

Sustainable education building construction: lessons learnt in UK

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1) Sustainable development

Sustainable development (SD) has been emphasized in some novels including *The limits of Growth* and *Silent Spring*, and some governmental reports including Our Common Future (Brundtland, 1987) in which it is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Despite of its importance, SD hadn’t received enough supports for at least two awareness errors taken for granted in early years: 1) the human and the natural system act independently; 2) environmental responses to human behaviors are linear and predictable (Folke et al., 2002).

In recent years, sustainable development has been accepted as a must. For example, more than 95% major companies in Europe and the USA accept its importance and many are members of the World Business Council for Sustainable Development (Giddings et al., 2002). However, its abstract definition as showed in Brundtland’s definition hinders meaningful practices. To enhance sustainable development, Folke suggested that understandings of the environment should be changed from the static equilibrium view to a dynamic one and more management controls should be conducted (Folke et al., 2002). In addition to the fact that building sector alone accounts for 40% of energy use in the world, related construction activities affect the environment negatively and widely, including dust and waste generation, land occupation, pollution and noise (Zhao et al., 2012). Because of such large environmental impacts of construction industry (Hill and Bowen, 1997; Ofori, 2000), increased awareness of sustainable building construction is thought to be key to environmental impacts and find best practices (Pitt et al., 2009).




As a student interested in education and social responsibility, I am interested to focus on sustainable education buildings. Since I have been working on construction cost modeling, I am also interested to do some analyses to know “whether sustainability cost more”. Although I had been thinking about this issue for a long time, the SRA award gave me the opportunity to go to the UK to observe and discuss experts there. Therefore, I would like to thank the Tokyo Foundation for supporting my visiting research plan with the amazing Sylff SRA program. I would also like to thank Prof. Martin Skitmore and Dr. Bo Xia as my supervisors in QUT, Prof. Jack Goulding and Prof. Akintola Akintoye as my directors in University of Central Lancashire (UCLan). Without their recommendations and supports, I cannot make it.

2) Sustainable education buildings in UK

In construction, three basic targets are cost, quality and time. As the emphasis of sustainable development, more issues including resources, emissions, biodiversity, social equity, economic constraints and environmental quality should be taken into account (Bourdeau, 1999). Educational institutions have been widely accepted as pioneers in providing sustainable buildings, since these buildings can teach students vividly the necessity and beauty of sustainability. Eco-Schools is just a program for designing sustainable in schools by encouraging youths to take participation and it was firstly used in some European countries like Denmark and now a worldwide program applied in more than 40 countries (Kayihan and Tönük, 2013).

In UK, a more commonly used certification system is BREEAM (Building Research Establishment Environmental Assessment Methodology), started in use since 1990 and now with more than a million buildings registered around the world. The UK department of education (also known as department for Children, Schools and Families) requires funded new built or refurbished primary/secondary schools to achieve BREEAM “very good” as the minimum requirement. Similarly, higher education in England use BREEAM to assess building performance and use universities’ carbon reduction performance as funding requirement 2010 report.

Table 1. Some BREEAM certified buildings in UK universities

BREEAM excellent @ UCLan	BREEAM very good @ Reading University	BREEAM Excellent @ Loughborough University
		

3) Lessons learnt in UK

How much more do BREEAM increase capital cost?

Budget has been mentioned most frequently when I discuss with some project manager what should be considered when deciding which BREEAM related issues. Many academic articles also support that increased cost is the biggest barrier for sustainable construction (Häkkinen and Belloni, 2011). Some industry reports (e.g. BRE and Cyril, 2005) do limited simulations of selected cases without considering a bigger sample. In my perspective, I would like to take the effect of project size into consideration. Unit extra capital cost of large projects, should be much less than that of smaller projects. Therefore, increased cost of large projects should be easier to be compensated by reducing operation fees and charging higher rents for commercial projects. This probably can explain many large sized school buildings tend to get BREEAM but not smaller ones. However, further empirical evidences are necessary to validate this assumption.

Worth to change awareness of decision makers

It is seems that much more arguments and claims between clients and contractors happened in current construction projects. In addition to more complex construction technologies and changing environment, deficient and untimely transformation from clients' needs to project requirements can be attributed to this problem greatly in many situations. Since clients are normally not professional in construction, their minds may clarify their scope largely after knowing some new concepts in construction progress. Green buildings are just one popular concept especially popular in designing and constructing institutional and education buildings.

Although sustainable development is an option hard to refuse at the first glance, improved cost related to sustainability in buildings hinders its wider applications. Without extra costs allocated by clients for such requirements, contractors may bid a low price that they cannot afford to finish the actual buildings in the clients' imagination. In addition, sustainable buildings do not necessarily result in higher cost, if we consider reduced operation cost, improved health wellbeing.

Sustainability certified but not energy-efficient?

As discussed above, it is key to compensate the increased capital cost by reduced costs in operations including reduced consumption of gas and electricity. A sad fact known by discussing with some experts is that BREEAM "very good" buildings do not necessarily result in an energy-efficient level it should be with such costs. This may be because BREEAM consider many other aspects like transportation as well. Therefore, some strategies may be applied to achieve the targeted BREEAM level with minimum inputs. This problem should be noticed for further studies.

Table 2 Group meeting photo in UCLan



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Research highlights

How are principles of sustainable development applied in building construction in educational institutions? What are motives, barriers and challenges when developing sustainable education buildings? To acquire knowledge on these aspects, Bo Xiong, a Sylff fellow from Chongqing University and an ongoing PhD student in Queensland University of Technology has been worked on these problems and want to gain some lessons from practices. In this article, he reports his research conducted in the UK with support of an SRA award.

The major research objective is to learn from practices of sustainable education construction in UK. Detailed aims include identifying motives and barriers when applying sustainable education buildings, conducting cost analyses, and discussing with experts there. It is found that budget is still much frequently mentioned when discussing barriers of achieving sustainability in new education buildings. Therefore, further cost analyses based on bigger sample is necessary. A further quantitative analysis is necessary to validate the debate on whether sustainability cost more and how much if yes. It is also found that leaders' awareness on sustainable procurement and construction is important since they are decision-makers of project scopes. Finally, a defect of BREEAM, the mostly used sustainability building certification system is that a certified building is not necessarily an energy-efficient in some cases. These findings can benefit further researchers in this area.