Barriers to sustainable construction contractors

Abstract:

This research aims to investigate Sustainable Construction barriers implementation to SMEs (Small and Medium sized Enterprises) in the UK.

The undertaken investigation mostly emphasises the Production/Construction phase, referred to as the RIBA Plan of Work Stage K. Research shows that barriers to the implementation of Sustainable Construction were most prominent during this stage. Through an extensive literature review the main barriers presenting themselves to SMEs have been identified at the beginning of this stage of investigation.

Later, these barriers will be questioned through the investigation of the literature acquired and the most noteworthy will be scrutinized in greater detail.

There were found to be six key barriers to be considered while implementing Sustainable Construction Techniques in the Production/Construction phase of a project, these are as follows:

1. Cost
2. Time
3. People
4. Technology
5. Market
6. Legal

Even though progress in the UK construction industry as a whole is showing great potential and is showing a steady line of progression (however still

lagging behind other European countries such as France, Germany and Spain), implementation by SME construction firms is limited and poor. This is mainly due to the fact that sustainable construction is considered to be expensive, complicated and time-consuming. It needs greater support from every party involved including clients, suppliers, sub-contractors, government and local authorities to achieve the goal of satisfactory implantation.

Introduction

As the construction industry is such a main contributor to the economy of the UK, contributing 10% of UK GDP (Gross Domestic Product) and employs 1. 5 million people, the environmental impact of the industry is extraordinary; contributing 70 million tonnes of waste to landfills and a huge 50% of energy produced is used by this sector.

(Addis, B. & Talbot, R., 2001: 21)

It is estimated that UK SMEs are responsible for as much as 60% of carbon dioxide emissions.

(Marshall Report, 1998)

It is also estimated that 60% of commercial waste and 8 out of 10 pollution accidents are caused by this sector.

(Environment Agency, 2003 Environment Agency, Business survey reveals lack of environmental awareness, Environment Action (2003) (37). Environment Agency, 2003)

Studies have found that SMEs tend to have low levels of engagement with environmental agendas.

(Hillary, 2000a)

Most of the literature available focuses on the larger construction companies (LEs or Large Enterprises), which is why the author hopes to undertake a study of SMEs, particularly general contractors with less than 50 employees. In 2004 the Department of Trade and Industry (DTI) conducted a survey showing that there were 170, 000 construction contractors working in the UK and that 93% of this figure employed less than 8 people.

“ Initiatives by the construction SMEs indicate that this group is often ignored and hence, they are under-performed compared to larger construction companies”.

(Sexton, M. G. & Barrett, P. S., 2003a)

It is anticipated that the result of this enquiry will help the construction industry to support more medium and small construction firms in the implementation of sustainable techniques and principles suggested by the UK government.

This exploration is limited to SMEs which employ 50 people or less, and also to the construction site (known as Stage K, the production/construction phase of a project).

Aims and Objectives

Aim:

How to get SMEs to implement sustainable techniques through managing time, teams and possibly new methods of construction to maximise profit without having to police each individual contractor?

Objectives:

1. To discover the most relevant procedures to sustainable construction practices at production and construction phase.
2. To recognize exactly the current level of understanding and implementation, of sustainable construction at the production and construction phase of a project.
3. To identify the main barriers in incorporating sustainable construction and embracing new techniques involved in the construction process to SMEs.

Facility executives building green for the first time may find that the process requires as much unlearning of old ways as it does learning of new ones. The process of building green forces facility executives to think about the design and construction process in non-traditional ways.

From integrated design to commissioning, almost every step of the green building process is heavily focused on how building elements fit together to optimize efficiency and sustainability.

The catch is that the process, at least the first time, is more time and cost. While the strategies used may be similar to justifying expenditures in equipment upgrades, justifying processes may be a bit more difficult. It’s more difficult to pinpoint specific costs for more hours of design time.

There are a few simple sustainable ways of management for a contractor to utilise, and these cost saving measures help to maximise profit, here are some suggestions:

1. Make use of grants or funding available for sustainable construction.

- Contact your Local Authority or Regional Development Agency about local projects and grants.
- Employers registered with CITB-Construction Skills can claim Training Plan or Short Duration grant to support sustainability training.

2. Use recycled or sustainable materials whenever possible.

- Give preference to locally produced products.
- Crushed concrete and brick can be used to replace primary aggregates and avoid Aggregates Tax.
- Use timber only from sustainably managed woodland – ask for Forest Stewardship Council (FSC) timber.

3. Only order the materials you need and store them safely.

- Plan ahead when ordering materials.
- Work with suppliers/manufacturers to minimise and return packaging and pallets.
- Store materials in a secure and protected area and keep liquids/sands away from drains.

