Occupant engagement in the office environment: role assumptions about the building manager

Keywords: Building Manager, Occupants, Behavior, Engagement, Energy Efficiency

Abstract:

Purpose

This study puts the building manager (BM) as the professional responsible for implementing occupant engagement initiatives (OEIs) in the work environment, and discusses the challenges they may experience in fulfilling their responsibilities.

Background

The energy-behavior of building occupants is a key factor influencing energy use during the service life of buildings. Occupant Engagement Initiatives (OEI´s) seek to improve the energy performance of buildings by modifying the energy-behavior of occupants. However, the design of these initiatives often fails to recognize the complexity of the role of the professional(s) responsible for adopting or implementing these approaches. In turn, replication of these practices may suffer from lack of adoption, or implementation procedures that are unfitting to the social, cultural and organizational context in which they are to be applied.

Approach

This paper is based on a review of 9 studies (6 academic journals and 3 Conference papers) that discuss the design and implementation of OEI´s in office buildings.

Results

The following categories and sub-categories were identified: mediator (facilitative, stakeholder alignment and persuasive) and educator (context indifferent advice, context dependent advice and expert knowledge). We argue that embodiment of these roles should be supported through the delivery mechanism of the OEI´s, rather than assume them as given traits in organizational environments.

Practical Implications

Proponents of OEI´s should expand their focus from supporting engagement of building occupants, to fostering engagement of building managers and senior executives.

Originality

This study adopts the perspective of the building management profession to expose a gap in the design of energy-related occupant engagement interventions.

1. Introduction

The service life of buildings is the largest source of energy consumption during the lifecycle of a building (Sartori and Hestnes, 2007). At the same time, the energy behavior of building occupants is a key factor leading to inefficient use of operational energy in non-residential buildings (Menezes et al., 2011). A host of research has focused on improving our understanding of the factors influencing the energy-behavior of building occupants (e.g. Gaetaini et al, 2016; Menezes et al., 2014; Wang et al., 2016; Steg and Vlek, 2008; Masoso and Grobler, 2009; Haldi and Robinson, 2008; Dasgputa et al., 2012). The majority of these studies review and evaluate the effects of interventions targeting occupants directly. This means that typically a research team introduces a change. Then the effects of this change on occupant behavior is registered and reported. This approach is adequate in residential settings where occupant behavior includes in most cases the sole responsibility for building operation and maintenance. In non-residential buildings, this responsibility is delegated to or at least shared with professional building managers. In these settings, in limiting the focus on building occupants, proponents of *occupant engagement initiatives* (OEI´s as described by the USGBC) fail to account for the complex interplay of factors which influence the decisions of those responsible for the actual implementation of environmental behavior changes. Through their professional role, building managers particularly on the tactical and operational levels are in continuous contact with both the buildings and their occupants and are able to contribute crucial knowledge to OEIs (Aune et al. 2009). Moreover, professional building managers are able to take part in the implementation of longer lasting interventions than a research team that has to move on to the next experiment. These potentials are acknowledged by proponents of OEIs. However, as we will argue below, a rather simplified –and optimistic- view regarding the agency and capacity of these professionals to embrace and effectively implement these practices is prevalent.

This paper sheds light on some of the assumptions that proponents of occupant engagement initiatives make about the actors who are responsible for the implementation and sustained management of these practices. To this end, we conceptualize the rollout of interventions as led by the in-house building manager (BM) responsible for the operation and maintenance of the premises. The range of responsibilities that building managers are explicitly or implicitly expected to fulfill are identified and categorized. The potential challenges that BMs may face were they to absorb these responsibilities are discussed. The implications and recommendations for the design of interventions for sustainability improvements, particularly in the context of occupant engagement interventions are further debated.

This paper develops in light of the non -technical barriers affecting the uptake of sustainable practices in non-residential buildings. This study is based on a review of 9 academic studies (6 journals and 3 conference papers) that we are able to locate, and which propose and test OEI´s in non-residential buildings.

2. Methodology

This is a conceptual paper which systematically reviews empirical evidence on occupant engagement initiatives in non-residential buildings. The analysis is guided by the following principles: 1) Predefined objectives and eligibility criteria; 2) identification of studies meeting the eligibility criteria; 3) explicitly defined methodology and; 4) systematic presentation of findings. Rather than focusing on the actual effectiveness of the interventions under review, this study centers its attention on the data that describes the set of responsibilities embedded in the planning, design and implementation of these practices.

2.1. Eligibility Criteria

In order for inclusion in the review, the studies must be about interventions aiming to modify and potentially sustain the energy behavior of building occupants in non-residential buildings. Both technology oriented as well as soft management oriented approaches are included. We focus on the office environment due to its recognized large energy saving potential. Only studies published during the last five years (since 2013) were included. The timeframe was chosen to emphasize the current debate regarding the role of building occupants on energy use. Only studies published in English are included. Further criteria include: a) Region: Only studies published in the U.S. and Europe are included. This criterion aims to reduce the pool of literature without affecting the relevance of the study to both local and regional context (i.e. Norway and European Union); b) Publishing channel: only papers from peer-reviewed academic journals and Conference Proceedings were reviewed; c) To ensure relevance of results, only papers linked to the following disciplines were reviewed: engineering, energy, environmental science, psychology, social science, computer science and business management and accounting. Studies within the field of "economics, econometrics and finance" were also reviewed, but no relevant studies were identified.

