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Purpose of the Series

The aim of this publication is to provide an opportunity for students to publish the findings of their undergraduate or postgraduate work. Guidance on publication will be given by staff who will act as second authors. It is hoped that by providing a guided transition into the production of papers that students will be encouraged throughout their future careers to publish further papers. Guest papers are welcomed in any field relating to the Built Environment. Please contact E.A.Laycock@shu.ac.uk. A template will be provided on request.

Acknowledgements

The editorial team would like to acknowledge and thank Will Hughes, Professor in Construction Management and Economics, University of Reading for permission to use the ARCOM template and the associated resources.

EDITORIAL

Welcome to volume 8 of the Built Environment Research Transaction (SHU-BERT). It does not seem that long ago that I was working on the very first edition, and worrying that students would not see the value of the journal. I am still very pleased to be proved wrong each year, and for the student authors to put themselves forward to showcase their research work. I have always believed that an undergraduate dissertation should be the chance for students to shine, to follow a topic which is of interest to them, or will be of use to them in the future. I feel that the skills and attributes most valued in a rounded graduate are demonstrated here; determination and dedication, communication and negotiation and a good deal of hard 'graft'.

I am always very proud of the students that throw themselves wholeheartedly into their projects and really push their own limits as they strive to achieve the best mark that they can. While students may judge their own performance by the final grade, they may fail to see that it is the attitude to the journey they make which counts.

I hope that you enjoy reading these articles.

Prof. Elizabeth Laycock

Editor, Built Environment Research Transactions

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INVESTIGATION IN TO CONSTRUCTION SITE WASTE MANAGEMENT PLANS AND THEIR IMPLEMENTATION

Calum Volrath[1]

Calum Volrath studied Construction Project Management at Sheffield Hallam University and graduated in 2016 with a 2:1 before going on to work as a project manager for Kentdale Construction Ltd.

This paper is an investigation in to site waste management plans and their implementation on the construction site. The aim of the research was to establish an understanding of the selected company's SWM (Site Waste Management) system, while comparing the opinions of those within the company, on the execution of these systems. The research was conducted in the form of a literature review, questionnaires, field observation and interviews. The primary data focused on the site waste management systems of a specific small scale company. The research established that industry professionals do not hold site waste management as a project priority during the construction process. Currently the company in the study does not possess a formal SWMP (Site Waste Management Plan), or appointed manager for the process. It is therefore recommended that the company formalises a system to manage waste generated on site with an appointed member of the organisation made responsible for the process. While SWM is seen as a low priority this will be a significant barrier to the effective management of waste within the industry.

Keywords: Industry Attitudes, Plan Implementation, Site waste, Waste management.

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INTRODUCTION

The aim of the research was to establish an understanding of the selected company's SWM (Site Waste Management) system, while comparing the opinions of personnel within the company, on the implementation of site waste management. The research was conducted in the form of a literature review, questionnaires, field observation and interviews. The primary data considered the current practice of site waste management systems within a specific small scale company.

RESEARCH METHOD / RATIONALE

The initial research was conducted by means of a literature review, this provided background information on SWM both within the UK and Australia (as a similarly developed economy). The literature provided the basis for the questionnaires, which were distributed to employees of the selected company during the observation period. Follow up interviews were conducted with the company's Junior Manager and Project Manager, the interviews were designed to elaborate the results of the questionnaires and observations made of the companies SWM practices on site. The research questionnaire findings were analysed statistically, with the interviews and field research, were coded with similar ideas and themes being linked.

LITERATURE REVIEW

Definition of SWM

SWM is the process of managing waste on site; this includes the collection, transportation and disposal of waste materials/ goods (WMR, 2009). It is recommended that Site Waste Management Plans (SWMP) are developed prior to the onset of the project, as the initial step is estimating the types of waste that will be generated during the construction process along with the quantity (SWMP, 2011). During the project the removal of each type of waste and quantity are to be recorded, in order for reports to be formulated to ensure "*waste is dealt with in the most effective and profitable way possible*" (SWMP, 2011).

