A Conceptual and Literature Review of the Effectiveness of BREEAM

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A CONCEPTUAL AND LITERATURE REVIEW OF THE EFFECTIVENESS OF BREEAM

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Jack Sewell, the primary researcher, undertook the basis of this review in preparation for his dissertation, whilst reading BSc (Hon) Environmental Science.

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The literature examining BREEAM was explored to extract an overview of the effectiveness of the method in assessing sustainability in built developments. It was found that BREEAM is a respected assessment tool, with much potential to develop into a valuable driver towards sustainable development in the construction industry. Shortfalls were discovered in the way the method has been used, *e.g.* in the industry understanding of sustainable development as a holistic concept; in the focus on short-term financial rewards; in the lack of site-specific consideration of the application of solutions.

KEY WORDS: BREEAM, Sustainable Development, Environmental Assessment, Literature Review

INTRODUCTION

Over the last thirty years, the increasing attention on, and requirements for consideration of the built environment, has resulted in a range of assessment methods. One of the foremost assessment methods used in developments is the Building Research Establishment Environmental Assessment Method (BREEAM).

In order to conduct our own evaluation of the effectiveness of BREAM as a valuable assessment of the sustainability of a built development, we reviewed the existing literature. This paper presents our review of the literature. Our subsequent investigation was designed to fill in blank areas of analysis and user opinion (Sewell and Fraser, 2018a).

This review of literature follows the following structure:

- Definition of sustainability.
- Definition of BREEAM.
- BREEAM as an assessment tool.

LITERATURE REVIEW

Definition of Sustainability

BREEAM is self-styled as the world's first sustainability assessment system (BREEAM, 2017a), however as the term 'sustainability' is so variably defined, its interpretation has a profound impact on the effectiveness of any assessment method.

A major barrier to understanding how sustainable a development can be, or ought to be, is in the different meanings of the word 'development'. To a builder, it can simply be the planning and execution of a building project, for profit. That is the sense in which the word is most used in the construction industry and a sustainable development, in that case, is

one which is commercially viable, at least until the developer has delivered the project. Developers are known to have published priorities which are solely company orientated:

"*profit, cash* [for shareholders] *and financial stability*" (Bender, 2018 n.p.).

However, in the originally intended (WCED, 1987) sense of the term 'sustainable development', the word has a much greater meaning. Development includes a historical context - societal transformations, it has associations with 'progress' and 'modernity'. It has negative consequences in the utilization of more resources and global inequity. Development also includes policy to bring about such changes through governance, public and business actions (Sumner & Tribe, 2008). When this kind of development is working in a positive way towards, husbandry of resources and societal equity, it is called sustainable development.

BREEAM is a mechanism to encourage a wider consideration of the impact of the building development on the greater environment, in the long term.

The concept of sustainability is probably as old as humanity, or at least since the advent of horticulture and animal husbandry. The first laws covering the concept of sustainability are often cited as mediaeval, although the term 'sustainable' is modern and retrospectively applied. In 1355, Charles, King of Bohemia (later Charles IV, Holy Roman Emperor) produced what became known as *Maiastas Carolina*, which included rules on the harvesting of timber from woodland. William the Conqueror's restrictive Forest Laws from the 11th to the 13th Centuries were also designed to conserve the royal hunting resources (Young, 1979). However, although employing elements of sustainability, they were largely about consolidating political power and do not fit well with modern ideals of sustainable development. More recently, the Arts and Crafts movement of the late 19th century, UK, was a warning against the increasing resource consumption of industrialisation, which also commodified societies. It was an attempt to draw respect to artisan skills, cooperation within community and interdependence with the natural resources.