2.2. Systematic search methodology

Searches were run on the SCOPUS online academic search engine. The search strategy was inspired by the method used by Staddon et al. (2016), and covered four main search areas: energy use, people, behavior & engagement and workplace. Table 1 shows a description of the keywords and actual syntax used in the search.

Main areas of research	**Keywords**
Energy use	"energy conservation" OR "energy reduction" OR "energy management" OR "energy saving" OR sustainability OR "energy efficiency"
People	occupant* OR staff* OR employee* OR "building user*" OR work*
Behavior & engagement	engagement OR behav* OR "behav* change" OR "behav* intervention"
Workplace	workplace* OR commercial OR non-residential OR non-domestic OR office OR organi*ation
Search Syntax	(TITLE-ABS-KEY (("energy conservation" OR "energy reduction" OR "energy management" OR "energy saving" OR sustainability) AND (occupant* OR staff* OR employee* OR "building user*" OR work*)) AND TITLE-ABS-KEY ((engagement OR behav* OR "behav* change" OR "behav* intervention")) AND TITLE-ABS-KEY ((workplace* OR commercial OR non-residential OR non-domestic OR office OR organi*ation))) AND DOCTYPE (ar OR cp) AND PUBYEAR > 2012

Table 1 Search methodology (keywords and syntax)

After applying search-based filters (i.e. keywords, timeframe, publishing channel, territory and subject area), 205 documents were found. Upon revising their title and abstracts, a round total of 10 papers were found to meet further eligibility criteria. Due to access constraints, one of the studies could not be accessed through the researcher´s university network (See Agha-Hossein et al., 2015).The final number of studies reviewed is N=9.

2.3. Data Analysis

The data analysis procedure was as follows: First, a comprehensive read of the literature was carried out. Detailed annotations were made, highlighting statements that identified or suggested responsibilities associated with either the planning, design or implementation of a practice. Of particular interest was to identify the tasks or activities that were carried out by the building managers, or by the research team in charge on behalf of the organization. Further review of annotations helped to categorize responsibilities and define relevant labels. The following categories and sub-categories were identified (See Table 3): Mediator (facilitative, stakeholder alignment and persuasive) and Educator (context indifferent advice, context dependent advice and expert knowledge).

2.4. Limitations of the study

We acknowledge that this paper represents neither a large nor a systematic review of all available evidence. Instead, we claim an exploratory approach aiming to highlight part of a potentially larger construct of roles as suggested by current evidence on OEI. This approach could be improved by using a more comprehensive search methodology; for example, through the use of multiple database search engines or extending the list and combination of keywords.

3. Findings

Table 2 provides a brief description of these studies, indicating: perspective(s) or discipline(s) from which the study is developed, stakeholders targeted by the intervention, summary of approach or conceptual design, sample of the study and evaluation period. The studies are presented from earliest to most recent year of publication. Table 3 provides a summary of the responsibilities that BMs are expected to fulfill for the effective planning, design and delivery of the reviewed interventions.

4. Discussion

Two perspectives from which the complexity of the studies reviewed can be discussed are: One, in relation to the strand(s) of behavioral theory that the studies are based upon (See Table 2). The other, in terms of the range and depth of responsibilities they require for implementation (See Table 3). In this study, our primary focus is on the second form of complexity; however, we also investigate the relation between theoretical perspectives, the techniques used to enforce them, and the responsibility demands they generate. The motivation behind this approach is to describe the expected role of building managers in relation to the types of efforts being implemented.

In this context, we turn our discussion to the set of responsibilities that emerged from the review. In particular, we point to accountabilities that describe the role of the building manager as a mediator and educator. Further, we point to the different variations of these roles as represented in the different studies.

The BM as Mediator

The role of building professionals (e.g. building managers, architects, engineers and designers) as mediators has been thoroughly discussed in literature regarding the social shaping of technology (Rohracher, 2010; Janda and Parag, 2013). Janda and Parag (2013) discuss mediation as a mode of influence by which “middle-actors” can influence change sideways (to other professions or professionals), upstream (to policy makers) and downstream (to clients). Parag and Janda (2014) introduce the concepts of agency and capacity to describe actors´ ability to make their own free choices, and capacity to carry out the choices they make. We adopt a pragmatic view on the role of mediation described as a dynamic and iterative discussion often aiming to settle a conflict or reach an agreement or solution (Janda and Parag, 2013).

Three variations of the role of mediation were identified in the literature. The first can be described as facilitative mediation, where building managers require some degree of technical knowledge to support the objective of a practice. For example, Yearly et al. (2013) argue that by allowing occupants to propose their own energy saving solutions, they are better able to connect their actions with energy reduction outcomes. They propose workshops mediated by building managers to support occupants in identifying energy saving opportunities. A similar form of mediation is suggested by Lockton et al. (2013), where occupants were asked to post notes indicating the relation between their work environment and carbon relevant issues.

