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# Mapping of Sustainability Education to Construction Related Curricula: A Case Study of Quantity Surveying (QS) Degree Programme

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## Abstract:

An effective response is required to climate change and the steady diminution of resources of our natural world. We are all situated within and dependent upon the Built Environment for our survival. We all benefit from buildings and infrastructure. The creation, refurbishment and maintenance of this environment is a £100 Billion industry. Each new build operation, every refurbishment and the operation of existing systems all consume resources, in many cases scarce and non-renewable. What is vital is awareness in those actually responsible for the creation and renewal of the facilities referred to above? There can only be a concerted effort at sustainable building when there is genuine, informed, concern on the part of all members of the construction team. Perhaps we should look to our providers of construction-related education to instil students with increasing awareness of the issues. The current study examines the extent to which there is appreciation of issues of sustainability amongst educators and the extent of their inclusion within the curricula of (in this case) Quantity Surveying students at a northern university chosen for the study. The literature review findings and results from the content analysis of the series of interviews conducted suggest the level of inclusion appears to be low. This supports findings from the recent RICS research, which suggested that sustainability may be evident across only 3-5% of the curricula of most Quantity Surveying programmes, and incorporated at a basic level only.

## Keywords:

Carbon, construction education, quantity surveying, stakeholders and sustainability development

## 1 Introduction

*“Construction has the potential to enhance rather than degrade the environment and to promote rather than exasperate social and economic equity. If this potential is to be realised, everyone within the industry will need to attain some level of sustainability literacy”* (Murray and Cotgrave, 2007).

Given this statement, Murray and Cotgrave have set the stage for discussions on the future of the study of sustainability in the built environment. Many proponents in this area share this view and they believe changes are necessary to accommodate the needs of a changing world. The increasing emphasis on climate change has generated considerable interest in the sustainable development (SD) agenda throughout the world. In the UK, like any other country, there is increasing awareness of the significance and value of having a sustainable environment (Khalfan, 2006). The SD issue is one of the greatest challenges facing the world. In the built environment (BE), the challenges are large given the size of the construction industry, which account for 8% of GDP. The enormous amount of resources it consumes, the major impact of its products and activities on the BE in particular and the society at large, contribute to the economic well-being of the country; the social well-being of people and the impact on the environment (Cowling *et al.*, 2007; BERR, 2008). Theron (2010) estimated that the BE in its widest sense is responsible for 40% of CO<sub>2</sub> emission, as well as 40% of all energy used. The Kyoto protocol, EU Emission Scheme, recent changes in building regulations and the Climate Change Bill all indicate a growing recognition of the need to minimise the consequences of human activities on the environment. These initiatives have created the need for major reform in the UK construction industry and educational systems.

There are many proponents in this area who believe that the green agenda and construction education are intricately linked (Walton and Galea, 2005; Cotgrave and Alkhaddar, 2006; Hayles and Holdsworth, 2008; Theron, 2010). The rationale therefore, for embedding green issues within the construction curriculum is a powerful and imperative one. The rationale has mainly come as result of policy drivers and in some cases existing research or surveys in this area, but the response from academics so far is patchy. However, it is increasingly recognised that the curriculum should incorporate sustainability or green issues and produce graduates that are confident of taking care of the environment without damaging it for future users. Hayles and Holdsworth (2008) argued that the 21st Century is seen as the time for the UK universities to embrace new ways of working. This is especially important if the educational system is to continue to be competitive and also meet the needs of its increasingly demanding stakeholders. A major challenge for the universities however, appears to be on the question of its ability to provide products and, to an extent, services that meet stakeholders needs and aspirations, especially in relation to the sustainability agenda.

This paper has been developed in response to a growing interest in the sustainability agenda in the educational curriculum. The authors of this paper are particularly interested in identifying the quality and quantity of sustainability-related materials within the quantity surveying curriculum. The study is intended to describe the current state of affairs through the examination of a North East (NE) case study and identify broad and specific changes needed to bring about more incorporation of sound sustainable quantity surveying practices. However, the research project outlined in this paper attempts to establish and map the sustainability activities within the quantity surveying (QS) programme. To achieve this, a review will be undertaken to determine the main areas of interest in sustainable construction particularly in relation to the QS field. Primary data will be collected using a case study of the QS staff in Northumbria University in the NE of England. The results will be used to qualitatively map the extent of sustainability-related features within the curriculum in the QS programme. The

findings from this paper will be drawn from both the secondary and the primary data analysis showing limited application of sustainability-related education within the curriculum. Further research will aim to quantitatively map the extent of sustainability education within the QS curriculum and also recommend strategies of how such sustainability-related education can be incorporated into the curriculum to aid in producing graduates that can confidently take care of the environment.