Management to sustain a resource for its own sake (and not primarily the owner's) probably originated as a concept in forestry in the 18th Century (Wiersum, 1995). Since this time, sustainability has adopted different definitions, depending on the profession of the definer (Morelli, 2013). For example, Callicott and Mumford (1997, p32) very authoritatively and convincingly argue for ecological sustainability as a service "*meeting human needs without compromising the health of ecosystems*". Foy (1990, p771) defines an economic aspect of sustainability as a service "*that minimises costs of meeting standards for protecting environmental assets*" and that current economic decisions should avoid passing on, or creating disproportionate costs on the economies of future generations. In terms of society, McKenzie (2004, p12) defines sustainability as "*a process within communities that can achieve that [positive] condition*", where positive conditions are the maintenance of a just and equitable society. In that human communities are dependent on employment, businesses are necessarily involved in the structure and of society, few more explicitly than the construction industry, which designs, costs and provides many of the physical limits of our living spaces.

Questioning sustainability in a broader sense, Kuhlman & Farringdon (2010) dislike the narrowness of narrowly themed definitions, concluding that sustainability can only be achieved if all the dimensions (social, environmental and economic) have been equitably

considered, whilst also accounting for long-term effects and needs. This view is inspired by the oft quoted definition in *Our Common Future* (a.k.a. *the Brundtland Report*), the published output from the World Commission on Environment and Development, held in 1982:

> [Sustainable development is] "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*" (WCED, 1987 n.p.).

This is the opening statement in a much ignored chapter, which does give many examples of how to interpret and act on the sentiment in the statement. But, the rest of the report remaining largely unread, it is difficult to attain such an aspiration without guidance or instruction. There have been many further attempts at subject-specific definitions of sustainability, but they all rely on the inclusion of three themes, all of which are essential to stability, like a three-legged stool (Young, 1997), or three pillars of responsibility, holding up the lintel of sustainability (Figure 1). The three themes of concern are society, environment and economy.

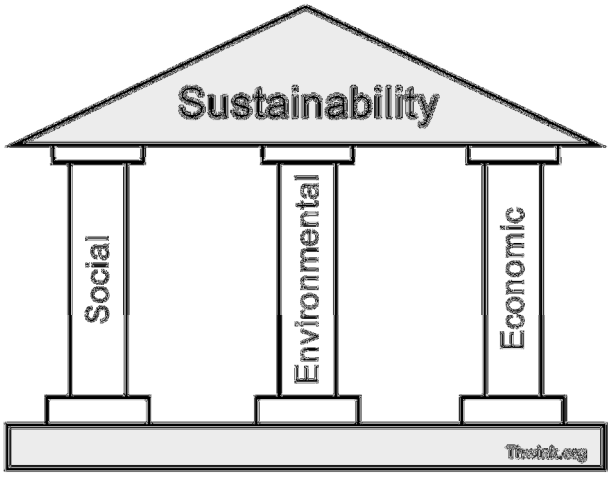

Figure 1: The Pillar Model of Sustainability (Thwink.org, 2014)

Elkington (1997) introduced the principle of the triple bottom line, referring to the economic performance of those three themes, all of which must be effective to reach sustainability. This sentiment has been repeated by Tanguay *et al.* (2009) and Reith & Orova (2015) all of whom conclude that development can only be sustainable if it deals effectively with all three themes. The three pillar model and the triple bottom line concept allow one to regard each theme as independent of each other. In fact, society creates an economy; the economy feeds back on society; society lives within an environment; economy relies on resources derived from the environment. The three themes of environment, society and economy can be presented as three spheres of influence, all overlapping to an extent in a Venn diagram (Figure 2). The degree of overlap represents interdependence of the themes.

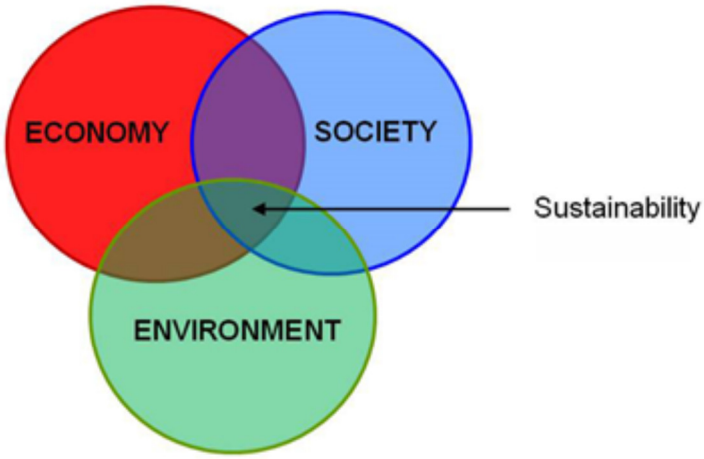

Figure 2: Venn diagram of sustainable development (after Willard, 2010)

