**Procurement for Holistic Sustainable Construction in the UK**

**Mr G. Hickerton, BEng(Hons), CEng, MCIBSE, MSt(Cantab)**  
Director of ATKINS Plc and Postgraduate professional doctorate research student University of Wales Institute Cardiff (UWIC)  
gehickerton@uwic.ac.uk

**Dr J.R. Littlewood, BSc (Hons), PhD, FHEA, ACIAT**  
Senior Lecturer/Director of EBERE  
UWIC, EBERE, Cardiff School of Art & Design, Cardiff, UK  
jlittlewood@uwic.ac.uk

**KEYWORDS**  
Procurement, stakeholders, education, training, design teams, consultants, construction industry.

**ABSTRACT**

The construction industry in the United Kingdom (UK) is undergoing a change in how it procurers and constructs buildings, due to the increasing need to deliver sustainable products. This paper will investigate the internal and external stakeholder’s influence on the design team and how they are leading the design and procurement process. It will formulate a hypothesis on the optimum number of stakeholders required to deliver a successful project and review the necessary skills and experience required to justify any stakeholder’s position within the team. A review of the grassroots process of creating and educating these key stakeholders will be undertaken, by comparing the traditional and vocational methods, to establish whether there are any advantages and disadvantages in each education system. The paper poses the question about whether the construction industry in the UK should train new entrants to be specialist in separate disciplines or whether they should be educated to understand construction in general first and then specialise after several years experience within the construction industry.

This paper concludes by reviewing the hypothesis and assessing how education and training can influence the number of stakeholders within a design team and if this in turn has an effect on how design teams function and procure projects. This paper will be useful to clients, developers, design team consultants and people dealing with procurement within the construction industry.
1.0 INTRODUCTION

This paper discusses the basis, overall aim and objectives of a research degree project as part of a Professional Doctorate Ecological Building Practices programme, which the first author of this paper commenced in September 2009 entitled ‘Procurement for Holistic Sustainable Construction in the United Kingdom (UK)’. The project is assessing the existing structure and operation of the UK construction industry, in particularly procurement strategies suitable for delivering sustainable design of the built environment. This includes reviewing the roles of the stakeholders within the design teams and if there can be a common goal for all the stakeholders to follow. Also the paper will review the advantages of vocational training as opposed to traditional institutionalized training and final outline the future research to be undertaken in order to complete the doctorate.

2.0 BACKGROUND AND CONTEXT

A well known definition for sustainability is:

“Since the 1980s, social sustainability has implied the integration of economic, social and environmental spheres to: “meet the needs of the present without compromising the ability of future generations to meet their own needs.” (United Nations General Assembly, 1987).

Sustainability can be classified into three categories, sometimes referred to as the triple bottom line, social, economic and environmental. In recent years, within the UK, ‘Zero carbon’ and ‘Near zero carbon’ have become the ultimate targets for building design.

The following definitions categorise carbon usage for housing but they can also be used as generic benchmarks for any type of construction.

“Zero carbon means no net carbon emissions from all energy uses in the home over the course of a year–so the amount of energy taken from the national grid is less than or equal to the amount put back through renewable technologies. This equates to Level 6 of the Code for Sustainable Homes and will qualify for Stamp Duty relief.

Near zero carbon means no net carbon emissions in relation to core Building Regulations energy performance specifications relating to heating, hot water, ventilation and lighting. This equates to Level 5 of the Code for Sustainable Homes. Choosing a zero or near zero carbon target for any development depends on location, site characteristics and size of the community.” (BRE 2008)
The term ‘carbon’ is used to represent the embodied carbon content of the element that is used to construct the building; i.e. the amount of carbon used in transportation of building products from the place of manufacture to the building site and also the carbon produced as a waste product from the operation of the building such as waste products of combustion from heat producing equipment. Therefore the term ‘Near zero carbon design’ is used to represent the design practice whereby the minimum amount of carbon both embodied and as waste products, is used in the construction and operation of the resulting building.

As the sustainability agenda gains greater momentum within the UK and globally, there are ever increasing demands being placed on individuals within the construction industry (specifically within design teams) to drive a more sustainable agenda. In the authors professional experience there is no clear contractual obligation for any of the design team members to support each other or to exceed the minimum regulatory performance standards.

The UK construction industry in its current form relies on the professional competency and expertise of individual professionals, who are brought together as a multidisciplinary design team in order to design, construct and deliver buildings.

