# THE ROLE OF KNOWLEDGE TRANSFER IN SUSTAINABILITY RESEARCH IN THE BUILT ENVIRONMENT DISCIPLINE

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Many research institutions have conducted research work to find the best approach for achieving a sustainable environment. However, if this research is to be useful it has to be applied to the areas of life where it can make a difference. The role of knowledge transfer centres in exchanging information between the higher education institutions, industry and third party organisations has been investigated. Documentation and observations of the Sustainability in the Built Environment Forum's meetings and discussions have been analysed. This analysis revealed that there is considerable interest in exchanging knowledge and sharing experiences among all the participants to achieve sustainability. However, there are many challenges facing this approach and greater efforts are needed to achieve best collaboration between academia and industry to attain the knowledge exchange in order to save our environment.

Keywords: built environment, education, knowledge transfer, sustainability.

## INTRODUCTION

The key aims for a sustainable built environment are to improve the quality of life of people within a sustainable economy. Therefore, sustainability has become a key issue in national and international discussions subsequent to the publication of the Brundtland Report (WCED 1987) and the 1992 Rio 'Earth Summit'. In the UK, several government initiatives called for reform in the construction industry to adopt new approaches in delivering its services and sustainability (Latham, 1994; Egan 1998; DETR 2000). The industry has been urged to become more market responsive to minimise waste, to reduce pollution incidents, and enhance its sustainability profile, and so on. In other words, the mission is to find a new way where social and environmental benefits accrue without increasing costs and lowering profits (Myers 2005).

The Higher Education sector plays a key role in achieving these targets. There is no doubt that these institutions supply the employment market with many graduates in a range of disciplines such as: developers who will significantly influence change in the physical infrastructure; architects and technologists who can have a major impact on the way buildings are designed and constructed; and engineers and surveyors who can have a direct affect on the energy efficiency of the buildings and the way they are evaluated and maintained over a period of time. Nevertheless, the job of these institutions is not limited to producing skilled labour but also to contribute to the

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development of knowledge as well as gain knowledge from experienced professionals and disseminate it to their students.

Considerable research efforts by academics and research institutions in the built environment field have been, and still are, investigating the best ways and methods to achieve these aims (e.g. Doughty and Hammond 2004; Deakin et al 2002; Papadopoulos and Giama 2007; Bosher et al 2007). Without a formal channel, the industry and the community as a whole will not benefit from these research outputs. In addition, academics need input and interaction with industry and other organisations and government bodies to conduct their teaching and research.

The Higher Education Funding Council for England (HEFCE) has recognised the importance of knowledge transfer and called for the establishment of knowledge transfer centres at higher education institutions (HEI). In response to this call, knowledge transfer centres have been established to act as channels for transferring knowledge between these institutions and enterprises and organisations. HEFCE has provided funds for these centres and this project is being funded through HEFCE initiative.

HEFCE has developed its own sustainability strategy and seeks buy-in by the HE sector. The vision of HEFCE is that, within years 2005-2015, the higher education sector in England will be recognised as a major contributor to society's efforts to achieve sustainability - through the skills and knowledge that its graduates learn and put into practice, and through its own strategies and operations (HEFCE 2005).

The aim of the paper is to study how research conducted at research institutions on sustainability can be transferred to related industries. The paper discusses the role of knowledge transfer centres in exchange of information between the higher education institutions, industry and third party organisations. It starts by defining sustainability. It then discusses knowledge transfer and exchange at University of Central Lancashire (UCLan). The discussion section debates the role of knowledge exchange in achieving a sustainable built environment and finally a conclusion is drawn up about the key findings of the paper.

## RESEARCH METHODLOGY

The research methodology underlying this work is twofold. The research within CKE is of participant-observation nature, with a focus on qualitative methods (documentation analysis, observation), examining the processes and behaviour of the participants in the knowledge exchange from both the industry and academia. This has generated a set of findings in the tradition of grounded theory (Glaser & Strauss, 1967).

To achieve the research aim, a thorough literature review was undertaken in an attempt understand the existing approaches to knowledge transfer and how these approaches are adopted. Meeting discussions and minutes and presentation done at these meeting were analysed to define the role of knowledge exchange in sustainability research.

