

## **The Users Impact on Buildings' Sustainability – A Qualitative Approach**

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### **Abstract**

With the built environment responsible for up to 40% of energy consumption, building sustainability is a topic of considerable discussion and research. Sustainability should also be considered in the context of a building's operational phase. Some claim that the 'in-use' phase is ignored in the larger context of energy consumption. Regarding practical concerns, there have been suggestions that the impact of users should be better accounted for, as energy consumption is essential for facilities managers (FMs) and building owners to consider.

The purpose of this paper is to illustrate the impact of users on the sustainability of workplaces, and to contribute to future research. This paper summarises related literature, as well as including further primary research in the form of interviews with experts. The paper organises the data into topic based sections, as well as summarising the treatment of usage and sustainability by the interviewees.

The data and literature provide an outline of the degree to which there is consideration for how a building's 'in-use' phase impacts on building's sustainability. Indicators of impact were also identified, as well as suggestions offered by the interviewees as to how to manage usage and sustainability.

Interviewees identified the factors of personal control vs FM, technology, and cooperation as key. There was also a commonality of approach with regards to many of the strategies. There was however, a disjuncture between the approaches of personal control vs FM. This came down to concerns over employee cooperation when faced with personal control and downfalls where cooperation is low, and FM infrastructure is poor. The interviewees also differentiated on the degree to which their organisations approached sustainability and usage.

Keywords: sustainable facilities management, green buildings, usage, sustainable buildings, sustainability strategy

## **1 Introduction**

In today's changing and evolving working environment, workplaces face new challenges that demand the attention of the management, the community along with influencing stakeholders. Sustainability is one challenge, and comes from overall political and societal activities, environmental protection and numerous corners of the industry. Green leases, corporate social responsibility (CSR), along with schemes assessing the sustainability of buildings, such as the internationally recognised Building Research Establishment Environmental Assessment Methodology (BREEAM), all have sustainability at the heart of what they demand from buildings. These and other factors, mandate workplaces and other non-residential buildings to rethink how buildings are developed, designed, construct and operated. Whilst contributing mechanisms like lighting, good insulation and low-energy electronics play their part; the impact of user's cannot be ignored. An example of this could be a computer monitor. Assume a user keeps their monitor on 24 hours a day 7 days a week, yet works for 8 hours a day for 5 days of the week. This results in 75% of that monitors energy use occurring when it is not being used (Bray, 2006, p.2). Computer equipment is only second highest in terms of energy consumption to lighting (Picklum et al: 1999. Roth et al: 2002, cited in Bray, 2006, p.6).

Usage also impacts on facilities managers (FM's), whose role is to keep buildings well maintained to a high operational standard, and also to potentially ensure that their role is compatible with sustainability factors influenced by users.

The purpose of this paper is to answer the question:

*How does usage impact on the sustainability of an office building, with a focus on the environmental performance?*

This paper will consider the research question by looking both at literature as well as interviews from expert witnesses procured from previous research done by the author. The paper is structured by looking at core issues that relate to sustainability, usability and FM. The main topics are 1. user intervention and FM, 2. user behaviour and attitudes, and 3. building technology, users and FM. The intention is that through a combination of interview data and literature, a clearer picture can be made of the users' impact and the challenges that exist for FM's, building owners and workplace managers.

For usability, a definition is offered by the International Organisation for Standardisation (ISO), describing usability as the “*extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*” (ISO 9241-11:1998, definition 3.1). Using ISO as a starting point, Hansen *et al* (2011), gave it a more societal bend, saying that “*that usability evaluations should be based on different user’s experiences and assessments of how well buildings perform. In order to assess usability one has to focus on the effect of a building in relation to the core business’s fulfillment of goals as well as the end user’s satisfaction and experience*” (Hansen, Blakstad, & Olsson, 2012, p.179). What is meant by the ‘user’ is that of those involved in using the building. A more literal definition is offered by the European Committee for Standardization, who describe it as being “*first, the client, with whom the service provider has a contract (e.g. building owner) and second, the customer, who acts on a tactical level (organisational unit that specifies and orders the services) and the end-user, who receives the services*” (CEN 2006, cited in Määttänen, 2014, p. 3).