In the UK, and within current multidisciplinary design teams for non domestic buildings it is deemed the responsibility of the building services engineer to complete and submit the calculations and drawings required to demonstrate that the proposed building achieves or exceeds the requirements of the UK Building Regulations, Approved Document L, Conservation of Fuel and Power (AD-L) (Approved Document L, 2006).

Building Regulations Approved Document L offers various means for meeting these requirements. These include:

- Limiting the heat loss and gains through the fabric of new and refurbished buildings;
- Providing space heating and hot water systems which are energy efficient;
- Providing lighting systems with appropriate lamps and sufficient controls so that energy can be used efficiently;
- Limiting exposure to solar overheating;
- Making provisions where air conditioning and mechanical ventilation systems are installed, so that no more energy needs to be used than is reasonable in the circumstances;
- Providing sufficient information so that the building can be operated and maintained in
such a manner as to use no more energy than is reasonable in the circumstances.

The Regulations have also been extended to include significant changes to controlled services and fittings in existing buildings, e.g. boiler replacement situations. (CIBSE 2004).

This shows that many of the means available for achieving the requirements of the regulations are engineering based and specifically the engineering undertaken by the building services engineer within the design team.

Since 2006 there has been a UK drive to reduce carbon emissions from both commercial and residential buildings in order to minimize the predicted effects of global warming.

“As the Prime Minister said at the Low Carbon Summit last month, moving to a low carbon economy is also a huge opportunity for environmental markets which are increasingly important to the economy. Published on 1st May 2008, ‘Building a low carbon economy: unlocking innovation and skills’, sets out how Government will work in partnership with business to encourage innovation and the necessary skills to make the UK one of the best places in the world to develop low carbon, resource efficient products and services.” (UK Climate Change 2008).

However, with only one member of multidisciplinary design teams required to submit their work in respect to carbon production, it is questionable as to whether other internal stakeholders (design team members) and external stakeholders (influences outside the design team) will place the need to minimize carbon production before their own needs and goals. In the authors professional experience this could lead to the architect’s desire for an aesthetically pleasing form to the building taking precedence over the some of the buildings functions or the developers desire to maximize profitable returns on their investment by ensuring that only the minimum performance standards are achieved for the building.

The author proposes that that until all the internal stakeholders involved in construction are contractually obligated to each other to deliver better, higher standards of buildings with the minimum level of carbon usage or production, then there will never truly be a situation where buildings are delivered to the highest quality, since buildings will be delivered that have some level of compromise due to personal or corporate gain.
The UKs drive for near zero carbon design could be the major boost for the UK construction industry, but this may involve widespread change in contractual, procedural, educational, legislative and commercial practices. As with all change this will involve some form of balancing the need to change against the benefits achieved from changing, this balance should be continually questioned.

“On 18 June 2009 Communities and Local Government published its long awaited consultation on changes to Parts L (Conservation of Fuel and Power) of the Building Regulations. For those who design buildings, or manufacture, install and commission building services, this is probably the single most significant legislation affecting how they work. Some proposals may even have an impact on energy assessors producing recommendations reports on existing buildings.” (ANON 2009)

Whilst this legislation may bring about the need for improving the methods used by the construction industry to design buildings, it does not deal with the need for contractual change and ultimately the apportioning of personal and professional responsibility to implement these changes.

Whilst the proposed 2010 AP-L changes will have an impact on the multidisciplinary design teams, internal stakeholders, then the introduction of Energy Performance Certificates (EPC) (Directgov, 2009) may impact the developers, clients and external stakeholders. These new performance classifications may have a direct impact on the market value of the buildings as there may be a need to improve the buildings energy efficiency (so making it more marketable), the subsequent increase in construction cost may reduce the level of profit achieved by the developers and clients.

“When Energy Performance Certificates (EPC) become established, the government asserts, it is likely that buildings with better ratings will attract higher rents and hence the property value will increase. This will result in pressure on landlords to improve energy efficiency to maintain the value of their property investment.” (Dowden, M. 2007)

If the correct common goal is found by, or imposed, on the UK construction industry then this may result in more united design teams (or internal stakeholders) with a common purpose greater than that of the individuals that form the teams. This common goal would also need to be adopted by the external stakeholders, as this is where much of the financial and legislative control resides.
3.0 Understanding the UK Construction Industry

The following definition of the construction industry can be taken as a general overview:

“General construction is the construction of entire dwellings, office buildings, stores and other public and utility buildings, farm buildings etc., or the construction of civil engineering works such as motorways, streets, bridges, tunnels, railways, airfields, harbours and other water projects, irrigation systems, sewerage systems, industrial facilities, pipelines and electric lines, sports facilities etc.