## 2 Literature Review

“Sustainability”, “Sustainable Development” and “Sustainable Construction” are words that have become common currency in recent years. They are phrases that are interpreted in different ways, but the underlying suggestion is one of doing things differently and better. In the UK, with climate change high up on the government and industry agenda, sustainability arguments are in strong demand. Numerous definitions have been proposed by various proponents working in this area. Despite its ubiquitous use however, there is an apparent lack of academic definitions of what exactly sustainability is meant to be within the curriculum. This section will review the fundamental change of the Sustainable Development Education at Higher Education and identify the challenges the quantity surveying programme will face if the sustainability agenda is not addressed in the curriculum.

### 2.1 Greening the Curricula

In light of the above statement on the sustainability agenda, this paper explores the views of some academics of current sustainability-related education within the built environment curricula. A review conducted of research in this area found that there are a number of studies that have been done to explore the opportunity to embed sustainability agenda into the built environment curricula (Sayce *et al.*, 2009; Iyer-Raniga *et al.*, 2010; Hayles and Holdsworth, 2008; Cowling *et al.*, 2007; Murray *et al.*, 2006; Cotgrave and Alhadder, 2006; Fenner *et al.*, 2005; Perdan *et al.*, 2000). These studies have been carried out to encourage staff to make commitment to sustainability by making changes to their modules or provide new modules for student learning.

As early as 2000, Perdan *et al.* attempted to adopt a multidisciplinary approach to teaching sustainability for engineering students at the University of Surrey and they developed IT-based learning materials and case studies to facilitate students’ better understanding of concepts of sustainability and how solutions could be developed. Fenner *et al.* (2005) did similar study; they reviewed the education for sustainable development (ESD) in Engineering Department at Cambridge University and encouraged students’ self-reflective learning processes to obtain their own solutions for the challenges of Sustainable Development.

In the built environment, Cotgrave and Alkhaddar (2006) reviewed the undergraduates’ construction management curricula at Liverpool John Moores University and established that the sustainable design and technology was superficial within final year study. Further studies found that the students’ attitudes towards environmental issues were very low or non-existent. Murray *et al.* (2006) implemented a full curriculum to identify the gap in provision of sustainable construction education at Plymouth University. Their study found that although discipline-specific environmental aspects

were being included in the curriculum, but few generic aspects of sustainability such as citizenship, poverty were being covered.

Cowling *et al.* (2007) argued that education for sustainable development has become increasingly significant within the built environment higher education curriculum at Kingston University. They explored students' familiarity, understanding and interest in sustainable development (SD) and how these developed over their time at the university. Their results showed that the school's emphasis on SD had an opportunity to contribute greatly to the students' awareness of the subject given that they entered the courses with interest but a low knowledge base.

Hayles and Holdsworth (2008) conducted an action research project at RMIT, Australia to embed sustainability agenda into the core curriculum of the school of property, construction and project management undergraduate programme. Their results showed how sustainability issues were embedded into three new modules. However, further exploratory research is needed to show how sustainability can be embedded within the whole of the built environment studies. In a more recent study, Iyer-Raniga *et al.* (2010) conducted research with construction management students at RMIT to compare students' sustainability activities between Melbourne and Singapore. Their finding showed that there does not appear to be any significant differences in the perceptions, knowledge and understanding of sustainability issues between the two sets of students.

While the list of previous works in the area of sustainability education in this review is not exhaustive, it does indicate the wide range of proliferation of research projects that should be considered in determining a more sustainable course of action to incorporate sustainability-related education within the quantity surveying programme.

## **2.2 Challenges facing the Quantity Surveying Professional**

Having introduced the concept of sustainability in BE education, the following section of the review will report the challenges facing the QS professional.