## SUSTAINABILITY IN THE BUILT ENVIRONMENT

The built environment represents a complex system that places significant strain on the wider environment but is also one of the major factors in determining the sustainability of a community. In particular, buildings have major environmental impact over their whole lifecycle during construction, operation and demolition. It has

been estimated that buildings contribute 40-50% of greenhouse gas emissions globally (Building Commission 2008).

Undoubtedly, sustainability is a noble virtue which everyone is looking to achieve although there are different opinions and definitions for sustainability. Each discipline has developed its own definition, objectives and agenda to achieve sustainability. Reid and Petocz (2006) argue that sustainability is a sensitising concept and may be impossible to define but it creates certain sensibilities and specific characteristics of the problems at hand. However, the most commonly accepted definition is the one reported in the Brundtland Report, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs", (WCED 1987). From this definition, the following objectives should be met by any sustainability plan (Pearce and Vabegas 2002):

- Minimise negative impacts to resource bases, while
- Satisfying human needs and aspirations both now and in the future, and
- Causing minimal negative ecological impacts.

## KNOWLEDGE TRANSFER AND EXCHANGE

The creation and application of new knowledge is the key factor for economic growth (Agrawal 2001). Higher education institutions are widely recognised as one of the prime sources of new knowledge. All forms of knowledge transfer including publications and patents may significantly contribute to economic growth. The HE-BCI survey revealed that UK HEIs received £2.25 billion from business and community interaction in 2005-06 (DIUS 2008).

Higher education initiatives that seek the outcomes related to environmental sustainability are extremely diverse. These can be different forms such as taught elements with conventional knowledge-based learning outcomes directly related to the built environment and business decisions made by the education institution relating to energy savings or recycling.

HEI play a key role in transfer of knowledge to end-users (society). Education is the most important mechanism for the transfer of research to end-users by (Cassar 2003):

- Making end-users aware of relevance of research to their work;
- Bringing research and implementation closer;
- Integrating research outputs with education and training courses.

Knowledge transfer can be conducted through different channels. These channels include, but are not limited to, publications in journals and conferences, sharing research facilities, patents and professional networks and boards. However, different phases in knowledge generation may also require different kinds of knowledge transfer channel. Furthermore, the level of a researcher's speciality has significant influence on the way knowledge transfer takes place. In other words, researchers who conduct extremely focused research may have a harder time transferring it than researchers who conduct a more multi-disciplinary research (Brennenraedts, 2006). The choice of the knowledge transfer, therefore, depends on several factors rather than the aspirations of the participants in the process.

At UCLan, knowledge transfer has always been a part of the University's activities: central to this is the way knowledge is transferred into business and the community through the skills and attributes of our students, graduates and researchers in order for

them to become more efficient and competitive within their chosen market place. Knowledge Transfer is not only limited to being able to transfer the knowledge, skills and information housed within the University into businesses and organisations but it is also about transferring the knowledge and ideas from businesses back into UCLan to ensure that graduates are leaving the University with the right qualifications, experiences and attitudes to work. Several forums for knowledge exchange are run at the University as part of knowledge transfer delivery channels, of which the, "Sustainability in the Built Environment Forum", is one.

## SUSTAINABILITY IN THE BUILT ENVIRONMENT FORUM

The Construction Knowledge Exchange (North West) at UCLan organised forums for representatives from industry, further and higher education institutions, sector skills councils and regional organisations to discuss 'Sustainability in the Built Environment.' The representatives encompassed a broad spectrum of professional backgrounds which included engineering, heritage, conservation, housing regeneration, facilities management, sector skills, design, architecture and environmental management. The key aim of the forums was to bring together an eclectic mix of people in the region involved in sustainability, to participate in a group exercise and discussion in order to identify commonalities and opportunities for working together to improve the sustainability agenda for education and training. In order to achieve this aim, periodical meetings are taking place. These meetings are intended for information sharing and best practice recognising that much work has been done in the past but needs up-dating; linking regional colleges/universities with organisations and industry (see Table 1) to improve business performance in the NW and setting the agenda for teaching and training in the Built Environment throughout the NW. However, the number of participants was kept low to make the discussion more interactive and the participants varied from meeting to meeting depending on the subject matter.

