare the application and reports the score to the Building Research Establishment (BRE). The BRE reviews the application and, if it passes, assigns a BREEAM label to the building. The BRE develops and issues the standard, accredits assessors, evaluates applications and awards the label. The BRE consults widely in developing the standard and presents the tools as both scientific/technical based and consensual, although the process by which credits are specified is not fully transparent. The BRE began its life as a government body, but it was successively transformed into a non-profit organization in the course of the 1990s [77].

While BREEAM is not the only label for green building in the UK, it is the dominant one. Until roughly 2008 BREEAM was not very widely used, but since that date the number of applications and certified buildings has increased rapidly. At the time of writing, the BRE website reported 2,252,078 registered buildings and 550,694 certified buildings [78]. At the same time, it remains a relatively small proportion of all new builds. While current figures are not available for the UK, in the US, at the end of 2015, about 0.7% of total nonresidential buildings had been certified ([8], p.43). BREEAM shares many of the core features of standards as defined by Borraz [79]. It is presented as an independent tool, produced through consultation with interested bodies and resting on scientific and technical base. As such, it is a central technique for the specification of green building, but not for buildings more generally.

For the purposes of this discussion, a key feature of this type of assessment methods is the incomparability of BREEAM scores. At any given point in time there are multiple versions of BREEAM under construction and on the property market. This is partly because there are different versions for different types of buildings and partly because the method itself is continually changing. BREEAM purports to offer above compliance recognition. In the UK, the pace of regulatory change has increased significantly over the past decade; this, in turn, has fueled the pace of BREEAM revision. For example, over the past decade both Part L (energy) building regulations and BREEAM standards have been updated approximately every three years.

3.2. What does BREEAM do?

In a relatively recent overview of BEAMs, Kajikawa [76] noted a lack of clarity over the role of BEAMs. From its inception BREEAM was designed to function as an assessment tool and as a market signal. At the time of writing, the official BREEAM website cites a single benefit, namely the reduction of cost and increase in market value. As the site explains:

> BREEAM was created as a cost-effective means of bringing sustainable value to development. It helps investors, developers, design and construction teams and occupiers to use natural resources more efficiently. There may be a capital cost to building to the enhanced standards promoted by BREEAM, but this cost needs to be seen in the context of the overall value of sustainable development. Growing evidence is demonstrating that sustainable developments, like those delivered through BREEAM, offer value in many ways, including: reduced operational costs [80].

A click on the link refers the reader to a more extensive report which lists a number of other benefits [81]. It is, however, significant the first thing which the viewer sees concerns the market value of the method.

In 1998, in the first of a string of influential articles on BEAMs, Cole noted that while BREEAM had been designed as an assessment method, it was increasingly used as a design tool. As he explained:

> …existing assessment methods are used as design tools, even though they were not specifically designed to do so. This, in combination with the fact that most assessment methods are voluntary …, is deeply problematic in that they may potentially institutionalize a limited definition of environmentally responsible building practice at a time when exploration and innovation must be encouraged, i.e. building owners may commit their designer's to achieving a high performance score on a specific assessment method ([82], p.10)

In the same text, Cole listed the functions of BREEAM as including:

- set environmental standards (criteria and target)
- demonstrate achievement of those standards
- document key features of building/data collection for management, financing, etc
- identify priorities so that owners can keep properties current within a changing market place
- communicate environmental qualities of building to prospective tenants (marketing),
- improve public awareness of these issues
- reference point for dev of environmental strategies (operationalize sustainability goals)
- produce body of knowledge and expertise to support assimilation of environmental issues into practice

(author's summary)

Most of these, it should be noted, focus on the insertion of classifications contained in BREEAM into the everyday decision making of a variety of different actors, including policy makers, construction professionals, building managers, investors and owners. Cole's concern for

the limitations which this type of calculative assessment method poses points to his awareness of their power/knowledge effects.

This overview of BREEAM highlights a number of features of BREEAM which are explored below. First, the method offers a way to operationalize (and thereby constitute) 'green buildings'. Secondly, the term 'BREEAM' is variously used to refer to a set of formal criteria, a method (enacted process) and a label. Thirdly, while formally comparable, users familiar with the BREEAM process know that the tools is continually changing, raising questions about the comparability of BREEAM certified building. Finally, BREEAM is increasingly seen to inform decision making in a number of different communities of practice, including policy makers, construction professionals (writ large), investors, real estate professionals and buyers. While a handful of discrete studies explore these different contexts, little to no attention has been paid to the way in which BREEAM travels across them. An overview of research into how BREEAM functions in different communities of practice serves to develop each of these points.