In this example, technical steering is arguably required to ensure that occupants carry out the "annotation" process in a manner that is relevant for the practice or intervention. Finally, Bull et al. (2015) also suggest a form of technical mediation through ensuring that the communications shared in the social media channels are kept relevant to the building´s operation. Arguably, the latter requires the least amount of technical expertise amongst all three examples provided; still, familiarity with building operation routines is important to validate the relevance and significance of ongoing communications. Furthermore, the building manager needs to ensure that the suggestions from building occupants are not in conflict with the day-to-day operation of the building.

A second form of mediation was identified in the study by Yearly et al. (2013) in relation to the alignment of stakeholder priorities. Through observation and informal communications, the research team learnt that building occupants had low interest on aspects regarding energy use. Grounded on principal-agent theory, the co-alignment of interests between the building management team and building occupants was sought. This meant designing a communication strategy which emphasized how common goals were being achieved in the interest of both parties. This form of mediation is not addressed in any of the other studies reviewed; however, many of the studies put in evidence the underlying difficulties of goal misalignment. For example, Gulbinas and Taylor (2014) point to "lack of time" and "inability to commit" as some of the main reasons given by occupants for opting out of their proposed intervention. Certainly, these reasons must be understood within the context of the intervention as a scientific study; however, they serve to highlight the potential role that mediation of goals can play in overcoming these barriers.

Finally, a third form of mediation was linked to the responsibility of building managers to persuade occupants to adopt a practice or new working habits. For example, Lockton et al. (2013) asked from office workers to either work from home or from an office space that was specifically designed for use after regular operating hours (e.g. after 5pm). This meant carrying out workshops to better identify the needs of building occupants. Mediation was essential towards informing the design of a working space that motivated individuals to modify their habitual practice. Persuasion is also important to support initial recruitment and ongoing participation in a practice. For example, by sending e-mail reminders (Gulbinas and Taylor, 2014; Murtagh et al., 2013, Mulville et al., 2016), raising awareness via printed cards (Lockton et al., 2013), and communicating specific motivational messages (Nilsson et al., 2015). This said, the responsibility to persuade can also be delegated to technology. For example, Lockton et al. (2013) argue that increased staff motivation can be achieved by adding new types of "apps"; Yearly et al. (2013) and Murtagh et al. (2013) aim to keep occupants motivated through the design of "persuasive" energy feedback mechanisms, and; in the study by Pollard (2016), engagement is driven exclusively by the interaction between the occupants, the gadget (eco-button) and the energy feedback they receive.

Code	Authors	Discipline or Perspective	Aims to engage…	Conceptual Design	Sample	Evaluation Period*
1	Lockton et al. (2013)	Human Computer Interaction Feedback Gaming	office staff	User-centered approach for the development and implementation of a digital platform (i.e. web apps, user dashboards, internal blog and group-level feedback on energy use), that enables and rewards employees for logging sustainability relevant actions. For example, the number of times they choose to either work from home or a new designated work area after regular working hours (See Scrunch app).	Office at the U.K. Department of Energy and Climate. Study target=ca.1000. Agreed to study n=412	12 weeks
2	Yearley et al. (2013)	Psychology Perceived behavioral control	Office staff	Feedback on energy use at the group-level was provided (via star chart visualization on a monitor display). Information was made as granular as practical. "Stars" were awarded according to achieved performance.	Student services building at a university in the U.K. Sample consisted of staffs and students. N=unknown	
3	Murtagh et al. (2013)	Psychology Feedback	office staff	Individual energy use (plug load) at work-desks was collected. Personal feedback on energy use was provided via a computer application. The impact of feedback on energy use at the individual level was assessed.	Research center in medium-size university in the U.K. n=83 (post-graduates, researchers, lecturers, administrative and technical staff)	18 weeks
4	Gulbinas and Taylor (2014)	Psychology Eco-feedback	office staff	A digital platform that provides feedback on energy use at the individual and group-level was implemented. Two groups, each subject to different types of interventions were formed (i.e. one with access only to feedback at the individual level, the other with access to feedback at the group-level.)	6-story multi-tenant, LEED certified, office building in the U.S. n=76 (full-time employees)	9 week
5	Foster et al. (2014)	Human Computer Interaction (HCI) Psychology	office staff & building control personnel	Uses digital applications (widget interfaces) to provide feedback on energy use at the group-level, as well as enable individuals to set goals at the individual level. Individual goals are translated into group-level goals.	Univ. Estates and Facilities (EF) depart. People responsible for overseeing physical environment at the university, including engineers, space development and residential services. n=16	12 weeks

6	Bull et al. (2015)	Psychology Feedback Participatory	office staff & energy service personnel	Uses digital tools (smartphones and social media) to enable the provision of feedback on energy-use at the group level and stimulate collaboration by enabling users to interact/comment on building/energy issues.	City Council in the U.K. Study target= 16 participants. Agreed to study=8 (2 members of energy service team and 6 members with no responsibility for energy)	8 weeks
7	Nilsson et al. (2015)	Psychology Group identity	office staff	An intervention involving goal-setting, feedback at the group-level, information and prompts was implemented. Two groups were formed. One of the groups was subjected to motivational messages aiming to heighten their sense of group identity.	Construction company in Sweden. Three different departments, similar in size (control=25; group1=35; group2=33). n=93	4 weeks
8	Mulville et al. (2016)	Psychology	office staff	Three separate interventions involving basic group-level feedback, detailed group-level comparative feedback and individual and basic group-level feedback were implemented. Three groups were formed, with each group subjected to a different type of intervention. Descriptive normative messages, goal-setting, perceived behavioral control and educational information were tested.	Two separate buildings within same company. Each of the three groups subjected to intervention were positioned on different floors. Initial target= 90 participants. Agreed to study n=39	14.3 weeks
9	Pollard, C. (2016)	Computer science	office staff	Installation of a computer device that that allows users to set their computers on different sleep modes with a single “push of the button”. Feedback on individual energy-use was provided and its impact on energy conservation behavior was tested.	Medium-size university campus in the U.S. n=146.	8 weeks