*Table 1: Attendees of Sustainability Forum at UCLan*

| | **July 07** | **Nov 07** | **Feb 08** |
|---|---|---|---|
| Academics | 6 | 12 | 14 |
| Industry | 4 | 3 | 4 |
| Organisations | 3 | 3 | 6 |
| Total | 13 | 20 | 24 |

*Skills*

With growing recognition that many human activities are unsustainable, there is increased pressure to explore new ways for operating the built environment responsibly without debilitating the natural environment. Such a mission is challenging and requires new skills in all disciplines related to the built environment.

Egan (2004) pointed out that sustainable communities are a holistic long-term objective requiring a holistic approach to skills to deliver the outcome the community is seeking. So, the forum members are of the view that sustainability must be embedded into all teaching so that students "live it" and so that sustainability becomes a lifestyle for all and not a preserve of the scientists and technologists. The information delivery and forms should be appropriate to the educational and direct interest level of the courses. Sustainability should be a recognised as one of the key criteria of assessment of validation and accreditation of courses.

Work-based education and training is often unrecognised and under-valued. Within the construction industry, there is a need for CPD in sustainability which is formalised and validated. Furthermore, some modernisation of an industry-driven sustainability agenda may be needed. Lessons from history might be directed to sustainability such as the acceptance of Health and Safety as an industry culture

*Energy- Low Carbon*

Nowadays, the major threat to humanity is the effect on the global environment through climate change. Therefore, urgent action is needed to reduce global greenhouse emissions significantly (UKERC 2005). The UK, Housing and Planning Minister has proposed that all new UK homes should be zero carbon by 2016 (URBED and TCPA 2007).

Buildings are regarded as the largest contribution to the energy consumption of a country. It is widely argued that 40% of the total generated energy is used in the construction and operation of residential, public, and commercial buildings. The use of energy includes heating, lighting and powering buildings. Domestic water heating accounts for over 5%, domestic space heating up to 20% and appliances and lighting up to 30% of the total energy consumption. Domestic energy consumption is about 30% of total energy consumption. The efficiency of buildings and appliances should be improved enough to cut their CO2 emissions by 25 percent (Podesta, et al 2007). The creation of an energy-efficient building starts with the design process and building materials selection. The following subsections briefly discuss these issues.

*Design*

Building design can be considered as the starting point for making buildings sustainable. In this process, building envelope, materials and orientation are designed and selected. There are several software packages available that not only assist in solving particular problems related to these issues but also for the design of heating, ventilation and air conditioning systems. Further more, these packages can help in the use of artificial intelligence in helping the designer to reduce the energy consumption of a building.

The selection of sustainable sources of energy such as solar, wind, and geothermal that can be used to reduce the carbon footprint of a building can be a challenging task. It is not necessary to mention here the available sources of renewable energy and their possible uses. However, designers should take into consideration the social and economical issues in their selection of a sustainable source of energy for heating, cooling, lighting systems and demotic appliances. Buildings may need to be designed in such a way as to integrate renewable micro-generation technologies such as solar photo-voltaic panels and solar thermal collectors. This may include the future proofing of facades and roofs for the installation of solar technologies. The other contribution that designers can make to carbon emission reductions is to reduce a building's energy demand by increasing the efficiency of these systems, and ensure the building itself does not leak energy. This can be achieved by making the building more air-tight, continuous insulation, passive solar design and responsible use of glass.

Waste is one of key issues that should be taken in consideration in assessing whether a building material is sustainable and design should take into consideration waste minimisation. Standardisation and modular design are one of the ways of reducing waste and materials selection also plays a major role in this aspect.

*Legislation*
Whilst there are risks inherent to policy intervention of any kind, there is also a risk that, in their absence, progress will be wholly inadequate. However, the main driver for the move to more sustainable built environment is compliance with environmental legislation. Most developers and constructors will not adopt sustainable approaches in buildings voluntarily. Generally, Building Regulations have for long time embraced the concept of sustainability. Amendment of the regulations have either encouraged achieving higher standards for energy conservation or more flexibility to permit progress of the sustainability concept. Nevertheless, there are only limited regulations with influence on sustainability. These regulations are Part E (resistance to passage of sound), Part F (ventilation), Part H (drainage and solid waste), Part J (Heat producing appliances), Part L (conservation of fuel and power) and Part M (access for the disabled). The most influential part of the Building Regulations is Part L as it deals with energy savings. The changes introduced in 2006 may lead to some reductions in carbon emissions but there may be a need for improvement in legislation. To avoid any gap between the design performance and actual performance of new home, Building Regulations therefore has a vital role to play in inspecting the detailed design proposals and the construction process for new homes.