What is meant by ‘sustainability’ is also important. Here, the Brundtland definition will be used stating that it is “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (Brundtland, 1987, p.15). This however, is not tangible enough in the context of workplace sustainability. Surrogate measures found in environmental performance indicators focusing on energy efficiency, are used instead. Roaf (2005) described some relevant indicators, including ‘*how much energy does the property use?*’, ‘*how durable are the buildings functions?*’, ‘*how adaptable are these functions over time?*’ and ‘*how happy are its occupant, and how much happier can they be made?*’ (Roaf, 2005, p.100).

What is meant by sustainable services also needs defining. According to Eva Määttänen (2011), sustainable/green property services are defined as: “*services that reduce negative impacts to the environment and human health while fulfilling the needs of the occupants and maintaining the property’s conditions and characteristics*” (Määttänen, 2014, p.2). This could be demonstrated through energy efficient technologies such as occupancy sensitive lighting, or FM that operates with the intention of improving energy efficiency and environmental performance.

## **2 Research Design**

The much of the data in this paper comes from existing literature from 2000 onwards, with only limited exceptions made for appropriate earlier material published prior to this.

The interview data was taken from one of the author's Master thesis. The thesis was titled "*How Does Usage Affect the Sustainability and Environmental Footprint of an Office Building*" (Collins, 2014). In the thesis however, the topic was approached from a broader perspective with less of an emphasis on FM. The interview subjects were selected from contacts known within the occupational circle of the author. This allowed for the use of both Norwegian and British contacts, which in turn offered a more international perspective on the data collection. Interviewees were selected due to the significant level of attention to workplace sustainability that their positions mandated. Prior to the interviews, interviewees were made aware of the subject matter with an offer to decline involvement should they feel they have inappropriate experience. On this basis, the Welsh Assembly Government declined to be interviewed. The data was collected in the form of qualitative partially structured interviews with expert witnesses from Norway and Britain. The interviews were conducted in February and April 2014. The questions related to how they and their organisations approached usage and sustainability, and how they felt this impacted sustainability of an office building.

The participants interviewed were:

1. The Chief Executive of Sustain Wales,
2. The Director of Sustainability at BREEAM,
3. A scientist at the Norwegian Research Centre for Zero Emission Buildings (ZEB)
4. Leaders from the Norwegian energy body Enova.
5. The Managing Director of Building Use Studies.

### ***Interviewees***

The participants were approached as experts. The following paragraphs are based on information collected by the author (Collins, 2014), with the aim of better illustrating to the reader why these individuals and their organisations warranted recognition as experts.

#### *1 The Chief Executive – Sustain Wales*

Interviewed 26/03/14

He has been the Chief Executive of Sustain Wales since 2012. Throughout his career his interests have remained in the area of sustainable development, including government panels and work with the United Nations. He also has competencies in building design, and was formerly head of

the Royal Institute of Chartered Surveyors (RICS). Sustain Wales was established as a sustainability network as opposed to a funding or assessment body.

## 2 The Director – BREEAM

Interviewed 27/03/14

The interviewee has been the Director of Sustainability at BREEAM since 2008. His career has mostly focused on environmental issues, and has worked for the Environment Agency. He has also been involved in pioneering the ‘BREEAM In-Use’ scheme, designed to assess and improve the environmental status of the operational phase of buildings’. BREEAM is an international organisation that has developed an assessment system for grading the sustainability of buildings (BREEAM, 2014).

## 3 The Researcher – The Centre for Zero Emission Buildings (ZEB)

Interviewed 02/04/14

The interviewee is a Professor at the Department for Interdisciplinary Studies at the Norwegian University of Science and Technology (NTNU), focusing on technology and its implementation in everyday use. He is also a scientist for ZEB, with a focus that includes the usage and operation of buildings. He is currently working on the Methodologies for Improvement of Non-residential Buildings' Daily Energy Efficiency Reliability (MINDER) project, dealing with how buildings are used in their operational phase and buildings' interface with their occupants (Berker *et al*, 2014. Valle *et al*, 2014).