*Evaluation period does not include baseline setting.

Table 2 Brief description of the 9 studies under review

Code	Authors	Planning	Design	Implementation
1	Lockton et al. (2013)	Make a case for securing senior management approval & funds for implementation. Lead or support initial staff engagement and set the project´s baseline (all studies)	Collaborate (via workshops) with the design team and staff to develop the application	Encourage occupants to use “annotation” cards to indicate the relation between their work environment and carbon relevant issues. Raise awareness (via printed cards) on the ongoing intervention. Facilitate an alternative working space after regular hours (e.g. ensure internet connectivity, printing capability, as well as provide amenities such as free cake and tea to motivate practice engagement).
2	Yearly et al. (2013)			Support users in generating their own ideas about energy saving opportunities relevant to the workplace. Lead/assist efforts to align stakeholder priorities, particularly between occupant needs and energy saving efforts. Send informational e-mails about wide sustainability issues, as well as context-specific energy-saving opportunities.
3	Murtagh et al. (2013)			Assess the technical capabilities of the computers of individual users. Install energy monitoring equipment and enable access to feedback system. Raise awareness on the system´s feedback capabilities via informational e-mails, flyers and promotional items.
4	Gulbinas and Taylor (2014)			Produce list of context-specific energy-saving actions for tenants to select from. Send informational e-mails about energy saving actions and features of the eco-feedback system. Produce and disseminate printed notifications to remind users to access eco-feedback system.
5	Foster et al. (2014)			
6	Bull et al. (2015)		Collaborate (via workshops) with the design team and staff to develop the application	Disseminate "expert"(1) knowledge (via presentations) about energy, people and buildings, as well as social media, to all participants in the intervention. *Disseminate (periodically) information about the building´s energy consumption. Respond to or at least acknowledge feedback provided by other users of the app. Lead/contribute to moderating social media channels to ensure feedback is kept relevant.

7	Nilsson et al. (2015)	Make a case for securing senior management approval & funds for implementation. Lead or support initial staff engagement and set the project´s baseline (all studies)		Produce/disseminate information about energy saving opportunities. Send weekly e-mails with information about changes in consumption of electricity and other. Send motivational messages to support the participant´s engagement (group subject to identity manipulation).
8	Mulville et al. (2016)			Disseminate (via e-mail) information about the building´s energy consumption. Disseminate (via e-mail) information on general energy-saving opportunities. Disseminate (via e-mail) information on the value of energy saving in the workplace. Disseminate (via e-mail) information on context-specific energy saving opportunities
9	Pollard, C. (2016)			

(1)"Expert" presentations were provided by the Research Team to participants.

Table 3. Summary of responsibilities expected to be fulfilled by the BM´s Team in the absence of a dedicated Research Team

The BM as Educator

We refer to education as a component aiming to increase people´s knowledge and understanding about energy issues. We point to instances where the building manager is expected to contribute to the overall learning experience of building occupants about energy in the workplace. Three variations of the educational role were identified in the reviewed literature, namely 1) context indifferent advice; 2) context dependent advice, and; 3) expert knowledge.

Context indifferent guidance: Many respectable academic and industry bodies, as well as government agencies, already provide valuable information about energy saving in the workplace. In this sense, the responsibility of the building manager is arguably limited to the collection, collation and dissemination of available information. For example, Yearly et al. (2013) use e-mails to raise awareness about wide sustainability issues (e.g. "sustainability matters" or "Earth Day"). Similarly, other studies use electronic messaging to convey the importance of saving energy in the workplace, and share information with occupants about energy-saving actions (Mulville et al., 2016; Nilsson et al., 2015; Gulbinas and Taylor, 2014). This form of education is in line with the notion of normative beliefs as described by Ajzen (1975), aiming to establish that the desired behavior is perceived as normal or standard within a social group.

Context dependent guidance: More demanding in terms of responsibilities for building managers is the provision of context-relevant guidance. This requires that building professionals consider the building context and relate their advice to the specific work environment of occupants. This form of education is better associated to control beliefs, aiming to strengthen the link between the actions of occupants and expected energy consumption outcomes. Both Yearly et al. (2013) and Mulville et al. (2016) expressly target control beliefs within their interventions. However, Yearly et al. (2013) introduced workshops mediated by building managers to allow occupants to come up with their own solutions. This meant collaborating with building occupants in defining energy saving options, and then preparing a communication strategy based on a bespoken energy program. On the other hand, Mulville et al. (2016) presented occupants with a list of predetermined energy saving opportunities in the workplace. Thus, the responsibilities of the building manager as an educator are confined to her/his own understanding of energy use in the workplace, as well as detached from the need to coordinate efforts with the building occupants. Gulbinas and Taylor (2014) also suggest using e-mails to inform occupants about context-specific energy saving actions; however, their study does not suggest a link to theories of perceived behavioral control.