3.3. Policy makers and planners

A number of observers, including academics, professionals and the BRE, have commented on the use of BREEAM by policy makers and by local planning authorities. In the UK all government procurement projects must obtain BREEAM Excellent for new buildings and BREEAM Very Good for refurbishments. Similarly, the National Health Service requires BREEAM Excellent for new buildings. At the municipal level, a report for the BRE found that planning permission was the primary driver in the uptake of BREEAM assessments. As the report notes: more than half of local authorities in England have a BREEAM requirement as part of their local development framework, with the number rising to more than 70% of authorities in major cities such as London ([81], p. iii).

While the importance of government bodies and local planning authorities in the uptake of BEAMs is well documented, their engagement with the method and its power/knowledge effects are less studied. Two articles provide initial insights. These include: Goulden et al's [83] account of the formulation of municipal environmental policy in Israel and Rydin's [62] study of local engagement with statistical indicators mentioned above. Goulden et al's paper focuses on the decision to incorporate an Israeli BEAM into municipal planning requirements. The paper is particularly relevant for its analysis of the meaning of BEAMs for policy professionals. A key finding of the study concerns the tendency of participants to interpret the Israeli BEAM either as a tool for sustainable development or as a measure of energy performance. The observation resonates with a number of comments in the UK professional trade literature where sustainability minded construction professionals bemoan the treatment of BREEAM as an energy indicator. As Mel Starr, a well known blogger in the BREEAM space wrote in 2012: "So where do I disagree with Amanda? She makes the cardinal sin of confusing BREEAM (broad sustainability) with energy and carbon savings. People, would you please STOP DOING THIS. BREEAM has one energy section out of a total of nine" [84]. The point is re-enforced by research documenting the limited effect of BEAM's more generally on the energy efficiency of buildings [85–87].

Both Goulden et al's analysis and Starr's comment suggests that the incorporation of the method into municipal policy does not necessarily point to consensus on the nature of green buildings (problematization). Instead, many policy makers engage with BREEAM as a label, with little to no idea of what's behind it. While this is not unusual – education authorities may very well have little to no understanding of the content of the curriculum or what is needed to achieve passing grade – it does raise questions concerning the power/knowledge effect on the policy community *writ large* and suggest the need for research into the implementation of local planning requirements and role of public sector clients in enforcing BREEAM requirements. The assumption that it is enough to set a target for it to effect change is widespread in both the policy and academic literature. It can be found in the focus of policy reformers on voluntary tools such as Key Performance Indicators, sustainability indicators or BEAMs. It is also evident in Goulden et al's analysis of BREEAM. In their paper, the authors describe policy makers' focus on the label rather than the method, as a form of black boxing in which the content is obscured from view. Far from a limitation of the technique, Goulden et al. present it as a source of influence. As they explain:

> Green building standards, then, tend to operate as 'black boxes' (Latour [99]) – with their internal components taken for granted. They can transition nimbly and legitimately between different contexts as a universally accepted green building definition, to become part of a 'rational' policy narrative despite different rationales or requirements in different situation ([83], p.9).

The argument is seductive and provides academic support for managerialist approaches to green building. But Rydin and Lehtonen's findings concerning the failure of local stakeholders to engage with environmental indicators (see above) challenge the simplistic assumption that policy tools necessarily transform policy objects and responsibilize individuals to deliver them. Governmentality suggests that, for BREEAM to matter, not only does it have to be set as a standard, but that standard needs to be inserted into generally recognized norms of good practice, as well as monitoring activity, incentive schemes and formal sanctions. When it comes to green building, relevant policy actors include building controllers and public sector client representatives, charged with overseeing conformity to contractually agreed targets.

3.4. Design and construction teams

A second community of practice which engages with BREEAM is the design teams and construction professionals who register for BREEAM certification and produce BREEAM certified buildings. In the UK the distinction is relevant since far more buildings are registered than actually go through with the certification process. As a sustainability-minded developer indicated at a workshop of industry and academics in 2014, projects need BREEAM in their business case and they have to register it. "But registration doesn't cost…when they go forward it often falls off the agenda" (workshop transcript). While cost is clearly one reason for not following through to certification, the failure of planning authorities and public clients to monitor or sanction non-compliance with their requirements may be another. In a study of eight BREEAM cases, three out of eight failed to achieve their initially specified score, but in none of the cases was there any penalty [70].