Previous researches have provided some understanding of the meaning and significance of quantity surveying (Lee and Hogg, 2009; Perera *et al.*, 2010; Simpson, 2010). The role of quantity surveyor as suggested by RICS (1971) cited in Nkado and Meyer (2001) is associated with measurement and valuation. They argued that quantity surveyors provide a proper cost management of construction project in the context of forecasting, analysing, planning, controlling and accounting. Other proponents in this area have suggested that competent quantity surveyors must have a range of skills, knowledge and understanding which can be applied in a range of contexts and organisations. What is clear is that the roles and activities of quantity surveyors have now become extremely diversified, with a range of employers to match. Ashworth and Hogg (2007) argued that their skills have been enhanced to meet these needs. However, within the same period, sustainability has emerged as area of growing importance to the construction industry. In the UK a number of construction companies have re-branded themselves to try and meet the needs of the sustainability agenda. The responses of the industry highlight that there is growing interest in the sustainability issue and that the sustainability issue is beginning to be taken very seriously.

Achieving progress towards sustainability is critical to the future well-being of society and this has long been recognised by HEFCE (HEFCE, 2010). They have placed sustainability as a major objective both organisationally and within their sphere of influence and activity. It is suggested that universities have a big role to play in tackling the sustainability agenda (Jones *et al.*, 2008). In HEFCE (2010) report, it is argued that the universities and colleges are in a unique position to lead the way and change the awareness of sustainability agenda. It is therefore expected that universities will be at the forefront of embedding sustainability both within their own institutional values and within the curricula that they deliver.

Dixon (2009) argued that there has been progress over the last two years in linking sustainability into professional practice globally, but he suggested that the key barriers continue to be lack of knowledge and lack of expertise from graduates and experienced professionals. This reflects the inadequacy of training and education in universities. In the recently completed EcoBuild conference in 2010, Paul Morrell, government adviser on construction stated that the government's greatest worry is how to satisfy the carbon and green agenda. He went on to state that the construction industry does not have the capacity to meet the sustainability agenda because the universities are not producing the graduates with adequate knowledge.

It is crucial for the whole construction sector to make strong contributions to sustainable development. Many construction professionals such as architects and engineers lead the sustainable construction in the world. The industry is continually raising its standards; however, there is lack of evidence showing that Quantity Surveying professionals are demonstrating sustainability leadership in the business and services environment. It is of paramount importance to identify what types of new skills are required by quantity surveyors in order to tackle the sustainability agenda. RICS (2007) in their review identified all kinds of surveyors' competencies and have also identified a number new skills required for QS to provide sustainability services through the life span of a building project. The identified areas are: value for money, whole life costing, cost of alternative materials, renewable energy schemes, recycled content schemes, the ethical sourcing of materials and labour. Other key elements also discussed in other literature include; sustainable procurement knowledge & skills and sustainability performance measurement. Furthermore, RICS also listed a number of responsibilities for QS in terms of sustainable development:

- Protecting and enhancing the natural environment
- Encouraging the sustainable use of resources
- Reducing waste generation and responsible disposal of waste
- Reducing energy consumption
- Promoting community development and social inclusion
- Minimise any negative social or environmental impacts of development
- Promote sustainable land use and transportation planning and management
- Promote sustainable design, development and construction practices, including whole-life costing

Much has already been written about the skills which will be necessary for QS to meet the challenges outlined above. However there is a huge skills gap between the quantity

surveyor in higher education and new skills. So far there is little research conducted to investigate the incorporation of sustainability-related education within the QS curriculum. Achieving sustainability education with the QS curriculum will require an exploration of the general definition of SD and its three spheres; the economic, the environmental, and the social. In addition, one must acquire knowledge of regulatory and technological issues that encompasses both the parts and the whole in dynamic interaction. Dale and Newman (2005) argued that the key to achieving these skills is adaptability, meaning the ability to change, particularly in a changed economic climate and the threat of global climate change. Clearly universities operating in the built environment field have a vital role in shaping the future pattern of practice and policy in relation to the sustainability agenda. So, it is vital to map the curriculum towards sustainability. As a high profile university in the UK, Northumbria University could make a substantial, exemplary and on-going contribution to sustainability education by aligning its curriculum to address sustainability issues within the QS programme. This will enable the staff to educate and inspire the new generation of quantity surveyors and influence them to be tomorrow's leaders in sustainable development.