4. Minimise road journeys to and from the site.

- Use local suppliers wherever possible.

- Plan deliveries to site: during the day time in residential areas and at night and in city centres.
- If you have a van, ensure it can carry a variety of small materials to prevent unnecessary trips to suppliers.

5. Separate and recycle waste then dispose of the remainder legally.

- Separate different types of waste and mark containers clearly.
- Recycle as much as possible.
- Use registered waste carriers and keep the paperwork.

6. Avoid causing pollution to land, water or air.

- Stop uncontrolled water entering or leaving excavations, especially run-off from earth works.
- Avoid spillages on site and clean up if accidents happen.
- Don’t burn waste materials – recycle or dispose of them responsibly.

The UK government has urged industries to take on environmental measures on their own accord on the basis that it will be good for business, a qualitative study investigating the environmental procedures of small and medium-sized construction firms found that the views of owner-managers had little resonance with this ‘ win-win’ approach. Respondents might not be aware of the financial returns to be obtained from eco-efficiency processes to be substantial enough to warrant the short-term investment in time and resources required to engage in them.

In addition, the market was not indicating that product value could be raised or that clientele could be won by implementing environmental best practice.

Respondents consistently highlighted that the enormous competitive pressures on small firms made cost and speed of build the number one priorities whilst environmental management remained a peripheral concern.

At the top of the supply chain, architects claimed that whilst lip service was paid to sustainability issues within the industry, there was currently little in the way of environmental design occurring in the UK, and sustainability tended to be a peripheral issue in their own work. Although it was acknowledged that architects should be at the forefront of sustainability, most respondents felt that it was difficult to push an environmental agenda forward because clients tended to be driven by commercial rather than environmental or social concerns. Most architects thus did not promote environmental issues for fear of alienating clients, and environmental designs were only explored if it was expressly asked of them.

Overall the builder cannot become environmentally friendly because the client does not want to specify certain techniques to the architect because they think it’ll cost too much, they’re more interested in the economic side and the architect doesn’t want to specify sustainable techniques in case of maybe excluding some clients.

These market dynamics were clearly having a knock-on effect down the supply chain as builders perceived a low demand for sustainable buildings and construction methods, and therefore were not incentivised to improve their environmental performance or to differentiate themselves on environmental credentials.

Suppliers wont stock things that aren’t being sought after and that aren’t being specified.

How can the SMEs get these sustainable products then, without maybe having to travel to a specific supplier and look themselves, making it time consuming and not cost effective.

Respondents claimed that the usual criteria for choosing products was price, as buying the cheapest equivalent product was one way for builders to squeeze a profit out of tight budgets. Some builders confess that they rarely considered the environmental impacts of materials, and beyond the use of timber from sustainable sources, most were not even aware of which materials might be greener than others. Information about environmental impacts was thought to be difficult and time-consuming to obtain, and many respondents highlighted that building suppliers could do much more to encourage the use of green materials in construction, such as eco-labelling schemes to differentiate products with lower environmental impacts.

The key issue for firms in this study was that customers invariably focused on ‘ value for money’ at the expense of environmental concerns. Many architects were of the opinion that there was not much of a business case for sustainable design to present to clients, who were unwilling to pay the premium for a more sustainable building.

Respondents highlighted that there was little financial incentive to save energy on site as the mains electricity used was paid for by the client. Some felt that energy efficiency was more of an issue for designers than builders

as it was in the end-use of a building that most energy savings could be made.

However, most claimed that little was reused (apart from the odd expensive item such as certain slates and metals), because the cost of keeping material was often more than buying it new, once storage and labour costs had been factored in. Also, the used material was usually not quite to the specification required for the next job, so many builders felt that it was just easier and cheaper to throw it away. Recycling was similarly dismissed because of the management and labour time involved in ensuring proper waste separation procedures:

“ It takes too long. It affects the labour. I mean if I’ve got 10 labourers on site, I’m not going to bring another labourer in just to make sure that copper is over there and plasterboard’s there and metal’s over there” (Builder 4, 85 staff)

Because small firms are typically more concerned with short-term survival than the long-term environmental impacts of their business, eco-efficiency measures may thus be rejected if the pay-back is not perceived to be immediate.

Objective 1: To Discover the Most Relevant Procedures to Sustainable Construction Practices at Production and Construction Phase.