In contrast to the policy community, design and construction professionals are obliged to engage with the content of the method (rather than the label). An exploration of variations in the effect of BREEAM on individual cases revealed significant variation in the design effect (embeddedness) of the tool. The analysis distinguished between cases where BREEAM was fully integrated into design and procurement decisions, cases where it was engaged sporadically and cases where it was treated as a bolt-on or tick box exercise, with minimal effect on design decisions [70]. A governmentality lens draws attention to the consequences of these different modes of engagement for the effect of the method on the definition (problematization) of green building and its normative valence (responsibilization). More specifically the empirical analysis draws attention to the paradoxical relation between the cognitive and normative effects of the method, as currently implemented in the UK.

A comparison of the eight cases suggested that the less involved and committed a project team is to green building or sustainability more generally, the more important BREEAM is in their understanding of the concept. Conversely, the more morally committed a project team is to green building, the less they relied on BREEAM to specify that value. More specifically, those teams which engaged the most fully with each

credit came to the project with a well-developed sense of green building and sustainability. Instead of relying on BREEAM to tell them what a green building looked like, they used it to justify and secure design decisions which might otherwise have been altered in the course of the building process. In their case, BREEAM provided a useful resource to promote their own agenda (along with a variety of other tools), while the ambition to reach the highest rank in the label served to unify and energizing the team. In contrast, in projects where BREEAM figured primarily as an assessment method (with little to no design effect), professionals were much more willing to accept the method as an adequate definition of green building.

This dual effect of highly knowledgeable teams who engage fully with the design function, but carry with them an understanding of green building which extends well beyond the method, and less knowledgeable teams who accept BREEAM as an operationalization of green building, but have other priorities, challenges claims regarding the direct effect of BREEAM on subjects. At the same time, it invites further inquiry into the role of voluntary techniques in the incorporation of policy or market demands into everyday production activity. While BREEAM did not dictate design decisions, its presence as an element in the nexus of institutions, practices and techniques associated with green building, provided a valuable resource to defend that vision from competing problematizations, such as the need to deliver a building on time and to cost.

Another major function of BREEAM for construction professionals is the recognition which participation in a highly ranked BREEAM project promises to bring. Construction firms routinely list BREEAM Excellent and BREEAM Outstanding projects on their firm websites and high ranking BREEAM building projects are often mentioned in the announcement of sustainability prizes. But here too, the standard is not as strong as it might be. While this relative weakness can partly be ascribed to the value of BREEAM in the property market (see below), it can also be related to organizational features of the technique. The main difficulty within the construction professional community of practice concerns the disjuncture between the firm, which seeks recognition, and the standard which applies to a building project which was produced by numerous different firms. This same type of misalignment can be a source of frustration at the project level, where construction professionals feel aggrieved at losing points for aspects of the building over which they have no control [14]. In both cases the focus of the method and label on the building, rather than construction professionals and their work, weakens the effectiveness of the label as a source of firm level recognition and, by extension, as a mechanism of responsibilization.

3.5. Market based communities of practice

A third set of communities are those involved in the property market. This includes public and private sector clients, investors, property developers and buyers. From its inception, BREEAM was designed to function as a classic market signal, with the label serving to differentiate between green buildings and conventional buildings and the different ratings indicating different levels of 'greenness'. In this vision, the uptake of BREEAM would have been driven by consumer demand as clients increasingly opted for certified green buildings over their uncertified, conventional alternatives and as developers adjusted their offerings accordingly. The contribution of a Foucauldian analysis is to draw attention to the moral dimension of consumer demand (the extent to which it also depends on clients valuing green building, independent of any cost benefit analysis) and to the way in which the label defines commodities (distinguishing between green and non-green buildings). The contribution of an organizational focus is to underline the importance of alignments across elements in the nexus for this effect to perform to its theorized potential. As the example of the exam system suggests, the strength of BEAMs in this community of practice depends on the way in which the label links together a variety of different activities together, including, financing, insuring, marketing, sales, building use and renovating, contributing to the construction of green building as a recognizable and valued market commodity.