Expert knowledge: We refer to scenarios where technical knowledge and expertise of building managers are particularly important to achieving an outcome. Only one instance where this was the case was identified (See Bull et al., 2015). However, rather than being a requirement for the education of building occupants, it was the research team who used their technical expertise to inform the development of the intervention. In this example it becomes difficult to separate this requirement as either associated to the scientific investigation, or to the intervention as a potentially commercial practice. The reason for this is that the study does not specify whether participatory design is a component of the actual engagement process.

The challenge: narrowing the gap between role expectancy and actual practice

In the previous section we discussed the extents to which different practices suggest the need for building managers to embrace responsibilities associated to mediation and education (See Table 3).

In short, mediation was seen to play an important role across three areas: a) enabling occupants to identify context-based energy saving opportunities; 2) supporting alignment between the views of occupants and the building management team, and; 3) persuading occupants to change their work habits and encourage their involvement and ongoing participation in the interventions. Different expectancies of responsibilities were identified between and within these areas. Broadly, mediating responsibilities for the building managers were greater as occupants were more actively involved in the task of informing solutions.

Education-oriented responsibilities were framed around three aspects: a) provision of context indifferent guidance to, for example, raise awareness on the importance of saving energy in the workplace; b) provision of context-dependent advice, focusing on the link between occupant actions and outcome expectancy in the building they occupy, and c) Technical expertise towards informing the design phase of interventions. However, not all practices require building managers to adopt educational responsibilities. Some practices just focused on increasing engagement (Lockton et al., 2013; Murtagh et al., 2013; Pollard, 2016), others on fostering communication (Bull et al., 2016), and some just delegated to technology the responsibility to educate (Foster et al., 2014). Responsibilities associated with education are greater where a link between local context and energy outcomes is desired. These efforts required involvement from either building managers or building occupants in the process of designing the intervention, or mapping potential energy saving solutions.

Role	Variation	Objective
Mediation	Facilitative technical	Enable occupants to identify context-based energy saving opportunities
	Stakeholder alignment	Supporting alignment between the views of occupants and the building management team
	Persuasive	Motivate occupants to change their work habits and encourage their involvement and ongoing participation in the interventions
Education	Context-indifferent advice	Raise awareness on importance of saving energy in the work place, and provide general guidance to promote energy efficient behavior
	Context-dependent advice	Increase perceived behavioral control by linking occupant actions to outcome expectancy in the specific context of the building they occupy
	Expert knowledge	Inform the design phase of interventions

Table 4. Expectations regarding the role of building managers as identified in the literature

Now, we turn our discussion to the constraints that building managers may experience in terms of fulfilling these responsibilities. We guide our discussion along the lines of the structural and behavioral barriers that affect the commercialization, acquisition and use of energy efficient systems. In this way, we are able to discuss constraints resting within and beyond the control of individuals.

The role of building managers is one commonly (and historically) associated to cost-reduction activities and less to issues of strategic enhancement or people and change management (Pitt and Hinks, 2001; Elmualim et al., 2009). Building managers can suffer from role isolation, a position that negates the building manager´s ability to influence or effectively manage change in the organization (Goulden and Spence, 2015). In turn, the building manager can act as a passive bystander retracting to the maintenance tasks she or he is accustomed by professional habit. Organizational complexity, including regulations,

policies, size and fragmentation have the potential to deter (rather than support) the building manager´s ability to act in a proactive manner within organizations.

It is not difficult to argue how such limitations can affect some of the expected responsibilities as identified in the literature; in particular, activities requiring the building manager to engage both downstream (with building occupants) and upstream (with building owners) and lead processes of knowledge production (Lockton et al., 2013), support stakeholder alignment (Yearly et al., 2013; Bull et al., 2015) or secure the necessary buy-in to adopt and implement a practice (Foster et al, 2015).

Further, the lack of knowledge, skills and understanding of sustainability issues within the BM profession has also been stressed (Elmualim et al., 2009; Dubem, 2013). Yearly et al. (2013) point to the lack of knowledge (or understanding) on energy issues as a factor affecting the attitude of the building manager to support implementation of the practice. Yearly et al. (2013) suggest that the perceived skepticism of the BM was rooted in the BM´s own lack of perceived control over the energy performance of the building. The research team tackled this barrier by raising the BM´s awareness regarding the impact of his actions over energy use in the building. As a result, they argue that the BM was more open (or at least, less skeptical) to support the initiatives presented by the project team. In the end, Yearly et al. (2013) offer an example where lack of knowledge is identified and accordingly addressed by a research team during the course of implementation of an intervention. But, how would "lack of knowledge and expertise" affect the decision of the building manager to adopt a practice, provided the absence of the research team? Or how does a technical knowledge gap affect participatory design approaches that demand specialized input from building managers?