As human impacts are now all-pervasive, we must regard the environment as the world. All societies therefore live within the environment. The powerful economies exist within certain societies. This reality suggests a hierarchy of theme spheres, with the economy within the society, which is within the environment (Figure 3). This is known as the Nested Dependencies Model (Willard, 2010) and encourages a more global vision and realistic view of a development's role and impact in the environment.

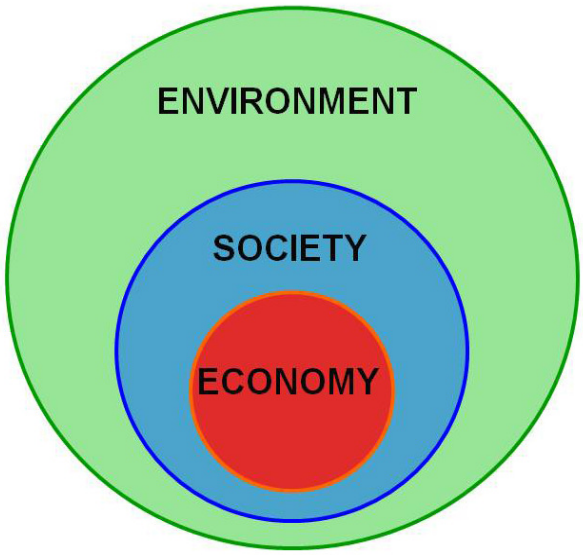

Figure 3: The Nested Dependencies Model of sustainable development
(image: Doppelt, 2012)

Thus to be an effective assessment of the sustainability of a building development, any methodology must consider impacts on these three themes over the life-cycle of the development.

Definition of BREEAM

It is in this definition of development, that BREEAM seeks to act as an aid to project design and evaluation. The models are still more aspirational than helpful; however a great deal of detail is given in the United Nations Organisation's (2017) seventeen Sustainable Development Goals, many of which directly affect construction projects.

The importance of sustainability in the built environment is not a new idea (Wu, 2014), and the concept has progressively pervaded governmental policies since the inception of 'sustainable development' by the WCED (1987). There are several and varying assessment tools designed to address the sustainability of a development, but, available since 1990, BREEAM is regarded as the first tangible environmental assessment method (Turner & Arif, 2012), and the world's leading sustainability assessment method (BREEAM, 2017b).

How an assessment tool is defined tells of what it seeks to achieve. Evaluating the effectiveness of BREEAM presents challenges because it is not definitively defined. This is due to a number of factors: conflicting opinions within the literature; differing statements made by BREEAM across web pages and documents; the evolving nature of the mechanism itself.

BREEAM was the first environmental assessment method for buildings and produced by the Building Research Establishment (BRE) in 1990. The system methodology was developed in collaboration with private developers in the UK (Ding, 2008) as a result of industrial sectors recognising their detrimental impact on the environment (Haapio & Viitaniemi, 2008). Currently, it is the most widely recognised and used assessment method; the numbers of BREEAM certified and BREEAM registered buildings are 560,872 and 2,262,650 respectively (BREEAM, 2017a). This compares impressively with what is, arguably, its closest alternative method - LEED (Leadership in Energy and Environmental Design) (Nguyen & Altan, 2011), which has 89,600 buildings certified, as of January 2017 (USGBC, 2017).