## 4A The Head – Enova

Interviewed 23/04/14

She is the head of Unit Buildings and Heating at Enova, and has worked in the energy business since 2005. Her role is to promote and devise energy efficiency schemes for the building industry, along with renewable heating. Her team are responsible for the follow up and promotion of the buildings that have adopted these initiatives.

## 4B Head of Marketing – Enova

Interviewed 23/04/14

He has been the head of Marketing for the Unit for Non-Residential Buildings at Enova since January 2013. He was formally a lecturer at NTNU, and was originally trained as an architect. He takes a particular interest in sustainability concerning building lifecycles, new construction and building refits.

Enova is dedicated to encouraging better energy consumption, and is owned by the Norwegian Ministry for Petroleum and Energy (Enova, 2013).

## 5 The Manager

Interviewed 07/04/14

The Managing Director has been the head Building Use Studies since 1987, and specialises in office buildings' occupant feedback. He pioneered work on building productivity and building studies in the 1990s, and has co-authoring seminal works in this field. He is the secretary of the Usable Buildings Trust that focuses not just on building productivity, but also sustainability. He stated in the interview that he was representing himself, and not Building Use Studies.

## 3 Discussion

### 3.1 Intervention of Users, and FM

Technology is not as easy to control as often intended, however the unpredictable behaviour of human users is a more difficult factor to make compatible with a sustainable workplace. This topic was touched on in the work done by Leaman and Bordass (1999), who viewed the topic from the perspective of office productivity, a variable difficult to define. When interviewed, the Manager agreed that in this context, productivity and sustainability were interchangeable when looking in the context of usage. According to Leaman and Bordass (1999), buildings that performed best (in the context of productivity) did so when they had efficient and well-resourced FM. What they meant, was that in these buildings problems were resolved promptly, with many resolved before the occupants knew they existed. When issues could not be solved immediately, dialogue was kept with the user informing them of its progress (Leaman & Bordass, 1999, p.11). The Manager said that if good FM can solve building problems, they can also solve energy and performance issues. This covers many areas of building usage, from monitoring and adjusting the workplace temperature, to ensuring the likes of computer monitors are turned off (Interview 05).

The impact of strong FM on the user experience was highlighted by the Researcher in a PhD project he was involved with. The student interviewed a caretaker responsible for a building where users had a degree of environmental control. The caretaker was the head of a larger FM team, where they had technologies that allowed some remote environmental control. He was an electrician by education, but also possessed good people skills. He also accepted that the ‘*intelligent machines*’ could not solve all of the environmental problems, meaning that a degree of interaction with building users was essential. The caretaker knew the buildings sustainable performance expectations, and was concerned to ensure the best user environmental comfort. By combining his technical and people skills, he and his team were able to create a high level of comfort for users’ as well as ensure the building was energy efficient (Interview 03). This also alluded to the MINDER project, where the report stated that “*facility managers should be key members of the design team*” (Berker et al., 2014, p.3).

Removing much of the sustainability burden from the user may pose risks. The researcher claimed that there is the possibility through technology and good FM, that building users could be just “*cogs in a perfect machine*” where the user has little control, but the building has much greater control over its sustainability. The effect of this however could be the potential for lower user satisfaction. This is further complicated by the perceptive nature of satisfaction, something also noted by the Researcher (Interview 03) as well as 15 years earlier (Leaman & Bordass, 1999, p.7).