### **3 Research Methodology**

Two distinct data gathering methods were employed to develop the sustainability framework relevant to Quantity Surveying (QS) and to qualitatively map the extent of coverage of the identified sustainability knowledge areas in the QS degree programme of the School of the Built and Natural Environment at Northumbria University. These strategies are illustrated below.

#### **3.1 Use of Published Sources**

A detailed literature review was carried out to explore the sustainability agenda and its impact on construction related curricula in general and QS education in particular. The main areas of interest in sustainability and the RICS QS functions in the light of current practice and future roles were identified through the review. This culminated in the development of a framework which identifies the sustainability knowledge areas relevant to construction and QS roles. The framework triggered and provided the basis for the later strategy used in the research.

#### **3.2 Sustainability Mapping Case-study**

A series of interviews were carried out with key QS staff to review and verify the framework developed from the literature findings. Subsequently, their views on the extent of coverage of the identified sustainability knowledge areas in the QS degree programme at Northumbria University, which is the research case study, were probed.

##### *3.2.1 Sample Population*

The respondents include the subject director, construction economics professor, distance learning director, programme leader and the year tutors of the QS programme at Northumbria University. These persons were deliberately chosen based on their accurate knowledge of the programme as they play a significant role in designing and maintaining the curriculum used to teach the QS students. In their different capacities, they are familiar with the entire range of modules that make up the curriculum and also

with the contents of each module. Based on the above and their appreciation of the learning outcomes at every stage of the QS degree programme, they are able to advice on the extent of coverage of sustainability in the curriculum used to teach the students.

### *3.2.2 Quantity Surveying Degree Programme*

The QS undergraduate programme is either studied as BSc (Hons) Full Time for 3 years full-time or 4 years sandwich. In Year 1, (otherwise known as Level 4), studies focus on the principles of knowledge on which quantity surveying is based including undertaking a UK-based residential field study visit. Year 2 (or Level 5) concentrates on the role of the Quantity Surveyor in practice and also prepares students for work in the optional placement year. Students are strongly encouraged to undertake a placement year as it gives them the opportunity to put into practice what they have learnt in the first 2 years of their study before progressing onto the final year. In Final Year (otherwise referred to as Level 6), the broader role of the Quantity Surveyor is investigated whilst further developing relevant academic skills and also undertaking an optional European-based residential study visit.

### *3.2.3 School of the Built and Natural Environment at Northumbria University*

Being a major university of its kind in the North East of England responsible for training construction students for the professional world of work, its programmes have to be sound, up to date and at the fore front of knowledge. This is absolutely critical if these are to maintain their absolute relevance well into the future and to keep attracting applicants from within the region and beyond - not least its QS degree programme, which is RICS Accredited and the largest in the School. The adequate inclusion of sustainable development as it relates to construction and the current and future QS function is one of the principal elements that could enhance its construction related curricula of the School in general and the QS degree programme in particular. This is also an area within which the government hopes to increase academic funding in the nearest future as a means of promoting the global sustainability agenda. It is therefore necessary to examine the extent of coverage of sustainability within the QS curriculum, to enable the programme continue to produce seasoned graduates confident of taking care of the built and natural environments.

### *3.2.4 Interview Process*

Each of the identified respondents was probed, using a predesigned question format, on the sustainability framework. The framework initially developed from the literature findings categorises those sustainability knowledge areas relevant to construction and the QS profession in particular, into 6 main categories with several subcategories. Based on their knowledge, the respondents were asked to explain to what extent each of the stated subcategories in the list is covered in the academic curriculum of the QS degree programme, perhaps covered as an outline, as a full lecture, or as a module on its own. If not in the syllabus, they were asked to explain whether such work is planned for the future as a learning objective or is considered not applicable based on their experience. Also they were given the opportunity to mention other issues which they think should have been included in the framework. Their opinions about the sustainability agenda in generic terms and in specific terms to the QS profession, programme and the industry were also captured.