In the academic literature, BREEAM is generally held in high regard, acknowledging its suitability for assessing environmental criteria (*e.g.* Cole, 1998; Todd *et al.*, 2001; Ding, 2008; Turner & Arif, 2012). Nine years after its inception, it was lauded as the first real attempt to "*establish comprehensive means of simultaneously assessing a broad range of environmental considerations in buildings*" (Crawley & Aho, 2010).

The inherent flexibility in BREEAM is intended to allow for more suited application in a range of types of sites as well as for the evolution and betterment of the method (BREEAM, 2017b). BREEAM (2017a) began with the claim that the method was "*the world's leading sustainability assessment method*", but also "*the world's foremost environmental assessment method and rating system*" (BREEAM, 2017c). The difference might show evolution or it might evidence an identity crisis and lack of clarity over whether it assesses sustainability or aspects of the environment. That said, BREEAM (2011) did outline how they set standards for best practice in sustainable building design, but state that the assessment method is recognised as a measure of environmental performance and not sustainable performance.

BREEAM as an Assessment Tool

A large proportion of literature concerned with defining and assessing sustainability, agrees that BREEAM is an assessment of sustainability (*e.g.* Zanni, Soetanto & Ruiker, 2014; Andrade, Bragança & Camões, 2016). Four studies assume the sustainability impact, but focus on comparing multiple assessment methods for their framework and criteria weightings. They do not explicitly address it validity as a measure of sustainability

(Schwartz & Raslan, 2013; Seinre, Kurnitski & Voll, 2014a; Seinre, Kurnitski & Voll, 2014b; Ferreira, Pinhero & Brito, 2014).

There are many studies which add to a conflicting perception of how to define BREEAM by referring to it solely as an environmental assessment method. Nguyen and Altan (2011) compare multiple assessment methods, but have no clear focus. Widely cited work by Ding (2008) and the earlier work by Forsberg and Malmborg (2004) examined the role of assessment methods when measuring sustainable construction and what is required within an assessment to measure sustainability. Interestingly, all the studies that define BREEAM as a sustainability assessment tool are more recent, the earliest being Chandratilake and Dias (2012).

A degree of confusion is understandable when details of the method itself are reviewed (*e.g.* Schweber & Haroglu, 2014). The method in the UK assesses developments against nine separate categories, with unequal weightings (Figure 4).

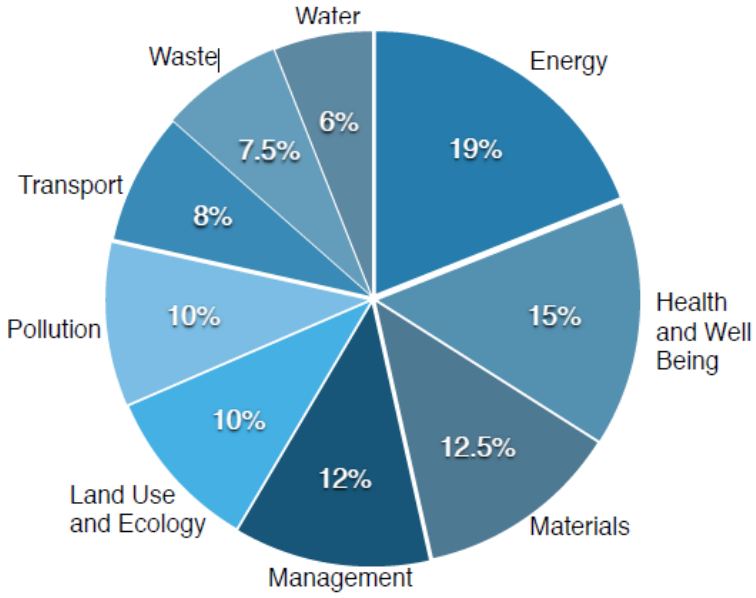

Figure 4: Total percentage weightings of coarse categories in BREEAM (2016)

The weightings suggest that energy will be the most important of all criteria in every case, when in reality geographical variations can favour very different best solutions (Aspinall *et al*., 2012). Whilst the sheer number of environmental categories skews the assessment in favour of this theme, it does render BREEAM the most effective assessment tool for measuring the environmental performance of a building (Alyami & Rezgui, 2012; Reith & Orova, 2015). Despite this potential shortcoming in wider sustainability assessment, there are reviewers who acknowledge the large emphasis that BREEAM places on setting standards for best practice in sustainable building design, construction and operation (Schweber, 2013; Schweber & Haroglu, 2014; Nesteby *et al*., 2016).