The opposite, would be providing greater control to users, with systems in place to counteract potential sustainability problems. The Director championed personal control, and gave an example of a BREEAM project (Interview 02). The recently opened Co-operative Group Headquarters in Manchester is a BREEAM ‘Outstanding’ project, achieving a score of 95.16% (“One Angel Square, Co-operative Group HQ, Manchester,” 2013). According to the Director, the Cooperative went down to a massive level of detail in designing their building, even down to staffing. Along with the advanced technical systems, employee enthusiasm and cooperation were essential in ensuring that the building performed sustainably. This included adjusting how staff worked, even looking at their travel plans (Interview 02). To the Co-operative, sustainability involved all of their staff from the board room, down. To quote the Director, “*they want to lead by example and now as a consequence when you talk to the staff and the people who visited the building, it is inspiring, because they truly understand that sustainability isn’t just a ‘nice thing’,*

*it's not just about being green, it's about a business philosophy.*" (Interview 02). It is hoped that the building that with correct education, employee autonomy would be less of a risk the buildings sustainability. This is important, given that there is "*some evidence that giving occupants a more active role and responsibility for changing their behaviour in environmentally sustainable buildings is a necessary condition for success*" (Vischer, 2008, p.106).

Elements of the example above are seen in literature. Rohracher (2001) states that the role of building users is essential for a building's sustainability. Building users need to be educated in how their building is expected to perform, and need to have an understanding of their role, conducting their behaviour in a "*compatible way*" (Rohracher, 2001, p.139). This is especially significant when looking at statistics connected with building usage. In many countries, buildings account for up to 40% of energy consumption ("Sustainable Buildings," 2014), and there are also claims that the 'in-use' phase is often ignored in the larger context of energy consumption, with instead focuses veering more towards combining it with factors such as construction and maintenance (Dutil et al 2011, p.445). User-building engagement has also been given attention in other studies, such as Piccolo *et al* (2014) who suggest the installation of tangible technological devices in buildings to better encourage the user engagement (Piccolo *et al* 2014, p.10).

### **3.2 User Behaviour and Attitudes**

Whilst the Co-operative sets an example as how to encourage better user behaviour, technical elements and FM, disjointed sustainability values can cause problems where education isn't sufficient. The Chief Executive saw this as vital, especially regarding attitudes. He noted an example of a journalist at BBC Radio 4, and how his daughters approached resource use. They did not leave the bathroom taps running after they left, because they knew it was wasteful. Despite this, they regularly left their bedroom lights on and music playing when they were not present (Interview 01). They didn't realise that both were wasteful. This can related to the example from Bray (2006), and how monitors are left on because users may not see this is as wasteful. The Researcher acknowledged this, as even if people exhibit sustainable behaviour in their own homes, they don't always transfer this attitude to their workplaces. We operate buildings in different ways, whether it is a home, hospital, or office, with little scope to create common behavioural currency that will positively impact the sustainability of every building (Interview 03). This, also relates to elements found in behavioural theory such as Reeve's (2009)



claim that motivation itself channels behaviour, and that social and cultural reasons can impact on a person's rationale for their actions (Reeve 2009 cited in Piccolo *et al* 2014, P.7)

The Chief Executive related to how this impacts on FM, and to some extent control. He claimed we rely too much on technology to make our environment comfortable, and less on adapting our practises, saying "*we have forgotten that we all don't have to be wandering around in shorts for 24 hours a day, 365 days a year, that we can respond better by using better clothing, and we don't. Particularly, dare I say, in offices.*" (Interview 01). In essence, a shift in behaviour combined with receptive FM, can result in a positive outcome for workplace sustainability.

### 3.3 Building Technology, Users , and FM

Technology and FM go together in ensuring the optimal operation of a workplace environment. Although certain technical systems such as computer cooling are not impacted by users, other technologies can pose challenges for FMs. The Head agreed, stating that FMs' and assistive technologies were better for sustainability. The example she gave was that of user preferences regarding environmental comfort. In her workplace, she felt that her preference for more warmth could cause 'environmental conflict' with her colleagues. This could cause technologies to be used poorly and inefficiently, and the responsibility for energy efficiency and sustainability would be better placed in the hands of FMs and technology. To quote, "*I favour technology, as then we can be better at looking how much energy these buildings will be using. We need peoples help though, buildings cannot operate by themselves*" (Interview 4A). There has however, to be an understanding that user satisfaction can be negatively impacted if buildings have "*innovative sustainable design features that occupants have either not wanted or not been able to use*" (Vischer, 2008, p.106).