In practice, there is a large inconsistency across BM knowledge and skills due to the lack of professionalization across the industry (Elmualim et al., 2009). As pointed by Pitt and Hinks (2001), the role of BMs is not a position generally filled by one assembly of professionals. Building operation positions are often occupied by janitors or professionals from different technical backgrounds such as carpenters and electricians (Aune et al., 2009). Thus, it is important that scientific studies conduct investigations whilst accounting for organizational roles along that reflect the actual knowledge and professional experience they carry.

In regards to environmental attitudes and motivation, many studies have investigated the causes leading building occupants disinterest in energy efficiency in non-domestic buildings. They point to lack of financial interest, shared use over equipment in the workplace, disconnection or detachment from the workplace, or just a lack of control over the energy consuming systems in the building (Bull et al., 2014). However, very few studies have placed interest in understanding environmental attitudes from the demand (or management) side perspective. One of such studies is (Anonymized for review forthcoming). They describe the perceptions of building managers and building owners regarding the impact of building occupants on energy use in the context of energy efficient schools and office buildings. (Anonymized for review forthcoming) argue that the attitudes of building managers towards occupant engagement are closely related to their perception regarding occupant impact on energy use. This means that where building occupants are perceived to have no relevant impact over energy use, building managers are more likely to have passive and potentially adverse attitudes towards engagement. These attitudes may be reinforced by many factors, including professional habits, simplified understanding regarding how energy is used, but most importantly, perceptions of control and authority over energy performance as influenced by the affordances of energy efficient technologies (Anonymized for review forthcoming)

Overall, a strong and complex representation of the attitudes, intentions, habits and practices of building occupants is reflected across the studies under review. If we accept the logic that inscribes depth and complexity within the role of building occupants, it makes sense to acknowledge the factors influencing the decisions of those who take operational and management and decisions. From a demand side perspective, only one of the studies (Yearly et al., 2013) addressed the challenge of securing engagement on behalf of the in-house building management team. One possible reason for this is that in the majority of the studies reviewed, the role of implementation is either substantially or completely absorbed by the "research team" behind the intervention. Lockton et al. (2013), Bull et al. (2015), Foster et al. (2014) and Gulbinas and Taylor (2014) all acknowledge their lack of consideration for organizational roles within their studies. As pointed by Bull et al. (2015), to further consider the impact of individual roles can bring to question "…challenges of control, responsibility and power" in the organizational context.

In turn, this exclusion negates the opportunity to learn about potential factors affecting implementation process outside of an experimental setting. In cases where the "research team" adopts a guiding role, it could be argued that their agency and technical capacity complements and even supersedes the agency and capacity of the in-house building management team. This is, that the freedom and capacity to influence change throughout the duration of the experiment, is arguably possible due to the scientific credentials of the research team responsible for the implementation (or better said, experimentation).

In discussing potential hindrances, we argue not against the prospective of building managers having the agency, capacity and motivation to effectively undertake the roles in question; instead, we argue that due to the existing diversity in BM management experience and personal attitudes, building managers fitting that profile are more likely to be an exception than the rule. This notion is supported by Aune et al. (2009), who analyze and discuss the daily activities of building operators in four non-residential buildings in Norway. In comparing the agency between the building management teams from two of the cases, their paper argues that the size and complexity of one of the organizations resulted in their building management team being forced to react and juggle between their many responsibilities. In turn, their role as change agents was perceived as less prominent than that of the management teams in the smaller and simpler organizational settings.

Furthermore, feedback on energy-use was found to be a central theme across all 9 studies. This approach has long been considered a useful method for promoting energy conservation behavior (Carrico and Riemer, 2001). As pointed by Carrico and Riemer, the success of feedback approaches is tied to the extent to which individuals are able to perceive that their actions lead to an expected outcome. In the studies reviewed, the link between occupant actions and outcome expectancy was reinforced through techniques founded on a wide range of theoretical perspectives. These included theory of interpersonal behavior, social norms, perceived behavioral control and goal setting. However, irrespective of their theoretical foundations, these interventions were mostly aiming at keeping occupants informed about energy-use in the building, and in cases, aware of energy saving practices in the workplace. In turn, from a design perspective, they explore only a fraction of design opportunities to secure engagement and ultimately achieve a desired goal i.e. to modify and sustain healthy energy behavior.

By drawing from the work by Daae and Boks (2014), it is possible to illustrate how the studies reviewed favor design interventions which tend to put control in the hands of the users. For example, by keeping occupants informed about energy saving opportunities, or enabling and guiding them towards making healthy environmental choices (See Figure 1). The observed inclination towards design interventions that put users in control may be explained by the scope of the literature review, which included studies aiming to achieve and/or sustain occupant engagement (See Table 1). As design interventions become deterministic in nature, they take control away from users and put it in the hands of a product. In other

words, these interventions take away from users the freedom of choice of action. Thus, user behavior is no longer determined by the user´s level of engagement, attitude or motivation towards change, but by the control that a given product imposes over the user. Ultimately, the designers´ understanding of users and their context should guide the selection of design principles (Daae and Boks, 2014). As a result, it is paramount that designers of energy saving behavioral interventions in the workplace account for the variability and complexity of the behavior of both occupants and building managers. In this regard, user-centered research has the potential to open up the solution space for designers of sustainable behavior interventions.