The significance of using this process was to gather qualitative first-hand information from key staff members who have major input to and knowledge of the QS academic curriculum, born of their experience of the profession. Their “take” on the sustainability agenda and its relevance to the QS degree programme were revealed. Content analysis of the interviews conducted helped to identify other issues not already included in the framework and served as a catalyst for its refinement. The extent of coverage of sustainability in the current QS curriculum was revealed and ideas on how better to incorporate sustainability education into the QS degree programme, where considered relevant, were suggested. The refined framework, which identifies the sustainability knowledge areas, considered relevant to the profession and the QS degree programme is presented in the following section.

## 4 Findings

The literature findings and the interviews led to the development of the final sustainability framework which identifies the knowledge areas relevant to the QS degree programme and the profession. The framework has been developed in the light of the current and future roles of the professional quantity surveyor as informed by the sustainability agenda. According to the findings from the research, QS graduates will need to have awareness and knowledge of the issues identified in the framework (though to differing levels of detail) to be capable of taking care of the built and natural environments now and in the future. The refined framework (see Table 1) categorises the sustainability-related knowledge areas relevant to QS education into 6 main categories (high level categories) with several subcategories (low level categories).

Table 1. Sustainability Framework relevant to QS Degree Programme

SUSTAINABILITY FRAMEWORK						
HIGH LEVEL CATEGORIES	CATEGORY A - BACKGROUND KNOWLEDGE AND CONCEPT	CATEGORY B - POLICIES AND REGULATIONS	CATEGORY C - ENVIRONMENTAL ISSUES	CATEGORY D - SOCIAL ISSUES	CATEGORY E - ECONOMIC ISSUES	CATEGORY F - TECHNOLOGY AND INNOVATION
LOW LEVEL CATEGORIES	<p>Sustainable development overview and principles</p> <p>Climate change and global warming issues</p> <p>Impact of the construction industry on the environment</p> <p>Sustainable construction concept</p> <p>Role of QS in sustainable development</p>	<p>Changes to Building regulation, e.g. Part L (energy efficiency) and Part F (means of ventilation)</p> <p>Code for Sustainable Homes</p> <p>Energy Performance Certificate (EPC)</p> <p>The Kyoto protocol</p> <p>Relevant EU Directives such as the EU climate policy, EU ETS, etc</p> <p>Climate Change Act</p> <p>Sustainable Construction Strategy</p> <p>Sustainable Procurement Action Plan</p>	<p>Protecting and enhancing the built and natural environments</p> <p>Environmental Impact Assessments (EIA)</p> <p>Environmental Management Systems: ISO 14001</p> <p>Environmental Assessment Methods: BREEAM, LEED, Green Star</p> <p>Reducing energy consumption, that is, emitted and embodied</p> <p>Reducing greenhouse emission such as methane, carbon, nitrous oxide and refrigerant gases</p> <p>Carbon Agenda (Carbon footprinting, Zero Carbon, Retrofit)</p> <p>Waste reduction principles (recycling, reduction, reuse, effective design)</p> <p>Brownfield development</p> <p>Natural resources, renewable and non-renewable materials</p> <p>Water usage and Sustainable Transportation Plan</p>	<p>Corporate Social Responsibility (CSR)</p> <p>Ethical issues such as ethical sourcing of materials and labour, for instance</p> <p>Equity and social justice</p> <p>Community development and social inclusion</p> <p>Health &amp; safety</p> <p>Employment, training and education</p> <p>Social assessment methods (e.g. Design Quality Indicators, KPIs and benchmarking, etc)</p> <p>Cost Benefit Analysis (i.e. impact of human factors on the community)</p>	<p>Cost planning and management</p> <p>Value management or engineering (cost of alternative materials and designs)</p> <p>Sustainable procurement strategies</p> <p>Feasibility studies</p> <p>Whole-life appraisal/ Life cycle costing</p> <p>Financial incentives (such as subsidies, climate change level, aggregate tax, carbon credit, Brownfield land tax, etc)</p>	<p>Renewable energy technologies (Photovoltaic, Wind Turbine, Geothermal, Biomass, etc)</p> <p>Green Building Materials</p> <p>Rain water harvesting and Grey water collection systems</p> <p>Professional and management software packages such as BIM, etc</p> <p>Modern methods of construction: offsite production, use of precast material, lean construction, etc</p> <p>Passive design methods such as day lighting, intelligent facades, carbon storage and offsetting, etc</p> <p>Supply chain management</p> <p>Effective information control and management (using e-business)</p>