From the perspective of standards, one striking feature of BREEAM is its relative weakness in differentiating and ranking buildings. While this is partially due to client requirements, it is also effected by organizational features of the technique itself, most notably its continual revisions and consequent failure to offer a basis for comparison and adjudication. On the one hand, the BREEAM Excellent and Outstanding ranks are promoted as a gold standard for the industry and the country. On the other hand, in the UK most public sector clients set BREEAM Excellent as their baseline. As a sustainability-minded developer noted at the BREEAM workshop:

> our decision to engage with BREEAM was voluntary, we didn't wait for people to ask us to do it, and funnily now that they're asking for it, but its slightly confusing, I remember reading that the idea of BREEAM excellent was that it would be equivalent to the top 25% of new buildings and that it would continue to improve and just keep drive it forward and I can't reconcile that with the local authorities saying that every building has to be BREEAM excellent because that's not the top 25%, that's all new building and that needs to be thought (developer, workshop transcript)

Similarly, an architect also present indicated

> I feel now that BREEAM excellent is the lowest common denominator, certainly BREEAM good doesn't exist…I think BREEAM excellent is almost recognized as the lowest common denominator and certainly over the last two years many clients feel that they don't really want to do BREEAM, they ask why not just focus on getting it really air tight or on our energy, I noticed that on 2 or 3 occasions. (architect, workshop transcript)

The problem which both of these quotes signal concerns the failure of BREEAM certification to differentiate between buildings of different ratings, leaving BREEAM as a relatively blunt market signal and undermining the reputational value which is one of the main drivers for construction professionals.

This diluting effect is exacerbated by the multiplicity of different substantive standards associated with the same label. The continual modification of BREEAM schemes in response to user feedback, changing technical and scientific knowledge and changing regulations means that BREEAM buildings cannot be meaningfully compared. As anyone who engages with the standard knows, the requirements for BREEAM 2006 are very different from those of BREEAM 2011 (see [88] for a similar point with regards to LEED). Far from flaws in the implementation of BREEAM, these two features point to tensions between the multiple functions which BREEAM, and other environmental assessment methods, are called upon to perform. On the one hand these effects potentially harm the promise of BREEAM to function as a market signal; on the other hand they are essential for the authority and legitimacy of the method, which rests in part on its scientific authority and in part on responsiveness to different stakeholders.

Turning to the property market, another source of misalignment concerns the speculative nature of property development and dominance of other types of standards, which weaken the power/knowledge effect of BEAM's. A study of the calculation of standards for London based commercial buildings documented the way in which developers adapt BREEAM to align with and support commercial criteria. In a study of ten BREEAM certified commercial buildings in London, Cass showed how the choice of credits within a BREEAM assessment was 'manipulated' to support speculative, rental market considerations. For the purposes of this paper, two points are of particular interest. The first involves the importance of the British Council for Offices (BCO guidance). The BCO is an, informal, but well established standard for Grade A London based commercial building, some of whose criterion are at odds with both energy considerations and particular occupant

needs, which helps to explain the drive for BEAM gaming. The second point concerns the speculative nature of the commercial property market, which breaks the direct link between developers and occupants. Whereas policy makers work with an idealized market model in which future occupants chose green certified buildings out of a newly developed, normative set of criteria for their new premises, actual building is shaped by a speculative business model, in which developers do not exchange directly with future occupants. A similar point, it should be noted, can be made for housing developers, whose business models depend on land speculation rather than the value of the homes they build and who also have little to no direct contact with or accountability to future occupants.

Finally, the empirical question of how property market actors engage with BREEAM can be indirectly captured by considering the literature on financial returns. Here the picture is mixed, with proponents of BREEAM highlighting commercial successes and other observers warning against the promise. In a study of commercial renters' choice of properties, Dixon et al. [89] found that while BREEAM provides a useful market signal for occupiers already committed to sustainability, for other groups, location, cost and availability continue to take precedence. Their finding echoes the point made above, that the less a person cares or knows about green building, the less likely they are to engage or, in this case, to use it as a market signal. In separate studies, both Lützkendorf and Lorenz [90] and Fuerst and McAllister [91] found that BREEAM certification has a very limited effect on property valuation. Similarly, Parker's survey reported that only 12% of respondents thought that the BREEAM rating would help attract higher rental values.

4. Discussion

The discussion above used existing primary and secondary research to reflect on the effect of BREEAM as a technique, viewed through the lens of governmentality. The discussion focused on organizational features of the method. As such it explored a relatively underdeveloped aspect of Foucauldian research into governmentality. The argument developed herein is that the effect of techniques in the constitution of problems and subjectification of actors varies with its embeddedness in a nexus of institutions, practices and other techniques and with its reach across different communities of practice. A comparison with exam scores serves to underline weaknesses in the embeddedness and reach of BREEAM with consequences for its effect on problematization and responsibilization.