Following the Egan Report the Government of the UK published “ Building a Better Quality of Life” in 2000. Inside this publication it has been suggested a few key topics for which can be used in the construction industry:

- The re-use of existing building assets
- Designing for minimum waste
- Aiming for lean construction
- The minimisation of energy in construction
- Not to pollute
- Enhance and preserve biodiversity
- The conservation of water
- Respect people and the local environment
- Monitor and report in order to set benchmarks

In 2005 the Government published " Sustainable Development Strategy, Securing the Future" which was a substitute to " Building a Better Quality of Life".

This proposed the following four key terms:

- Sustainable communities
- Natural resources protection and environmental enhancement
- Climate change and energy
- Sustainable consumption and production

Environmental Impacts:

The Environmental Agency tells us that the construction industry is responsible for:

- Using over 420 million tonnes of material resources
- Converting 6, 500 hectares of land from rural to urban use per annum
- 13% of all materials delivered to site go into the skip without ever being used.

- 90 million tonnes of construction and demolition waste (three more waste than all households in the UK combined)
- Responsible for 21% of UK’s hazardous waste
- 10% of the UK’s energy consumption is used in the transport and production of construction products and materials
- Due to building on flood plains 185, 000 commercial properties and 1. 85 million residential homes are at risk of flooding and this figure looks set to rise

Waste Management:

- Waste Segregation: Separating recyclable materials such as timber, plastic, plasterboard, hard-core, cardboard and general waste. Also materials such as concrete, bricks and blocks, stones and slates can be used as filling for roads, footpaths etc.
- Recycling: Waste and Resources Action Programme (WRAP) claims that 30% of materials used on site can be recycled elsewhere at no extra cost. Recycled timber (off cuts) can be used in stud partition walling and can also be used in flower plant bedding.

Purchasing Policy

- with Suppliers: Packaging waste and unused materials can be returned to the builders merchant and used several times over.

Energy Consumption

- Reduction: Simple steps like using energy efficient heating equipment and lighting, supervising the usage of mains electricity according to equipment requirements.

- Water Conservation: Where practical the use of low-flow water fixtures, rain water harvesting and recycling of grey water where hygiene is not a priority.

Material Selection:

The focus for this section is to identify products with a relatively high sustainability score at no significant increase in capital cost over a traditional material option. Many modern building materials are now being linked with environmental and health concerns. Alternatives do exist which eliminate many of these potential impacts and risks to end users, constructors, developers and investors.

Timber or Aluminium instead of PVC where possible.

Formaldehyde free MDF

- Insulation: Recycled cellulose insulation, Rockwool, Foamed glass. Solid Concrete with primary aggregate Permeable pavements Concrete with recycled aggregate (RCA) or glass
- Window Frames: uPVC Durable timber framed windows, renewable source without health impacts from disposal of PVC. Double glazed units with low emissive coatings (Argon filled).
- Flooring: Ground Flooring: Solid concrete, hollow concrete elements with reclaimed aggregate/limestone. Hollow concrete uses less material.
- Solid Walls: Clay brick: recycled Bricks (recycled content 15-100%)/Reclaimed Bricks.

Reclaimed bricks can also aid in character requirements of refurbishments.

- Partitions: Can be built from recycled wood used in construction. Timber quicker to erect and saves material costs. Pitched Roof Plywood from non FSC MDF chipboard (low Construction: formaldehyde), reduces carcinogens from standard chipboard
- Construction: Pitched Roof Reclaimed slates, tiles/Sedum (turf)/Fibre cement tiles.
- Covering: Turf can reduce urban water run off. Green roofs typically last 3x long as standard roof.
- Plasterwork: Lime mortar re-absorbs some of the CO2 given off during the firing process when it sets.
- Sewers: Clay pipe can be recycled to make new pipe, brick and roof tiles.
- Paving: Concrete slabs with recycled content e. g. recycled glass. Reclaimed slabs and stone can be sourced free often paying only haulage costs.
- Semi Hard Paving: Paving Gravel, Wood chippings/Recycled glass, sand. Wood chippings can be derived from off cuts in construction.

Local Sourcing of Materials and Labour:

“ Obtaining construction material from local outlets or from the existing site”;

The use of locally sourced materials should be promoted when issues involve cost, embodied energy and meeting local character requirements are

considered. A local sourcing policy costs nothing to implement and requires no specialist expertise.

Locally sourced materials minimise the impact of fuel transport costs/emissions and support the local economy. Stone, earth and timber (assuming it comes from a sustainable source). Salvaged materials from existing construction or demolition such as steel can also be used.

This previous abstract demonstrates that significant improvements in building sustainability performance can be achieved at very little additional cost. These minimal cost increases also provide ‘ added value’ elsewhere. For example, in the case of sustainable buildings, in-use cost savings of fuel for heating can be generated over the life of the building. With increased uncertainty over future energy costs, a very short pay back period of a sustainable approach can be realised.