History

Waste is defined as "…*any substance or object which the holder discards or intends or is required to discard*…" (DEFRA, 2012, 1995). The construction industry is renowned for having a bad reputation with clients and the public

for wasteful behaviour (Farell, 2011). In 2008 the construction industry was responsible for producing 109 million tonnes of waste, 24% of the total waste produced nationally (Constructing Excellence, 2008). In excess of 400 million tonnes of materials are delivered to construction sites annually, and of this 60 million tonnes are discarded due to over ordering, damage and poor storage (Baker, 2008).

"*The cost of waste disposal in the UK has traditionally been low since sites suitable for landfill have been readily available*" (The University of Gloucestershire, 2008). This is no longer the case with ever increasing Landfill Tax introduced in October 1996, as the government puts increasing pressure on the industry to become more sustainable (The University of Gloucestershire, 2008). Figures show that the construction industry has a huge impact on the amount of waste produced nationally (BRE, 2006). SWM stipulates the methods to minimise this while simultaneously benefiting contractors and the environment, indirectly giving the industry a better name through good practice.

Regulations regarding SWM

The Department of Trade and Industry (DTI) Site Waste Management Plan 2004 voluntary code was introduced to improve waste management within the industry. The voluntary Code of Practice was aimed at clients and contractors, setting out basic SWMP structures while providing guidance on best practices (Envirowise , 2007).

Site waste management plan regulations were put into effect in 2008, making practices set in the DTI 2004 plan a legal requirement (Envirowise , 2007). Any construction or demolition project in the UK equal to or exceeding £300,000 was subject to the legislation (Legislation update, 2013) while projects in excess of £500,000 were subject to more detailed requirements (stricter regulations). Failure to comply with regulations resulted in prosecution with the potential of £50,000 or on the spot penalties and both companies and individuals were liable if found not to have followed the correct procedures (SWMP, 2011).

The SMWP regulations were put into place in an attempt to achieve 3 main objectives:

1. Improved efficiency and profitability
2. Reduced fly-tipping
3. Increased environmental awareness of the workforce and management

The Regulations waste actions follow the hierarchy outlined by Wrap;

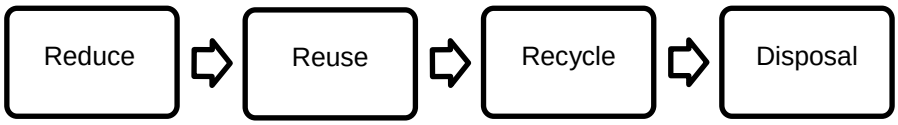


Figure 1 Wrap Waste Hierarchy (Wrap , 2013)

Following an extensive review of 21,000 individual regulations the government retracted the plan, and SWMPs are no longer mandatory. This came into effect in 01/12/2013. However SWMPs are a requirement with some local planning authorities (depending on the project), or for projects attempting to achieve BREEAM standards (Legislation update, 2013).

The regulations were retracted when the major problems with them were identified; while local authorities and environmental agencies have power, they did not possess the duty to enforce regulations. The £300,000 threshold was too high as the regulations were designed to cut fly-tipping, but most instances of fly-tipping within the industry occur with contracts below the £300,000 threshold. While statistically fly tipping has been on the decline, it has remained at the same level within the industry. DEFRA (the Department for Environmental, Food and Rural Affairs) estimated that the retraction of the regulations would save businesses £3.9 million in administration costs (Legislation update, 2013).

The burning of waste is seen as being damaging for both the environment and the reputation of the industry. The potential for the re-use or recycling of waste materials is lost when burning is employed as the waste management system, along with the pollution of air, land and water in the local area (Net Regs , 2016). The Environmental Protection Act 1990 placed a duty of care onto businesses requiring waste to be disposed of in a suitable manner. Burning is not deemed to be a suitable method by which to dispose of waste, with offenders found to have breached their duty of care liability, risking prosecution and fined upon conviction (Wrexham, 2010). Smoke caused by any fire that causes statutory nuisance to neighbouring properties will receive a notice with failure to comply resulting in prosecution (Wrexham, 2010). The Clean Air Act 1992 specifies that it is an offence to burn anything that produces black smoke on an industrial or trade premises with offences resulting in a maximum penalty of up to £20,000 for each offence committed (Wrexham, 2010).