This work can be carried out on own account or on a fee or contract basis. Portions of the work and sometimes even the whole practical work can be subcontracted out. Also included is the repair of buildings and civil engineering works.” (National Statistics, 2007)

3.1 The Structure of Companies within the Construction Industry

The construction industry is divided into many thousands of different sized companies, ranging from one person organisations to 10, 20, 30 thousand employees.
From figure 1, above (Office for National Statistics, 2009.), it can be shown that 67% of the work undertaken by the UK construction industry is undertaken by firms employing more that 34 staff.

In order to assess the possibility of the UK construction industry being able to accept change, it is necessary to understand what percentage of the industry would need to change. If 67% of the work undertaken by the UK construction industry is completed by firms employing 34 or more staff, it is important to understand what percentage of the total number of firms with in the UK construction industry these firms represent.

Figure 2 below, (Office for National Statistics, 2009.), shows the percentage of firms employing more than 34 staff in relation to the total number of firms in the UK construction industry.
The primary information to be gained from Figure 2 above, is that only 2% of the firms within the construction industry employ 34 staff or more, therefore if the largest construction projects are undertaken by the larger companies (commensurate with levels of personal liability) then in order to implement the greatest change within professional practice, the primary focus for change should be concentrated on changing the practices of this 2% of the construction industry.

### 3.2 Key Internal and External Stakeholders

Figure 3 below, is a pictorial representation of the relationship between the external stakeholders, internal stakeholders and the building.
In the authors professional opinion figure 3 shows how the internal stakeholder are influenced by external stakeholders, as listed, which in-turn will influence how the building is procured through design to construction and delivery.

3.2.1 **Internal Stakeholders** - are the building professionals who form the design team. A typical design team will comprise of the following members:

- **Building services engineers** - Are responsible for the design of the mechanical, electrical and public health systems within the building. They will also be responsible for compliance with building regulations with regard to energy performance and carbon emissions.

- **Structural Engineers** - Are responsible for the analysis design and research of structural components and structural systems

- **Architect** - Is responsible for the planning and design of the building and participates in supervising the construction of the building.
- Client (corporate or public funding) - Is the person responsible for funding the design team and the construction team, in order to design and construct a building that fulfils their requirements.

- Real Estate Developer - Will undertake the same roles as the client but only for projects that are privately funded, therefore any project will either have a client or a real estate developer as the primary purchaser for the building.

- Quantity Surveyor (QS) - Is employed to manage and control contracts and costs on behalf of the client or real estate developer for the procurement of the design team, construction team and the resulting building.

- Project Manager - Is responsible for the planning and organizing of resources in order to achieve the successful completion of the project.

- Construction Design Manager - Is responsible for ensuring that the Construction (Design and Management) Regulations 2007 (CDM) introduced by the Health and Safety Executive are implemented throughout the design and construction process, their aim is to improve safety within the construction industry.

- Main Contractor (in association with other sub-contractors) - Is responsible for the methods to be used in the construction of the project in accordance with the contract documents such as the QSs budget cost plan, the head end contract of agreement, CDM regulations, specifications and drawings etc. The primary reasons for the main contractor to employ subcontractors is to reduce cost and offset risk.

- Sub-contractors - Comprise of the many businesses employed by the main contractor to undertake specific tasks as part of the overall project such as steelwork construction, concrete pouring, facade engineering, mechanical ventilation equipment, landscaping, lighting, electrical distribution etc.

- Sustainability Engineer - Will provide advice on practical solutions to achieve sustainability and low carbon design requirements of the building. They will primarily deal with thermal performance, passive building design, part L building regulation compliance, analysis of low
carbon design, renewable energy etc. The Chartered Institute of Building Services Engineers (CIBSE) is the governing body for registering low carbon consultants.

The descriptions above outline the general roles and responsibilities of the internal stakeholders and also highlights that while each stakeholder is dependent on the others within the design team, they also stand alone as independent specialists in their own right.

Therefore it is not possible to optimise the team based on reducing the numbers of stakeholders but more important to review how these specialists are trained and if there exists a common goal for them all to follow and achieve.

3.2.2 The Function of Building Professionals

The preceding section explains the need for the extensive number of professionals required to form an integrated design team. Each of the members has their own task and objectives but the priority is to find some common ground that all parties can agree on.