The government should provide alternatives not just preventing or making unsustainable actions expensive. In transportation sector, for example, it is not fair to introduce higher tax on certain categories of cars without provide an alternative for some people who public transport is not ideal solution. For residential buildings for example there should be tax breaks to encourage people to install energy efficiency measures, or grants to help households install renewable energy on their homes before increasing tax on and price of energy.

*Materials*
Construction materials are one of the prime criteria for assessing sustainable developments. To consider a building as sustainable it must, by nature, be constructed using locally-produced sustainable materials. There are certain criteria which should be met by materials to judge their sustainability. These are:

- The use of local material will keep travelling to a minimum, reducing harmful fuel emissions - but locally-sourced materials must be replenishable.
- For a material to be regarded as sustainable, it should contribute to the maintenance of the environment in years to come. For example, wood is biodegradable whereas metals will be more damaging to the environment over a period of years as they are not biodegradable, and are not easily recyclable.
- Materials used should be renewable, non-toxic and, therefore, safe for the environment. Ideally, they should be recycled and recyclable.

The manufacturing of building materials generates around 10% of carbon content of building. Using as much as possible raw materials will contribute to the reduction of carbon foot print of buildings.

## DISCUSSION

Sustainability is a wide issue which can not be defined in a narrow way. The major component of the built environment is buildings and here sustainability is concerned with the complete life cycle of buildings which need to be well thought-out from design and construction through the operational stage to deconstruction (rather than demolition). This requires skills appropriate to these stages of the whole life cycle of the buildings - skills which are not in the possession of many existing professionals

and employees in the built environment discipline. These days, there is huge pressure on staff and students in higher education to become more engaged with sustainability. It is widely claimed that most staff development programmes and academic curricula still fail to deliver the competencies, knowledge, skills and attitudes required for achieving the goal of sustainability. One of the delivery methods of information related to sustainability is knowledge transfer.

HEI staff involved in knowledge transfer activities face many challenges. Establishing and maintaining personal contact with industry professionals is regarded as one of the key challenges. Industry professionals usually prefer to work with people they trust as there is substantial amount of information which, in their opinion, is sensitive and should not be available to others especially their competitors. In this regard, industry professionals usually want to make sure that they benefit from such involvement or collaboration in a project. Knowledge generated at higher education institutions would be useless without funds for transferring it. The existing funding mechanism does not encourage many education professionals to engage in knowledge transfer. These funds should be continued or at least for longer periods as knowledge transfer process is lengthy. More over, the selection of appropriate process of knowledge transfer is sometimes challenging. The selection largely depends on the level of co-operation of the industry partner. Many SMEs are reluctant to give some of their time to knowledge transfer process even though they are likely benefit from their participation in such project.

New and innovative ways of knowledge transfer should be developed as the existing routes are exhausted and become discouraging for academics and industry partners involved in knowledge transfer. The existing funding mechanism discourages many academics from engaging in knowledge transfer, therefore, there should be sustainable source of funding to secure the continuity of knowledge transfer centres at many HEIs. Assessment of existing ways of knowledge transfer may be needed so improvements can be introduced. This may encourage many industry professionals to benefit from knowledge generated at HEIs.

Examples of best practice to encourage businesses and the society to benefit from knowledge generated and held at higher education institutions should be published and be available to all. However, many businesses, particularly SMEs, have a long way to go, before they can effectively manage the opportunities that emerge from the sustainability agenda.

## CONCLUSIONS

From the outset, this paper sought a tentative exploration of the role of knowledge transfer for sustainability in the built environment discipline. Having taken the first steps, conclusions must remain tentative. Regulation, education and incentives are needed if a sustainable built environment is to be delivered.

Sustainability may be embedded across all the functions of a higher education institution to make a significant contribution to improvement of environment. The fact that there is no single definition for sustainability and its concept still not well defined gives HEIs the opportunity to grapple with the concept and develop new ways of thinking about it. Sustainability provides them an opportunity to face their core values, the way they design the delivery of learning programme for students, the way they think about resources and allocate these resources and their relationships with the wider community.

Knowledge transfer is one of the channels to influence society. Challenges include continuity of funding and lack of awareness of importance of knowledge transfer among industry professionals. There is a need to look at these challenges and find proper solutions to them by all stakeholders involved in this process.

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