Fly-tipping is the illegal dumping of waste within an area not designated for that use (Dudley , 2016). The Environmental Protection Act 1990 finds the action of fly tipping in violation of section 33(1)(a), which can result in a fine

or prison sentence (Goverment Statistical services, 2015). During the 2014-2015 financial year there was a total of 9,000 incidents dealt with by local authorities, an increase of 5.6% from the previous financial year. Authorities state that the increase in incidents recorded may be due to better surveillance rather than an actual increase of the number of incidents (Goverment Statistical services, 2015). Incidents occurring within the construction industry are typically synonymous with smaller construction companies (Legislation update, 2013), and the industry as a whole contributes to 5% of the total percentage of fly-tipping incidents. (Goverment Statistical services, 2015).

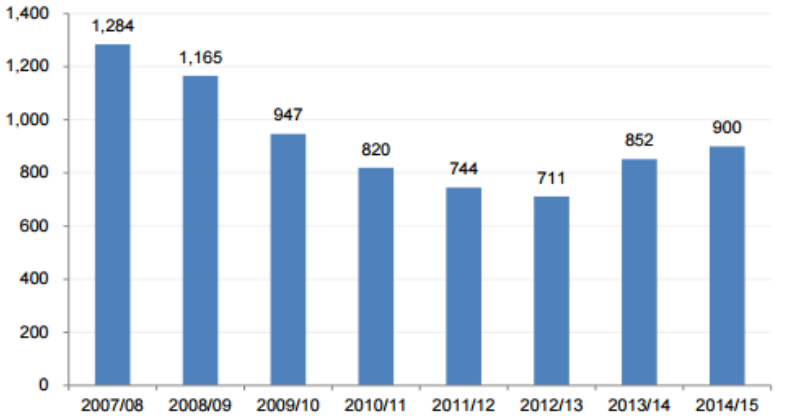


Figure 2 Trends in number of fly tipping incidents in England (thousands) (Goverment Statistical services, 2015)

The government's strategy for sustainable construction (2008), aims to achieve the following:

- Increasing profitability by using resources more efficiently;
- Firms securing opportunities offered by sustainable products or ways of working;
- Enhancing company image and profile in the market place by addressing issues relating to Corporate and Social Responsibility.

(Vadera & et al, 2008)

Among the sustainable goals, the strategy outlined plans to reduce the construction, demolition and excavation waste directed to landfill by 50% in 2012 (Vadera & et al, 2008). WRAP declared the strategy a success with over

800 companies signing on to reduce waste to landfill by 50% (Wrap, 2016). Implementation of the strategy saw a reduction of 28% of waste directed to landfill in the first year (2009). The figure rises when the spending within the industry is taken into account: waste sent to landfill per £ million was decreased by 44% as seen in Figure 3.

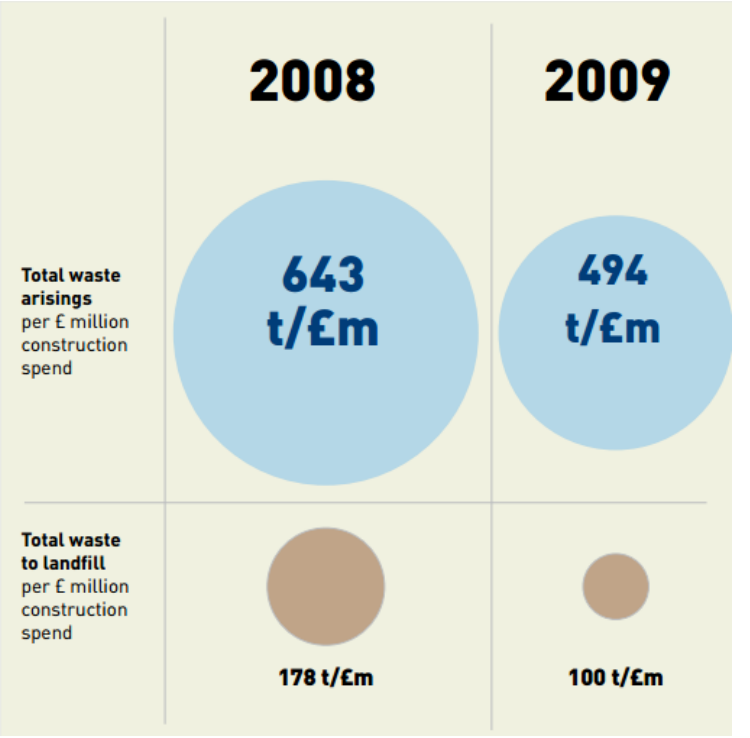


Figure 3 Reduction of waste to landfill 2008-2009 (Wrap , 2011)

Opinions Regarding SWM

"*Construction is a labour-intensive industry and consequently, the effectiveness of waste management practices are dependent on the willingness of individuals involved in the construction process to change their attitudes and behaviour*" (Teo & et al , 2000). This builds on Faniran and Caban's (1998) theory that identified that waste is linked more closely to human factors rather than the type of construction or the company carrying out the work. Both studies identify the success of SWM being linked to those participating within the industry's willingness to carry out SWM.