“The integrated design team work with other members of the design team in order to optimise building energy performance.” (CIBSE 2004)

This offers us a basis for the team to work together i.e. ‘building energy performance’ but in turn this will possibly be of more importance to building services engineers than architects and structural / civil engineers.

“Conversely, focussing on improving energy efficiency in buildings necessitates and often results in many ‘Egan’ outcomes, e.g. greater integration of teams and processes, integration of design and production and a culture of performance measurement.” (CIBSE 2004)

This statement would lead us to believe that concentrating on energy efficiency will result in an efficient team with a common goal but figure 4 below, clearly shows that there are many opposing design requirements that need to be resolved by the design team to achieve an optimum solution.

Figure removed due to copyright restrictions – the figure can be accessed from p.2-1, CIBSE Guide F: Energy Efficiency (2004). The guide if free to download for registered users here: https://www.cibse.org/membersservices/downloads/listings.asp?pid=377. Registration is free.

Figure 4 – Key factors that influence energy consumption (CIBSE 2004)
In order to start to assess the performance of a design team and the relevance of the individual members to the design process there still remains the need to have one common goal.

“The overall goal is 'better buildings' and this can often be achieved by focussing on energy efficiency………… buildings that are designed and managed in an energy efficient way can be more comfortable and their staff more productive, making investment in good energy efficient design and management even more cost effective to a client organisation.” (CIBSE 2004)

If we take the goal of ‘better buildings’ and place this next to figure 4, it is not clear what process needs to be followed to achieve the goal or if the goal itself is properly defined. A greater level of clarity is required with little ambiguity so that each member of the team either in meetings on isolated in their offices, clearly know what their obligation is to the design process.

One possible solution to this predicament is to use the benchmark of 'low carbon design' where each member of the design team is required to demonstrate that their proposals and subsequent solutions will result in the minimum use of carbon.

Further research into the possibility of each stakeholder being assigned a proportion of the total calculated carbon production for the building based on the m² area of the proposed building, which they can apportion as they wish to their areas of responsibility but can only gain more carbon by trading with other stakeholder who have not used all of their allowance. An example of this would be the architect borrowing some more carbon from another stakeholder to allow for a greater percentage of glazing on the building. The other stakeholder may be the structural engineer who has excess carbon due to minimizing the amount of concrete needed in the design of the structure.

This method of working will be investigated to see if (with the correct contractual and procedural documentation) it can be used by internal stakeholders to undertake the design process while concentrating on a combined goal and not individual objectives.

3.2.2 External Stakeholders - are those parties that have no direct risk or liability with regard to the project but who express an opinion on how the project should be undertaken and how the resulting building should perform, those who impose performance related criteria via legislation and those who
have an economic, educational or political agenda which may effect the UK construction industry such as;

- Environmentalists - Advocate the sustainable management of resources and stewardship of the environment through changes in public policy and individual behavior

- Vocational learning vs. Traditional learning - Influences the internal stakeholders by offering differing methods of training, this can result in professionals that have undertaken vocational training having considerably more experience than those following the more traditional routes. Both methods of education need to be closely aligned with the realistic needs of the professional and the industry but not necessarily the needs of pure academic rigor.

- Legislation (statutory law) - An example of this is the ADL (Approved Document L, 2006), which set out to define the design and performance criteria which buildings need to achieve, but in the authors professional opinion this legislation at times can be regarded as the minimum performance requirements which both clients and real estate developers wish to achieve in order to reduce cost and so minimize expenditure for clients and maximize returns for the real estate developer.

  In many instances, in order to achieve low Carbon design, these standards need to be exceeded which results in conflict between the design team and the client/real estate developer. In addition to this increasing standards, such as the proposed changes to ADL (Approved Document L, 2006), will result in architects possibly being restricted in how they design buildings due to the need for greater thermal performance, one possible result being less glass facades being used for building cladding and greater use of high density / mass solid cladding

- UK Government - Is responsible for administering its departments to produce legislative documents such as the building regulations, but the government (at any one time) is only elected for a short period and will always have other agendas in order to achieve re-election. An example of this conflict can be seen in the following excerpt from an interview with Sir Jonathan Porritt who was the government's adviser on sustainability.

  "I am hoping that Lord Mandelson in his time at business is going to be true to the sort of speeches he is now giving about the importance of the UK getting good at a green industrial revolution."
Maybe he can undo a decade of systematic obstruction inside the business departments which stood in the way of sustainable technologies, of the UK achieving breakthroughs on energy efficiency.