Necessities, Not Luxuries

Key to justifying some of these ostensible add-ons is not to view them as add-ons in the first place. Commissioning, for instance, is a critical step in the green building process and a requirement for facility executives planning to certify their buildings with LEED, an internationally recognized green building certification system. On traditional construction projects, commissioning may be considered a luxury. But, according to a study by the National Institute of Building Sciences, commissioning a building can mean it will cost 8 to 20 percent less to operate than a non-commissioned building.

Objective 2: To Recognize Exactly the Current Level of Understanding and Implementation, of Sustainable Construction at the Production and Construction Phase of a Project.

The incentive to innovate among construction SMEs often starts with having an awareness to seize an opportunity or a need to response to market, development or client conditions.

Her are a three motivational needs as described below:

- Survival: Project based innovation focuses more on survival of a company due to the type of market operated in by contractors.
- Stability: When survival has been established firms will look then towards stabilizing and consolidating their position to ensure prosperous conditions over the medium term.
- Development: Once this stability has been attained the motivation necessary to exploit this becomes apparent and the firm will begin to develop and grow.

When SMEs find themselves in survival posture firms do not tend to take as much risks and are more aware of outgoing costs.

Not all firms are want to grow in size indefinitely, companies want to stabilize at a certain that is compatible with the aspirations of the owner.

Innovation activities can be grouped into two areas, improving the effectiveness and the efficiency of the company, meaning making sure the company is doing the right activities and doing them well.

Adoption of new Innovations:

This is dependant on several key capabilities and motivations which are time, financial, company's structure and people.

Time and Financial:

The dominant role of the contractor allows for quick decision making if need be which means that in an ever changing market modernizations in sustainability can always be updated.

Due to a contractor's own resources a contractor will only bid on work according to their own capabilities in terms of types of work and size. Most would also prefer to work directly with clients as main contractors rather than just sub-contractors, this tends to limit risks and costs and is typical of a survival posture.

Company's Structure:

SMEs cannot afford to do as LEs do and have numerous departments assigned to carry out various roles and tasks.

It is the job of many directors and owners to obtain information and knowledge for innovation and also to gain business contacts. Many directors find it hard to manage time for all of this, which could include attending trainings and workshops.

External Supports and Motivations:

These largely come from government policies but are mainly appropriate for large companies and have to be altered to suit the small and medium sized enterprise.

Market Network:

Rapidly shifting client demands and market conditions requires construction SMEs to involve themselves in a number of business's of varying complexity in order to provide knowledge and expertise to their own enterprise.

Access to these companies is achieved through supply and client interactions, research institutions, professional associations and government bodies.

Access to Technology:

Technology can be exploited to increase competitiveness among SMEs but this can only be effective when the knowledge characteristics of the technology can be transferred easily.

SMEs tend to use technologies which can contribute to the growth of a company, financially, quickly and easily, dovetailing into capabilities already possessed by the firm. Technology that is out of that league and that requires more effort to invest risk, time, effort and money are generally shifted out swiftly and intuitively.

Objective 1: To Identify the Main Barriers in Incorporating Sustainable Construction and Embracing New Techniques involved in the Construction Process to SMEs.

Key Barriers to Sustainable Construction:

Facility executives building green for the first time may find that the process requires as much unlearning of old ways as it does learning of new ones. The processes of building green forces facility executives to think about the design and construction process in non-traditional ways.

From integrated design to commissioning, almost every step of the green building process is heavily focused on how building elements fit together to optimize efficiency and sustainability.

The catch is that the process, at least for the first time, is more time and cost. While the strategies used may be similar to justifying expenditures in equipment upgrades, justifying processes may be a bit more difficult. It’s more difficult to pinpoint specific costs for more hours of design time.

The Barriers to Sustainable Construction have been classified under six key headings:

- Cost
- Time
- People
- Technology
- Market
- Legal

These subsequent barriers will be challenged and validated in the following chapter.

Cost:

Increased Construction Costs:

“ There has been a perception by many construction companies that sustainable construction practices may incur additional or perhaps higher capital cost”

(Cameron, R., 2003; KDG, 2006)

The added cost is normally related with additional labour hours necessary to perform activities such as recycling and separation of waste on site.

There is also the argument that sustainable materials bring upon higher search costs; this is the time spent searching for these “ illusive” materials, and other connected costs like driving, phone calls etc.

All of these increase the total cost of a development and eat into a seemingly already tight budget for the contractor and therefore are looked upon as an unnecessary and irrelevant expense.