The research on Operatives' attitudes towards waste on construction project, conducted a number of surveys regarding SWM:

Responsible Party	% of Respondents
Project Manager	42.8%
Site foreman	29.7%
Environmental Officer	24.6%
Sub-contractors	18.1%
Tradesmen	10.1%
Labourer	10.1%
Everyone	69.6%

•Percentage for each category calculated from a total of 100%

Table 1 Responsibility for waste management on-site (Faniran & Caban, 1998)

Table 1 shows the findings from work on who is responsible for the delivery of reduced wastage on site. The table identifies that, although there is recognition that everyone has a duty to be responsible for waste reduction on site; site managers are ultimately responsible. Further research showed that site foremen identified themselves as being most responsible for reducing waste on site while tradesmen on site felt more obliged than the other occupations to take it upon themselves to reduce waste on site (Faniran & Caban, 1998).

Project goals	% of Respondents
Cost	44.9%
Time	55.1%
Quality	70.3%
Waste management	10.9%
Safety	71.0%
Productivity	44.2%

*Percentage for each category calculated from a total of 100%

Table 2 Project goals identified as important for a construction project (Faniran & Caban, 1998)

Table 2 identifies which aspects the respondents viewed as the most important project goals during the construction project. Waste management is

viewed as the least important goal to achieve when working within the industry.

Reasons behind the prevention of reducing waste have been attributed to time pressures, space constraints, lack of incentives, inadequate on-site facilities, lack of knowledge and the operative's attitudes towards waste on the construction project study (Teo & et al , 2000). Within the construction industry, small scale construction companies view the implementation of SWM as a financial burden that would result in "financial losses" (Williams & Turner, 2011). Williams and Turner (2011) conducted research that specifically focused on the way in which small construction companies implement SWM on site. Major obstacles facing the application of SWM were identified as the limited space on site for the use of multiple skips for the segregation of waste and the perception of increased costs incurred for carrying out SWM practices. The research presented stock control as the most effective method of reducing site waste as it reduces the risk of over ordering while ensuring materials are available onsite when necessary (Williams & Turner, 2011).

Literature Review Summary

SWM is the process of coordinating and carrying out the collection, transportation and disposal and/or recycling of waste. Literature indicates that the SWM is dependent upon the attitudes within the industry. Faniran and Caban's (1998) research shows that the industry does not place much importance on SWM as only 10.9% of the respondents highlighted SWM as a project goal. This is not a good indicator as supplementary research suggests the success of SWM has a direct correlation to attitudes of those practicing it. SWM is described as a process designed to increase efficiency and profitability whilst simultaneously reducing the impact the construction industry has on the environment. SWM is presented as a practice with seemingly no negative aspects, Williams and Turner (2011) suggest that not all professionals within the industry share this view. It is suggested that small scale construction companies regard SWM as a costly procedure not worth investing in.

RESULTS

Primary research was undertaken using a questionnaire. Table 3 presents the views of respondents and showed Safety to be the most important outcome for a project followed by the Quality of work produced. Time and Cost were