Content analysis of the interviews conducted was carried out and this helped to identify other issues not already identified from the review, and also served as a catalyst for the refinement of the sustainability framework relevant to the QS degree programme. The next section presents a critical discourse and summary of the sustainability education, QS degree programme and sustainability framework, extent of coverage and ideas on promoting sustainability education in QS degree programme based on the literature review findings and content analysis of the interviews conducted.

## **5 Discussion and Conclusion**

Awareness is growing amongst the general public, encouraged by Politicians at Local, National and International levels, of the need to reflect upon the relentless consumption represented by maintenance and growth of the Built Environment.

We shall not survive by mere reflection and associated promises but, rather, by making best use of those scarce and sometimes non-renewable resources left to us and by seeking sustainable solutions for the long term future. Those involved in the construction industry will be key players. Specifically, the Quantity Surveyors, with their perspective on the economics of construction will be crucial. However, this “economic perspective” must be expanded beyond that of mere capital cost of construction (the traditional boundary of their skill) to embrace a perception of the life time cost of the buildings, of the districts, of the cities even in which we all live, together with the infrastructures which serve and link them.

The researchers have examined the core body of knowledge currently taught to students on a Quantity Surveying degree, the very people who in five or ten years time, with other construction professionals, will be responsible for shaping and managing the built environment. Through a series of interviews with key staff, those responsible for developing and directing the Programme, the study revealed the role which sustainability plays in the students’ studies, and the importance afforded it by those who teach. More detailed work in future, through questionnaires issued to all staff responsible for the delivery of the degree, will look at specific module curricula.

The research findings so far appear to support those of earlier researchers in the area. The study results seem to indicate that there is quite a large sustainability-related void in the education of student Quantity Surveyors, and quite possibly those in other disciplines within our School, studying to be members of the construction team. The current research has indicated two possible causes. Firstly, it appears that realisation of the very real threat we all face is only just becoming apparent to Academic Institutions as a whole and to the Professional Bodies, who to a significant extent direct the pattern of our curriculum. Secondly, few existing academics have enough detailed knowledge of sustainability-related issues to incorporate the subject confidently within the materials which they deliver. They themselves were educated in and possibly also worked through times when the sustainability agenda had not yet been uncovered. Apparently there was no threat to address. To some extent, education on matters of sustainability needs to extend up the chain, to those doing the teaching as well as down it, to students now and in the future.

One practical reason cited for the apparent failure to recognise and address the significance of the sustainability issue, often given in apology and sometimes as an excuse even, is the lack of spare time or space within the existing curriculum. “So much to teach, so little time to teach it in” is the cry. However, awareness of the sustainability agenda and its importance to what we do is vital for our survival. Therefore, whilst it is not suggested that academics should talk of nothing else, the research implications suggest that they might plant an awareness of its relevance to most things, emphasising it to a greater or lesser extent its importance across the whole of the existing curriculum. To certain subjects such as Law and Management it may indeed seem and be somewhat peripheral. To Construction Technology and Construction Economics, for example, it must surely be of fundamental importance?

The examination of the existing curriculum, and of curriculum leaders’ perceptions of its content and delivery at one sample institution suggests some uncertainty as to exactly where, and how, sustainability-related issues should be delivered. It is hoped that eventually it will be possible to produce a template, illustrating the relevance of sustainability to each key subject area, and ways even by which it may be effectively incorporated. A number of specific suggestions were made by interviewees both as to the general direction which teaching might take, and on specific areas worthy of increased emphasis within the syllabus.

All (participants) agreed that an appreciation of the sustainability agenda should be a thread visible through all teaching at all levels. It was suggested more than once that where a multi-disciplinary School set-up existed every appropriate opportunity should be taken for students of differing disciplines to work through these issues together, as they will one day have to in their professional lives. There was agreement that, where possible, classroom work should take as its model, data from local schemes which exemplified good practice in the field. Also, current research within the School has much to offer. Opinions differed as to the value of studying in any depth the social costs of sustainability (as represented by exercises in Cost Benefit Analysis) – not seen by most as primarily the concern of the Quantity Surveyors. All were agreed however that the technological and cost implications were crucial, together with the ability to transmit these concepts effectively to clients.