Many construction companies are forced to submit a low bid for a particular project, and this comes about by reducing construction costs rather than increasing the value gained by building sustainably.

This is also on the increase in the areas of project partnership, where a fixed price tender means priority will be given to the lowest price rather than value for money.

Time:

Time is crucial in any phase of any type of project, most particular in construction projects. As the phrase goes, time is money, and construction developments are often under tight time constraints.

Slow advancement towards a change in attitude:

Because this industry is such a large and dynamic market it involves so many individual players, which means that it becomes so much harder to get everyone concerned to get into the same frame of mind and not to be just concerned with just profit.

There is a feeling that there is too much effort involved and learning new initiatives become too difficult in comparison to just continuing with the tried and trusted methods of known construction techniques already in practice throughout all construction sites in the UK at this present moment.

There is also the point that there is inadequate information on sustainable materials easily available, which means that getting access to manufacturers who supply such materials becomes more intricate and making them prepared within the time constraint of a project becomes too arduous to make the endeavour for.

Training:

Larger construction companies (LEs) usually have their own Research and Development departments but as for SMEs, they are more inclined to rely on directors to research new innovations. Directors also are relied upon to transfer this knowledge and information to staff. Due to their already hectic

workload, directors may find it difficult to set time aside for training programmes, seminars, and workshops involved in development initiatives.

Likewise because of limited staff in small and medium enterprises, it is frequently difficult to attend such time-consuming activities, or to attend such trainings.

Without these regular meetings contractors may find it extremely difficult to establish business contacts.

Emphasis is more on short term performance and speed of construction:

As construction companies are pushed on deadlines and short term maximisation of profit they are mostly interested in traditional construction as they know from experience how long a particular project will take and do not want to be taking risks on new innovations and techniques which could run on longer than previously thought.

The temporary nature of a development, along with short term dealings with people means that the sharing and transfer of information between teams can lead to be strenuous and extremely difficult.

(Sexton. M. G. and Barrett, P. S., 2003a; CPN, 1997)

People:

Lack of Knowledge and Skills:

Most small companies do not have the resources to gain access to information and acquire the knowledge and the skills necessary to partake in

such developments, or in some circumstances to investigate and research new alternatives and the benefits involved in such construction.

Lack of motivation:

New legislations and technologies can be seen as off-putting or even as a threat to SMEs who may not be willing to change with known traditions without substantial financial gain.

Poor Integration with New Procedure:

Failure of communication between contractors, sub-contractors, architects and clients may result in difficulty of implementation throughout a project.

Down to the littlest details like the separation of recyclable material and where to dispense certain products may cause disruption further down the line.

Short Term Interest:

Given the nature of the construction business speed is of the essence, trying to get a building taken off of a contractors hands as quickly as possible is key and therefore, as many developments have to be taken place within certain time limits and contracts are written up to enforce this, the contractor may have more pressing interests nearing the end of a job.

Technology:

Complicated:

Sustainable design may involve MMC (Modern Methods of Construction), which means that the making up of major house elements in factories including panels (including ready-made walls, floors and roofs. Panels may also have wiring and plumbing already inside, making construction even faster) and modules (ready-made rooms, which can then be pieced together to make a whole house or flat but are used most frequently for bathrooms or kitchens, where all the fittings are added in the factory; known as ‘ pods’).

Both of these products require skilled workers to install them, cranes and may require supplementary tools and machines to operate and fix these prefabricated structures into position.

There is also a lack of familiarity with these new technologies. Where the clients and the architects specify such methods but contractors do not get the opportunity to try out these new systems.

Market:

It is widely felt that there is a lack of demand within the supply chain, this is generally due to the unfamiliarity associated with the costs and benefits.

Lack of Marketing for “ Sustainable” Materials:

Sustainable materials are secondary materials; recycle, reclaim and re-use materials, and there are currently no marketing advertisements or such information on these resources.

Waste materials are usually perceived to be risky and a cheap solution to a problem and are thought to not perform to as high a standard as primary materials.

These may also incur greater search costs as they have a more dispersed location.

Dominance by Larger Suppliers:

If a supplier is larger than the contractor then the supplier has more power and is able to dictate to the supplier how the processes involved should be carried out. And as is with the case of most SMEs this is almost always the case.

If the supplier does not have a particular product which a small contractor requests then, more often than not, the supplier doesn’t feel the need to oblige the contractor as the supplier is more interested with the Les, meaning that the SMEs are often overlooked.

Legal:

These aspects include government legislation, policies, and planning procedures.

Limited Enforcement:

Standard of inspections has repelled many companies who may have been interested in building sustainably.

The companies themselves would have to push for higher