		User in control ↓ Product in control	Lockton et al. (2013)	Yearley et al. (2013)	Murtagh et al. (2013)	Gulbinas and Taylor (2014)	Foster et al. (2014)	Bull et al. (2015)	Nilsson et al. (2015)	Mulville et al. (2016)	Pollard C. (2016)
Informing	Information		X	X	X	X	X	X	X	X	X
	Feedback		X	X	X	X	X	X	X	X	X
	Enabling		X	X	X	X	X	X	X	X	
Persuading	Encouraging		X	X	X	X			X	X	
	Guiding		X	X		X				X	
Determining	Steering										
	Forcing										
	Automatic										

Figure 1. Adaptation from Daae and Boks “Distribution of Control”, applied to studies reviewed

5. Conclusions

In this paper we have deliberately placed building managers as the professionals responsible for the implementation of OEIs. We identified some of the responsibilities they are expected to embrace during the design and implementation of occupant engagement initiatives. Further, we discussed some of the challenges that building managers may face as they strive to fulfill these roles. Three key assumptions about the roles of the professionals in charge of implementing OEIs were highlighted: 1) they possess a sufficient degree of agency and capacity within the organization to enable effective implementation. Rather than assuming that these attributes are given (or present), OEIs should propose mechanisms to support (or enable) them; 2) they possess the necessary knowledge, skills and experience to undertake the role as educators. Instead, OEIs should target building managers as key targets within their programs aiming to raise knowledge and awareness on energy issues; 3) they have a positive attitude and willing intention to engage with building occupants on energy issues. OEIs should part from the understanding that the complex mechanism which affects the behavior of building occupants, also affects the decisions of building managers and senior executives.

The studies reviewed focused on feedback as the key mechanism for engagement. In this context, the responsibilities associated to the roles of mediation and education demanded a set of well-developed social and communication skills. People and change management skills have been regarded as essential towards enabling collaboration and supporting fundamental organizational change. Clearly, different OEI suggest different degrees of change, some of which may fall far from being categorized as fundamental. Ultimately, the extent of organizational change that is required will be dictated by the gap between the prevailing and the desired environmental attitudes, intentions, habits and practices of any given individual or organization. It follows that where some degree of organizational change is required, building managers should be sufficiently empowered to influence it. This does not mean having the authority to approve a strategy or corresponding budget to implement an intervention; but at least possess the agency and capacity to sell (to top senior executives) and facilitate organizational transitions on the grounds of valuable strategic organizational development.

More importantly, this study pointed to the lack of attention that more persuasive and even forceful forms of intervention receive. In adopting more balanced approaches between user and product control, designers may find alternate solutions that account for the variability and complexity of both occupant and building manager behavior in the workplace environment.

6. References

Agha-Hossein, M. M., Tetlow, R. M., Hadi, M., El-Jouzi, S., Elmualim, A. A., Ellis, J., & Williams, M. (2015). Providing persuasive feedback through interactive posters to motivate energy-saving behaviours. *Intelligent Buildings International, 7*(1), 16-35. doi: 10.1080/17508975.2014.960357

Aune, M., Berker, T., & Bye, R. (2009). The missing link which was already there: Building Operators and Energy Management in Non-Residential Buildings". *Facilities, 27*(1/2), 44-55. doi: doi:10.1108/02632770910923081

Bull, R., Lemon, M., Everitt, D., & Stuart, G. (2015). Moving beyond feedback: Energy behaviour and local engagement in the United Kingdom. *Energy Research & Social Science, 8*, 32-40. doi: http://dx.doi.org/10.1016/j.erss.2015.04.006

Carrico, A. R., & Riemer, M. (2011). Motivating energy conservation in the workplace: An evaluation of the use of group-level feedback and peer education. *Journal of Environmental Psychology, 31*(1), 1-13. doi: http://dx.doi.org/10.1016/j.jenvp.2010.11.004

Daae, Johannes Ludvig; Boks, Casper. (2014) Dimensions of behaviour change. Journal of Design Research. vol. 12 (3).

Dasgupta, A., Prodromou, A., & Mumovic, D. (2011). Operational versus designed performance of low carbon schools in England: Bridging a credibility gap. *HVAC&R Research, 18*(1-2), 37-50. doi: 10.1080/10789669.2011.614318

Elmualim, A., Shockley, D., Valle, R., Ludlow, G., & Shah, S. (2009). Barriers and commitment of facilities management profession to the sustainability agenda. *Building and Environment, 45*(1), 58-64. doi: http://dx.doi.org/10.1016/j.buildenv.2009.05.002

Foster, D., Linehan, C., & Lawson, S. (2014). *Effects of group performance feedback and goal-setting in an organisational energy intervention*. Paper presented at the Proceedings of the 18th International Academic MindTrek Conference: Media Business, Management, Content & Services, Tampere, Finland. http://delivery.acm.org/10.1145/2680000/2676481/p57-foster.pdf?ip=129.241.229.163&id=2676481&acc=ACTIVE%20SERVICE&key=CDADA77FFDD8BE08%2E5386D6A7D247483C%2E4D4702B0C3E38B35%2E4D4702B0C3E38B35&CFID=718269964&CFTOKEN=37031980&__acm__=1484827100_c8c4ae4299606aefa6b679a1728ccb93