Participants agreed that:

“[whilst] Quantity surveyors are not there to advise on designs for sustainable development, which is the designers’ job really [they] should be trained to understand the technologies involved and their implications more in terms of costs.”

As noted in a recent RICS research by Perera and Pearson (2011), sustainability ranks low in terms of the percentage part it plays in the curriculum at present, although other research has shown that a growing body of Professionals in practice do recognise the part it must play in their future workload. Surely academic institutions must do better than what has been done so far to equip the Quantity Surveyors of the future for what will surely be a pivotal role, in terms of the management of time, cost and quality in deciding the future costs to society of sustaining the Built Environment.?

As one interviewee remarked “SD is not going to go away... students are going to go out there in the next couple of years upon graduation to confront these issues which [are] out there and [are] not going to go away.”

## 6 Further Research

This paper presents the results of interviews carried out with quantity surveying staff at Northumbria University to establish the sustainability-related content within the curriculum. The research is part of a larger research within the school which aims at diffusing sustainability into the curricula of all built and natural environment programmes at Northumbria University. This research and other research have established that a holistic understanding across the disciplines is needed in order to accommodate the still evolving concept of sustainability. Consequently, future research is needed to extend or map the sustainability education within other construction related programmes in the school. This will enable decision makers to have a better understanding of the situation. Also it is of paramount importance for this research to consider and explore the link with other stakeholders. Thus, a key strategy for incorporating sustainability education within the construction related programme would be to include professional bodies, industry and students in this research (see Figure 1). The figure shows that for any meaningful strategy, the input from the various stakeholders is necessary to establish what is required and how the strategy will be implemented. Finally, it is anticipated that this strategy will lead to the development of a methodology that schools or universities generally can use to incorporate sustainability education within their curricula.

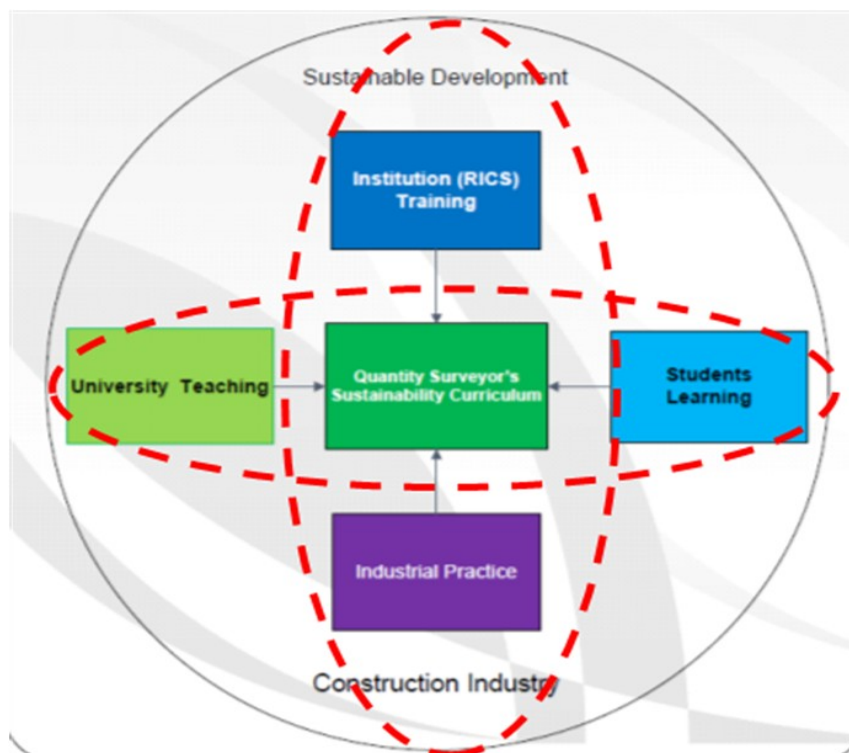


Figure 1. A holistic view of the QS sustainability research strategy

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