It systematically rubbish(ed energy efficiency programmes and managed to see off Defra [Department for Environment, Food and Rural Affairs] in battle after battle. I have seen a number of ministers go through that department with a serious intent to change the way it did the sustainable technologies agenda… most imaginatively Patricia Hewitt.

They've all been seen off until very recently. I can only attribute that to a generation of other senior civil servants who had other interests to promote.”(ANON b, 2009)

This previous extract (if taken literally) would highlight the conflict for the government between following a low carbon agenda and the need to appease major gross domestic product contributors. It can be assumed that should any low carbon agenda be imposed on these contributors that could result in reduced profit and subsequent lower returns for their shareholders. This could then lead to redundancies as the major contributors would need to reduce their overheads in order to achieve their forecast profit levels, which would not help the government’s chances of re-election.

- **UK Economy** - Is also a key external stakeholder in the construction industry. From the authors professional experience, during the current UK recession (2009) there is a lack of funding for construction projects which has resulted in the construction industry being forced to shrink by undertaking redundancies and early retirement. This results in reducing the number of more experienced staff as they are retired early and so forces younger and less experienced staff to undertake greater responsibility leading to a risk adverse culture.

- **UK Construction Industry** - The industry is based on a 'right of ascension' principle (in the authors experience), where time served combined with low risk and high profit performance results in a position in senior management. This results in design professionals being placed in a business environment with little to or no formal training, this also leads to an attitude of 'we have always done it this way so why change'.

In the authors professional opinion the methods used to train the stakeholders plays an essential part in their performance and professionalism. The following section will briefly review the possible benefits of vocational training as opposed to traditional institutionalized training.
3.2.3 Vocational Learning vs. Traditional Learning

One area for further consideration is how the industry educates and trains its future building professionals. Fundamentally thus will fall into two streams of education, either the traditional route with entrants to the industry starting after they have completed their degree, or the vocational route where the entrants start after secondary education and undertake their degree on a day release basis while working for a company.

“Break up between individual rationality and overall economic efficiency: For the individual it is often better to select a strategy in order to obtain a better job by means of a formal training certificate in respect of competition even when this job could have been taken on without the formal qualification (inappropriate employment). In terms of the economy this is ineffective and a waste of resources, but it may be a rational behavior in terms of the individual.” (Van Lith, Ulrich.1998)

This statement outlines the economic advantages for undertaking vocational training in preference to traditional education. It also starts to highlight the perceived class divide between those that are able to spend time in fulltime education and those who need to maintain an income while they study. In reality there should be more importance placed on how effective either route is in producing the correct caliber of professional that can drive the industry forward.

“If these considerations apply, then the return on investment in Vocational Educational Training (VET) depends very much on whether the requirements in respect of the various performance processes of industry and their changes by means of technical and organizational progress are recognized as early as possible and are incorporated into training decisions since more than ever today it is important that the talents and capabilities of the individual are correctly assessed and that they are being qualified for tasks and functions in industry in which they can do the best for themselves and other members of society.” (Van Lith, Ulrich.1998)

This statement highlights the fact that industries need to be continually changing in order to maintain a competitive advantage within the market place and that VET (subject to the quality of training) is a better vehicle for training as it allows the trainee to still be working and therefore exposed to all the ongoing changes.
The main concern for industry is as follows;

“In economic terms vocational education and training is always an investment in human capital. It only pays when the costs of the investment are at least covered by its return in the broadest sense (benefits)” (Van Lith, Ulrich.1998)

Finding some method of vocational training that may suit the entire design professional team, whilst still offering a return for the investing businesses, will be research further.

4.0 Methodology and Literature research

The methodology to be undertaken as part of the authors research degree project will involve interviews (Knight & Ruddock, 2008a) with professionals working for both the internal and external stakeholders and will be undertaken on a one-to-one basis. A complimentary form of primary research will be to undertake case study reviews (Knight & Ruddock, 2008b) of projects by interviewing internal stakeholders currently undertaking projects that have just started the design phase, just started construction or have recently been finished.

In addition to this primary research, the literature review has commenced on published Post-occupancy Review Of Buildings and their Engineering (PROBE Studies) of existing building projects that have involved multidisciplinary design teams, this will produce information around how successful/unsuccessful multidisciplinary design teams have worked on various projects as outlined in section 5.2.1 below

5.1 External Stakeholder interviews

The sample group for the external stakeholder interviews is to include technical experts in the fields of business practices (team performance), economic practices (economics versus construction), political practices (politics versus construction) and education practices to understand how the professional members of the design team have been educated. The stakeholder interviews to be conducted are summarized below.