Some authors argue against the popular opinion by challenging the ability of BREEAM to assess aspects of the environmental theme. Observations of the assessment, and of professional perceptions, have led to conclusions that BREEAM could be carried out without much involvement of the ultimate users of the development (Turner & Arif, 2012; Alwaer, Sibley & Lewis, 2007). Say and Wood (2008) identified that some of the environmental credits do not inherently possess the potential to provide life-cycle payback

of costs to the owner. This subsequently leads to the favouring of monetary beneficial credits over site-specifically suitable environmental credits. More recently, it has been determined that the data collection process of BREEAM is one of the worst of the top five building assessment methods (Nguyen & Altan, 2011). This can also lead to the favouring of economically beneficial credits. For example, the information required to achieve the materials credits is lengthy and time-consuming (especially if the design team are inefficient), for not a high percentage of credits. The equivalent number of credits could be 'traded' for the production of a specialised report, for additional fees. Having said that, the ever evolving nature of BREEAM, resulting from frequent review, provides an opportunity to remove such inconsistencies and loop-holes (Aspinall *et al*., 2012). A consequence of evolution has resulted in BREEAM being promoted as a design tool, which could promote sustainable design and construction. The success of this new role is greatly affected by the extent of sustainable development-mind-set in the design team involved in the project (Schweber & Haroglu, 2014). This work does show that BREEAM has potential to promote standards for best practice in design for sustainable development, despite its shortfalls which lead sustainable development experts to be less accepting of BREEAM's ability to achieve genuine sustainability (Schweber, 2013). Some criticism is levelled at BRE in its provision of quality assurance (Aspinall *et al*., 2012).

The adaptability of the method, its emphasis on energy credits and its market driven character, however, is also seen as an advantage in driving a response to the significant global energy footprint (40%) of the built environment; and is more successful in this respect than is LEED (Schwartz & Raslan, 2013). The energy credit determination in BREEAM is derived from environmentally relevant considerations (energy consumption, delivered energy and carbon dioxide emissions) compared with simply the cost saving calculations of LEED. Lee and Burnett (2008) determined that no matter what the percentage level of credits was, the reduction in energy usage was always greater in BREEAM assessed buildings, compared to LEED and HK-BEAM. Other early evaluations of BREEAM also conclude that the success of other methods measuring environmental aspects of developments have been dwarfed by the success of BREEAM (Cole, 2005; Haapio & Viitaniemi, 2008).

CONCLUSION

BREEAM is widely regarded as a very useful tool for assessing the environmental performance of a development, but does not address the wider issues of sustainable development, such a geographical site suitability of solutions and long term environmental footprint. It is therefore not a proficient measure of sustainability within the generally accepted definition of sustainable development. The main concerns from the literature are:

Positive

- BREEAM effectively addresses the environmental performance of a building.
- Early involvement of an assessor in the project design is beneficial to the assessment.

Negative

- BREEAM is seen to involve much less client participation than other assessment methods.

- There is a lack of incorporation of social and economic dimensions of sustainable development.
- BREEAM does not allow for adequate consideration of the variation in needs or opportunities indifferent geographical locations.
- BREEAM can be regarded as a box-ticking exercise more to satisfy financial considerations than to find the most suitable solution for sustainability.
- The ability of the BRE to provide effective quality assurance.

The flexible nature of the assessment tool and the intention of BRE to update and progress the methodology presents a good chance of BREEAM maturing and achieving its goal. To this end, the building users, designers and developers must have a common understanding of the real definition of sustainable development.

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