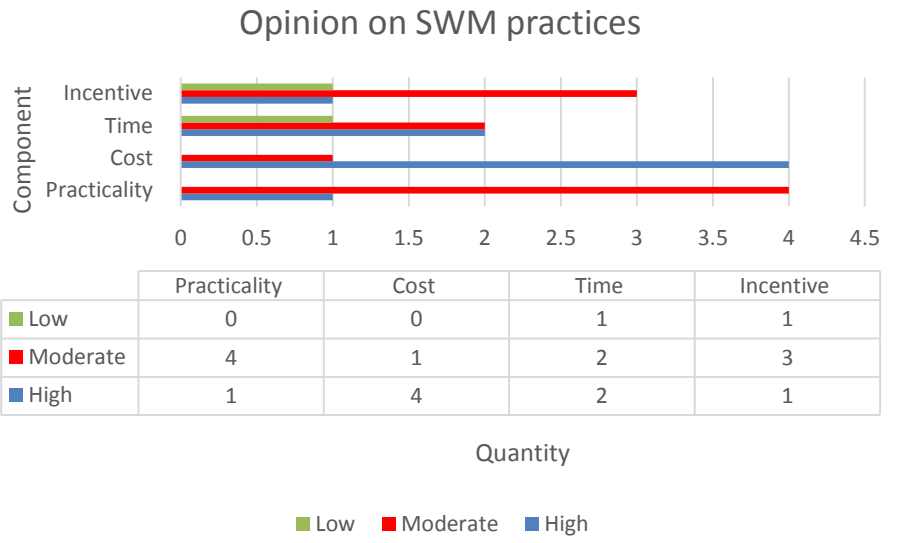
ranked equally below quality and SWM was identified as being the least important project goal.

Ranking	Project goal	Score
1	Safety	22
2	Quality	19
3	Time	14
3	Cost	14

Table 3 Ranking of project goals by priority on site (Source: Author)

Respondents were asked to identify which factors restricted the implementation of SWM on site and to what extent. The most important challenges facing the implementation of SWM on site were seen as attitudes within the construction industry, client expectations and the increased workload of carrying out SWM practices as being the biggest challenge facing. While not identified as an issue of the upmost importance, the cost of carrying out extensive SWM and the lack of training personnel to undertake this were selected as factors of importance that restrict the adaptation of effective on site practices. The final question of the questionnaire asked respondents to identify how they viewed the process of managing waste in regards to practicality, cost, time and incentive as seen in the responses in Figure 4:

The research findings show that personnel within the company view SWM as a moderately practical operation on site, with one respondent rating it as highly practical. The cost implications of implementation were seen to be expensive, with a majority of respondents associating SWM with high costs. A range of answers were provided by the respondents regarding the time implications, with one of the employees identified SWM as not being a very time consuming practice with the remaining participants selecting the process as being moderate to a highly time consuming process. There was some indication that participants had moderate incentivisation to carry out SWM, although opinions varied across the whole range of responses (Figure 5).



	Practicality	Cost	Time	Incentive
Low	0	0	1	1
Moderate	4	1	2	3
High	1	4	2	1

Figure 4 Challenges facing SWM within the construction industry Questionnaire responses (source: Author)

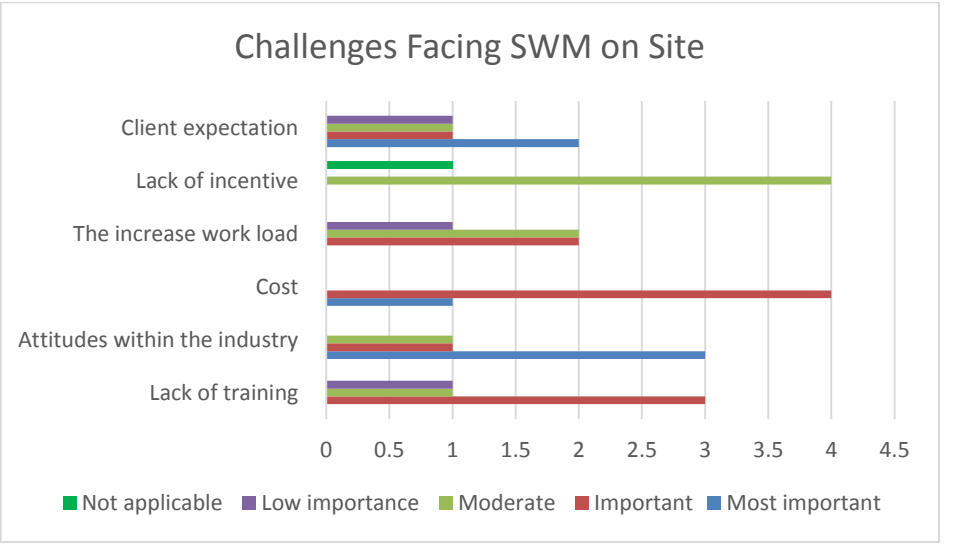


Figure 5 Opinion regarding specific components and SWM Questionnaire responses (Source: Author)