- Business Practices (teams) - Interview MBA / Business strategy experts on team structures and performance, to assess how other multidisciplinary teams work in different industries and if other, better ways of working can be adopted by the UK teams.
- Economic Practices (Economics vs. Construction) - Interview Economics Experts on UK economy and Influence of construction sector, to assess the links between the fluctuations in the UK economic performance and the associated affect on the performance of the construction industry.

- Political Practices (Politics vs. Construction) - Interview Politician/s about relationship between UK politics / construction / green agenda, to assess the political barriers to change and to investigate any ulterior reasons that may prevent future change in the UK construction industry.

- Education Practices (Degree Level) - Interview Degree course lecturers about standards / future / etc, to assess if the standard and quality of graduates entering the industry reflects the needs of the industry.

- Leaders of the Construction Industry (The Transition Zone) – The leaders of the construction industry fall into a ‘transition zone’ between the internal and external stakeholders, as they are no longer responsible for the design process but are also not in a position of sufficient influence to be considered as external stakeholders.

In addition, one-to-one interviews with existing design team members on a select number of case study projects (the type and number of case studies required will be assessed during the research phase) from the first author’s place of employment will also be included. The aim will be to assess the following issues:

- Successes and Failures in design teams;
- How is the design process working or not working;
- How can the design process be improved;
- Is the quality of the design dependent on the overall quality of the design team or the exceptional quality of a few members of the design team;
- Are the contractual forms of appointment used by the design team fit for purpose;
- Is the basis of appointment for contractors (such as lump-sum, guaranteed maximum price, cost-plus etc.) detrimental or beneficial to the design process;
- Are the other members of the design team sufficiently knowledgeable about low carbon design?
- Is the design team concentrating on renewable energy (photo-voltaics, solar thermal, CHP, bio-mass etc) more than designing the best performing building?
- Is low carbon design imposing problems on the industry or is the industry ill equipped to
undertake low carbon design?

- Should building control be required to re-visit building after they have been put into operation, at 1, 5 and 10 year intervals, to ensure that they are performing to the approved energy usage?
- What influences do external stakeholders have on the design process and do they result in positive or negative outcomes.
- How can the internal stakeholders influence the external stakeholders and educate / influence their decision making process.

5.2 Literature review

PROBE reports (PROBE Studies) are currently being critically reviewed to analyse if there is a difference in how design teams are performing on buildings procured using different procurement methods such as:

- Client lead – refurbishments.
- Real estate developer lead – refurbishments.
- Owner-occupier - Client lead new build.
- Client lead - Competition new build.
- Real estate developer lead - Competition new build.
- Client lead - Commercial new build.
- Real estate developer lead – Commercial new build.

More generally, the literature review is also considering the following issues.

- Sustainable design.
- Architectural practice management.
- Engineering practice management.
- Low carbon design.
- Benchmarking key performance indicators.
- Risk management.
- Contractual appointments.
- Investigate methods for more fruitful future collaborations.
- The current political agenda
- The influence of economics on construction
- The influence of internal stakeholders on each other, such as building services engineers, structural engineers, architects, clients, quantity surveyors, project managers, sustainability experts, construction design managers, main contractors, subcontractors and developers and
their influence on external stakeholders;

- The influence of external stakeholders on each other, such as the UK government, European design standards, UK economy, the education of professionals, the influence of the construction industry, existing and proposed legislation and existing and proposed contractual agreements and their influence on internal stakeholders.

5.0 CONCLUSIONS

This paper has discussed the structure of the UK construction industry; specifically the size of design professional contractors and how only 2% undertake 67% of the works available (by value) and therefore how major change within the industry may be achieved by changing the working methods of only a few companies.

The roles of internal and external stakeholders on the design team and the need for a common goal for all parties to adhere to has been discussed on the basis on trying to amalgamate the internal stakeholders and produce better products.

Also the need to review the methods of training used for there professional and the benefit that may be achieved for companies if they chose a purely vocational route.

In summary, the author believes that the UK construction industry is on the edge if a major step change in how it operates and delivers construction projects, which if managed properly may result in the industry becoming more efficient and better placed to compete in the global market place.

6.0 REFERENCES