Gaetani, I., Hoes, P. J., & Hensen, J. L. M. (2016). Occupant behavior in building energy simulation: Towards a fit-for-purpose modeling strategy. *Energy and Buildings, 121*, 188-204. doi: 10.1016/j.enbuild.2016.03.038

Goulden, M., & Spence, A. (2015). Caught in the middle: The role of the Facilities Manager in organisational energy use. *Energy Policy, 85*, 280-287. doi: 10.1016/j.enpol.2015.06.014

Gulbinas, R., & Taylor, J. E. (2014). Effects of real-time eco-feedback and organizational network dynamics on energy efficient behavior in commercial buildings. *Energy and Buildings, 84*, 493-500. doi: http://dx.doi.org/10.1016/j.enbuild.2014.08.017

Haldi, F., & Robinson, D. (2008). On the behaviour and adaptation of office occupants. *Building and Environment, 43*(12), 2163-2177. doi: http://dx.doi.org/10.1016/j.buildenv.2008.01.003

Janda, K. B. (2011). Buildings don't use energy: people do. *Architectural Science Review, 54*(1), 15-22. doi: 10.3763/asre.2009.0050

Liu, Y., Veríssimo, D., & Farhidi, F. (2016). Using social norm to promote energy conservation in a public building. *Energy and Buildings, 133*, 32-36. doi: http://dx.doi.org/10.1016/j.enbuild.2016.09.041

Lockton, D., Cain, R., Harrison, D., & Nicholson, L. CarbonCulture at DECC: Digital Engagement for Sustainability at Work.

Masoso, O. T., & Grobler, L. J. (2010). The dark side of occupants' behaviour on building energy use. *Energy and Buildings, 42*(2), 173-177. doi: http://dx.doi.org/10.1016/j.enbuild.2009.08.009

Menezes, A. C., Cripps, A., Bouchlaghem, D., & Buswell, R. (2011). Predicted vs. actual energy performance of non-domestic buildings: Using post-occupancy evaluation data to reduce the performance gap. *Applied Energy, 97*(0), 355-364. doi: http://dx.doi.org/10.1016/j.apenergy.2011.11.075

Menezes, A. C., Cripps, A., Buswell, R. A., Wright, J., & Bouchlaghem, D. (2014). Estimating the energy consumption and power demand of small power equipment in office buildings. *Energy and Buildings, 75*, 199-209. doi: http://dx.doi.org/10.1016/j.enbuild.2014.02.011

Mulville, M., Jones, K., Huebner, G., & Powell-Greig, J. (2016). Energy-saving occupant behaviours in offices: change strategies. *Building Research & Information*, 1-14. doi: 10.1080/09613218.2016.1212299

Murtagh, N., Nati, M., Headley, W. R., Gatersleben, B., Gluhak, A., Imran, M. A., & Uzzell, D. (2013). Individual energy use and feedback in an office setting: A field trial. *Energy Policy, 62*, 717-728. doi: http://dx.doi.org/10.1016/j.enpol.2013.07.090

Nilsson, A., Andersson, K., & Bergstad, C. J. (2015). Energy behaviors at the office: An intervention study on the use of equipment. *Applied Energy, 146*, 434-441. doi: http://dx.doi.org/10.1016/j.apenergy.2015.02.045

Parag, Y., & Janda, K. B. (2014). More than filler: Middle actors and socio-technical change in the energy system from the "middle-out". *Energy Research & Social Science, 3*, 102-112.

Pollard, C. E. (2016). Up close and personal: The value of feedback in implementing an individual energy-saving adaptation. *International Journal of Sustainability in Higher Education, 17*(1), 68-85. doi: doi:10.1108/IJSHE-03-2014-0043

Price, S., Pitt, M., & Tucker, M. (2011). Implications of a sustainability policy for facilities management organisations. *Facilities, 29*(9/10), 391-410. doi: 10.1108/02632771111146314

Rohracher, H. (2003). The Role of Users in the Social Shaping of Environmental Technologies. *Innovation: The European Journal of Social Science Research, 16*(2), 177-192. doi: 10.1080/13511610304516

Sartori, I., & Hestnes, A. G. (2007). Energy use in the life cycle of conventional and low-energy buildings: A review article. *Energy and Buildings, 39*(3), 249-257. doi: 10.1016/j.enbuild.2006.07.001

Staddon, S. C., Cycil, C., Goulden, M., Leygue, C., & Spence, A. (2016). Intervening to change behaviour and save energy in the workplace: A systematic review of available evidence. *Energy Research & Social Science, 17*, 30-51. doi: http://dx.doi.org/10.1016/j.erss.2016.03.027

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309-317. doi: 10.1016/j.jenvp.2008.10.004

Wang, Q., Augenbroe, G., Kim, J. H., & Gu, L. (2016). Meta-modeling of occupancy variables and analysis of their impact on energy outcomes of office buildings. *Applied Energy, 174*, 166-180. doi: 10.1016/j.apenergy.2016.04.062

Yearley, T., Hyde, K., & Box, W. (2013). Reducing building electricity use by increasing occupant perceived control.