In the case of exams, intellectual ability is quantified and used to rank not only pupils, but also teachers, heads and schools. The use of filters, be it an A-level tariff (set of scores needed to get into a particular course at university) or minimum set of marks which a school needs to avoid going into special measures, links scores to resources and opportunities. The internalization of those standards shapes peoples' sense of their own self-worth and spurs them on to achieve. The strength of the exam score rests on the widespread acceptance of those numbers as a meaningful indicator of much valued quality and the alignment of institutions and practices across multiple communities of practice, all around that single number or set of numbers.

In the case of BREEAM all of these links are attenuated (relative to the exam system). The norm of 'green building' is only one of a number of distinct criteria, such as cost, time and other measures of quality which inform planning policy, new buildings and the property market. Nor do BREEAM scores or individual credits dominate everyday activities in any of the communities of practice identified. Initial research suggests that policy makers, construction professionals (with less commitment and knowledge of sustainable construction), clients and property professionals accept BREEAM as a way of differentiating between green and not green buildings. However, they do not engage in a systematic way with BREEAM as either a filter or a ranking mechanism which informs either design or market decisions.

This relatively attenuated engagement can be ascribed to a number of related organizational features of the technique in use. When it comes to construction professionals, two factors would seem to be at play. These include the misalignment between the BREEAM process, which depends on the efforts of individuals, and BREEAM scores which certify and rank buildings, not people. It can also be related to the primacy of other values, such as time, cost and other standards of quality, as in the example of Grade A commercial buildings. Whereas in education, exam awareness infuses the classroom and exam scores are a primary measure of achievement, in the property sector, BREEAM is not the only measure of 'value' or 'quality'.

Within the policy sector, the strength of BREEAM would seem to be weakened by a lack of understanding of what it does or promises to do and by a disjuncture between those involved in policy formulation and those involved in (monitoring) implementation. For the former, BREEAM seems to function primarily as a label, which is used to deliver genuine or symbolic commitment to green building. As in the case of construction professionals, current evidence does not ascribe BREEAM with an active role in creating that commitment. When it comes to local authorities' role as public sector clients, calculable credits would seem to provide a useful management tool with which to oversee the progress of a new building project, although the extent of this effect has yet to be systematically documented.

Finally, in the property market, BREEAM seems to have made little headway as a market signal, except, again, amongst investors and buyers who are already committed to green building and in particular niche sectors, such as high end, urban commercial buildings. While this effect is extremely valuable and important, initial research suggests that people who care deeply about sustainability treat BREEAM as one tool amongst many to defend their vision. A key factor attenuating the effect of BREEAM was found to be the speculative nature of both the commercial and domestic housing markets which interfere with the type of market relations presumed by proponents of voluntary market based policy techniques. Again, an organizational misalignment would seem to weaken the power/knowledge effects of BEAMs. Thus, while BREEAM is clearly a valuable resource, it does not play the constitutive role which theories of governmentality and the example of exams suggest.

A final issue involves the reach of the method. While part of the hold of the exam system lies in the internalization of scores as a measure of achievement (responsibilization), much of its power is (also) due to its gatekeeper role. Through their filter and ranking effects, exam scores mediate the access of pupils to employment and higher education, just as they determine school funding and autonomy. In contrast, while BREEAM figures in policies and marketing campaigns, BREEAM's primary effects on everyday activity are currently confined to a single community of practice, the construction sector. This is partly linked to the focus of the method on buildings, rather than people or firms. When BREEAM does travel, it is a relatively minor player in the panoply of techniques and standards. Thus, while BREEAM has successfully inserted itself into the constitution, monitoring and taken for granted understanding of what counts as a green building, it does not seem to have imposed green building as a value on the institutional nexuses within which the concept is positioned. Stated differently, green building has yet to establish itself as dominant standard in either the policy or property sectors.