The Head of Marketing had a different view. He gave the example of an Enova project, that of the passive house Sparebanken Headquarters in Trondheim. Despite the technology in a passive house, and the design elements that are aimed at reducing energy consumption in the building, the role of the user was still important. To the Head of Marketing, a passive house will have a greater likelihood of operating correctly if users' operate it in a manner that is compatible with its performance values. The Head of Marketing hoped however that "*the building itself will do most of the work*" (Interview 4B).

The Researcher and his colleagues at MINDER have attempted to improve the user experience and their relationship with designers and FMs. This project aims to try and reduce the reliability gap in non-residential buildings (Berker et al., 2014, P.1). The main concepts associated with this project on an interdisciplinary level are continuous commissioning (CC), energy performance contracting (EPC), building performance evaluation (BPE) and soft landings (SL). EPC is aimed at optimising buildings environmental technologies. This involves a third party energy company monitoring a buildings energy use during a buildings operational phase, resulting in the opportunity for the company to alter and fine tune the buildings energy consuming processes (Berker et al., 2014, p.4). If this provides opportunities for FMs to improve their buildings, SL works similarly for users. SL is when members of the team involved in the design and construction remain at the building for a time after it begins its operational phase. This provides users opportunities to provide feedback on the buildings processes, resulting in feasible building alterations, which can allow FM's to work in a building more likely to operate at its optimum (Berker et al., 2014, pp.3-4) (Valle & Junghans, 2014, p.244).

#### **4 Concluding Remarks**

To conclude, this paper reconfirms the belief that usage has an impact on the sustainability of an office building, and that FM and building design are crucial to ensuring that this challenge can be better met.

Across the spectrum of interviewees, there was general consensus that user impact was significant. There was also consensus that buildings should be more cohesive and considerate in their approach towards the user experience. This was stated more bluntly by the Head of Marketing, who felt that “*sustainability will 'fix' architecture*” (Interview 4B). There was also agreement on the significance of getting environmental conditions correct, although opinions differed on how easy this would be to achieve or who is responsible.

Their main differences were mostly demonstrated by differing approaches to the weighting of responsibility. The Director championed user control, although this could only be successful if users were sufficiently trained. The Chief Executive to some extent shared this view. The Marketing Manager and the Head were clear that technology should take up a bigger role, but this had to be combined with good maintenance and efficiency through FM. The Researcher took a broader

view of whom, and what should take on greater responsibility, but felt FM was key regardless of the level of control.

This paper does not offer concrete answers to the usage and sustainability debate, but illuminates the ongoing difficulties. Whilst many involved in workplace sustainability acknowledge the impact of users, the lack of consensus on an overarching strategy has hindered progress. This of course is not the only reason. Poor national and international regulation is partially to blame, with the Chief Executive feeling "*there is no consistency at a political level*" (Interview 01). There are however ongoing efforts to address this issue, but they often come from the private sector. BREEAM In-Use and MINDER are projects also dealing with many of the concerns discussed in this paper regarding user impact in buildings.

Whilst legislation remains weak, there are ongoing developments that offer potential. Green leases can result in changing the behaviour of building users as per the demands of a building lease, with sustainability at its heart. This, according to the Better Building Partnership (BBP), a collaboration of property owners working together to improve the sustainability of existing building stock, is an increasingly recognised requirement that sustainable building performance is "*not an issue that they can ignore and are recognising that it is now an integral element of business risk management*" (Bugden *et al.* 2013, P.1). Such initiatives provide us with optimism that even if consensus is yet to be found, the issues are not being ignored. There is even the possibility of a paradigm shift of operational culture, with users possibly beginning to think more like FM's and vice versa, providing ground for a more consistent and cross disciplinary relationship when it comes to the sustainability of workplaces.

What the future holds for the role of users in this debate is still uncertain; however the role of in workplace sustainability will continue to be discussed whilst there is little doubt of the impact of their actions in a buildings operation.

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