5. Conclusion

In closing it is perhaps helpful to return to the starting point and to the performance of voluntary environmental policy tools. The paper began with an observation concerning the disappointment of many over the failure of labels such as ISO 14001, FSC Timber and BREEAM to perform as predicted. This observation can be extended to the relative weakness of management tools such as KPIs and targets in the construction sector, despite thirty years of concerted effort [92]. The

discussion above suggests that one of the reasons for this is that they are not deeply embedded in the communities of practice where they purport to act. Without a privileged place in the definition of what counts and how to do it or in the responsibilization of subjects, they come up against better established problem definitions, institutions, practices and subjects. The paper also suggests that this limited effect can partly be ascribed to organizational features regarding the way in which the technique has been positioned within the relevant nexus of institutions and practices.

Key features which the discussion highlighted include: the alignment of BREEAM with other elements in the nexus, the clarity and stability of the message which BREEAM scores communicate and the misalignment of incentives. All three support practical suggestions. In terms of the nexus, the BRE and other stakeholders are acutely aware of the limits which the lack of greater integration poses, especially when it comes to financial returns to BREEAM certification. Governmentality suggests that this may vary with the more subtle ways in which BREEAM enhances or conflicts with other techniques and standards. A recent paper on the incorporation of Building Integrated Photovoltaics (BIPV) into commercial buildings documented tensions between the demands of work packages, contracts and the technical configuration of the BIPV system [15]. In the case of BREEAM, the misalignment of the contractual division of labour and the requirements for a BREEAM assessment creates a vacuum in which no one owns the assessment process. Similarly, BREEAM does not currently seem to create commitment to green building, although it does offer a very valuable tool for those who already have it. For BREEAM's effect to spread it needs to be supported by other techniques, practices and institutions which lead in the same direction.

In terms of the message, there is a tension between the aspiration of BREEAM to provide a comprehensive and detailed tool which encompasses the range of professionally recognized criteria of green building and the desire to function as a market signal with a clear signal of value. It may be that in trying to do so many things, BREEAM misses out on the opportunity to do one thing well. Discussions with construction professionals point to the desire for a clear and stable market signal, possibly focused exclusively on environmental criteria and physical features, which can be used to compare buildings. While this would have to be kept stable for longer periods of time and coupled with other techniques focused on process issues and social sustainability, if introduced, it would help to address the impossibility of comparing BREEAM certified buildings. Similarly, there may be a place to recognize and certify firm achievement, as well as building characteristics. This, in turn, would have the potential of sharpening the reputational value of certification, thus removing some of the misalignment in incentives.

The paper also suggests new areas of research for the study of multi-criteria evaluation tools, such as Energy Performance Certificates, Environmental Impact Assessments and neighbourhood level assessment methods. At the moment, little is known about the implementation of these techniques and (local variations in) their effect on everyday practice. Nor is much known about how they complement or clash with other techniques, practices and institutions governing their objects. For a start, it would also seem important to explore what happens when engagement with one of these methods conflicts with other demands and how those tensions are managed. Finally, it would be interesting to compare how far they travel and the knock on effects across communities of practice.

This suggestion fits with more general calls for inquiry into the compatibility or tension between sustainability and commercial logics, but it shifts the focus from philosophy to the engagement of people with techniques, standards and classifications. On the one hand, there is an extensive literature on ecological modernization and the (envisioned) seemless fit between sustainability and commercial performance. On the other hand, there are also numerous perceptions of tensions between these two approaches and philosophical arguments suggesting that genuine sustainability requires a revolution [93]. As a first step, it would seem important to know how these tensions are currently being negotiated on the ground.

In terms of method and theory, this paper makes a case for a heuristic use of theory, in which ideal types and analytic concepts are used to explore empirical problems. This is particularly important when it comes to analyses of standards and their effects. Foucault's interest in the indirect effects of techniques draws attention to the effects of standards on the constitution of objects and subjects. The danger, however, is that scholars and policymakers will assume that all classifications and all standards are equally effective. That it suffices to produce a filter or ranking for it to travel and transform the world. This is, in some respects, the academic equivalent of policy makers who assume that their management tools will function exactly the way that they envision. The difficulty with this use of theory is that it obscures not only the way in which different groups of people engage with standards, but also variations in the way in which the same standards function across different settings. The issue is important in many areas, but especially so in environmental policy, where there is a large reliance on voluntary self-regulation supported by a mix of different techniques designed to impose new standards.

The contribution of the paper to governmentality lies in its analysis of the organizational impact of governmental techniques and their implications for better studied aspects, such as problematization and responsibilization. As such, the approach shifts the focus from the nexus which a particular technique (helps to) generate to the one in which it is deployed with the aim of implementing change, be it the greening of buildings or the education of teenagers. This shift draws attention to the role of dominant rationalities and practices on the effect of policy tools as well as to the different, often weaker but not insignificant, effect which they have on them.

Turning to the topic of this journal, namely energy research, this paper introduces yet another area and set of questions for future inquiry. The discussion above focused on market oriented policy tools and more specifically on certified multi-criteria assessment methods. But the proposed approach applies equally to more command and control policy tools such as regulations and to technical standards. Bowker and Star [68] present classifications and standards as the information infrastructure of everyday life and this includes electricity systems and energy systems more generally. As with voluntary policy standards, (socio-)technical standards vary in their embeddedness and reach with consequences for the technical working of the relevant system and its distributional effects.

To give but a couple of examples, G59 is an important technical standard in the UK electricity system which ensures essential safety protection for those working on the upstream power grid. It also makes new equipment connections visible to Distribution Network Operators (DNOs). As such, G59 acts as an important gatekeeper for electricity going into the grid. When respected, its reach extends from DNOs to manufacturers of electric equipment, electricians who need to be trained to apply the standard and to equipment owners. At the moment, there is nothing to stop a poorly qualified electrician from ignoring the standard when connecting a piece of equipment. There are also numerous manufacturers from outside of the UK who are constrained by the need to conform to this standard. Research into ongoing negotiations over G59, what it should look like, how it should be imposed, its relation with other closely related standards, how different communities of practice engage with it and what happens when it is not respected would provide valuable insights into the current management of the network and lessons for how to improve it. It would also provide a basis to evaluate the effects on markets, professional training and the uptake of new energy generating technologies, such as electric vehicles.

Another aspect of policy tools which the proposed approach introduces concerns the far-reaching impact of units of measurement. There is a tendency to accept the units of measurement which policy tools carry as given, but these too have far reaching consequences for

multiple communities of practice. In the case of the introduction of BIPV into commercial buildings mentioned above, a change in the unit of measurement for the energy generation target from energy generation in kilowatt hours (kWh) to square metrage of solar panels had significant consequences for the energy output of the system [15].

Similarly, an important issue in the attempt to operationalize the concept of zero carbon homes as part of the Code for Sustainable Homes (a BEAM for new homes) involved the unit of measurement. Government policy initially set targets in terms of 'improvement as compared to the energy section of the building regulations of 2006 (Part L)'. In an early version of the Code, new buildings were supposed to move from 25% reduction to 44% to zero carbon by 2016. But the measure was confusing and potentially impossible to meet. The industry, in the form of the Zero Carbon Hub, lobbied extensively for an alternative measure, which better suited their members. In 2010 the measure was replaced by a minimum Fabric Energy Efficiency Standard, expressed in Kilowatts hours per meter squared per year ($kWh/m^2/yr$) with different absolute thresholds for different types of buildings (apartment blocks, mid terraced houses and semi-detached) [94]. In this example units were linked to differentiations between types of houses, a logic which built on the existing construction nexus [95]. The shift was an important move on the path to making zero carbon a commercially viable category. The government's abandonment of the policy in Autumn 2015, just a few months before it was about to by fully implemented, removed the target, but the classificatory work which its protracted negotiation involved has significantly changed the way policy makers and the industry envision green buildings.

Moving outside of the built environment to electric vehicles, the current carbon performance standards, gCO_2eq/km (grams of CO_2 equivalent per km driven) only count the fuel that is put into the vehicle. As a result, the carbon emissions from the electricity grid for charging electrical vehicle don't count. Each of these and numerous other examples point to the way in which often taken for granted calculations contained in standards and techniques serve to filter, rank, distinguish and reward particular arrangements over others, with potentially significant implications for the effect of the techniques in which they are embedded.

The aim of this paper was to draw attention to the variety of different effects which techniques-in-practice exercise and to introduce a framework for systematic inquiry. The main argument is a plea for environmental researchers to take implementation seriously. The contributions of governmentality and the sociology of standards lie in the attention which they draw to the power/knowledge effects associated with the specification of the information infrastructure and the set of concepts which they provide to begin to explore it. These include attention to the micro-acts of calculation, differentiation and adjudication, especially as they effect the specification of classifications and standards and a systematic empirical study of the effect of the techniques in which they are incorporated. A systematic study of the embeddedness and reach of different environmental policy tools, it is suggested, would help to account for why so many of the more widely used techniques fail to fully deliver on their promise.

Conflicts of interest

None.

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