Interviews were undertaken with two managers and thematic coding carried out to determine whether SWM was being referred to positively or negatively to gauge the interviewees' feelings towards its implementation on site. (Table 4)

Interview	Positive	Negative
Interview 1	11	28
Interview 2	26	37
Total	37	65

Table 4 Record of positive and negative association of SWM (Source: Author)

SWM was referred to 102 times during the two interviews, the majority of this was done with a negative connotation (63.73%). The junior manager and the project manager positively described SWM 37 times. These results demonstrate that the positive impacts of SWM as presented are not fully realised within site professionals in the specified company.

Identification of the selected companies current SWMP

- The company implements a simple plan of a mixed skip used for the disposal of all site waste.
- The skip is specifically packed to insure that each skip maximises the amount of waste disposed of per load.
- The company looks to reuse materials when possible as money is saved through not having to pay for the disposal of waste.
- The SWMP is adaptable and will be changed in order to reduce project costs when possible.
- The management of waste is outsourced to a third party that sorts the waste at a recycling plant.

The Company's SWMP practice was determined through a week-long observation period of the company's SWM practices on site. It was observed that the company adopted a basic SWM policy for the studied refurbishment project. The company made use of a mixed skip that all site waste was deposited into. The SWMP was flexible with changes being made during the course of the project, with locals in the area asking for the timber to be separated in order to be reused. The joists were freely given as it created extra

space within the skip, reducing the quantity of skips required during the project. The company was also able to sell floorboards removed from the flats during the refurbishment, making a profit from the reclaimed material.

The operatives of the company that completed the questionnaire all cited a lack of training as being a restriction to the effective implementation of SWM; 40% of employees stated that they had received limited training in the management of waste. During the interviews the project manager explained that due to the basic nature of the SWMP, employees did not require extensive trading in order to carry it out to the companies required standard.

Waste removed from site by a third party was sent to be sorted in a recycling centre with non-recyclable material being sent onto landfill. The manager outlined specific instruction on how the skip should be packed by the employees in order to maximise the usable space. The project manager stated in the interview that for the type of work the company was undertaking there was no incentive to adopt a more extensive SWM system.

The opinions of the different ranking employees within the selected organisation on SWM.

- Both management and the employees within the organisation ranked SWM as a project goal of lowest importance.
- The practices of SWM are labelled as being an expensive practice.
- The majority of operatives within the company felt that there is a lack of SWM training.
- There is a lack of incentive for operatives to more extensively implement SWM on site.
- The interviews conducted with the managers identified the only incentive for implementing SWM as being the advertisement opportunity it provides within the local community

Execution of the selected companies SWMP on site

- The SWMP was carried out as outlined by the project manager.
- Deviations were made to the original SWMP during the construction process.
- Employees implemented the plan as instructed.

As seen during the field observation, the employees assigned the task of demolishing the shop storage room and disposal of the waste, carried out the task as instructed by the project Manager. Waste was temporarily stored in an alleyway behind the site, with waste being moved into the skip during the last hour of each working day. This method was adopted by the employees not through instructions issued by management but the employees were entrusted to accomplish the task using their own judgment. Timber joists were initially placed in the skip but moved at the project manager's request so that they could be recycled. The team efficiently removed the timbers and OSB board, piling it next to the skip for removal from site. There was no formal SWMP for the project other than the separation of metal for recycling. The SWMP was self-explanatory with employees expected to use the skip provided, and during the project the plan was adapted with wood also being separated for recycling.

DISCUSSION

The research work demonstrated that on site, there are a number of project outcomes desirable for the client and contractor. Research conducted by Faniran and Caban on operatives' attitudes towards waste on construction sites in Australia (1998) concluded that site safety was the most desirable outcome from a project and this was similarly the case from the questionnaires completed by the operatives within the selected company in this work, similarly SWM was shown in both studies to be the least important project outcome. Literature surrounding the implementation of SWM on site shows that personnel within small construction companies do not view this as a practice of significance, as publicised by Williams and Turner's study, where SWM was seen to be a practice resulting in financial loss (Williams & Turner, 2011), again mirrored in the findings of this work.. While projects have been recorded making significant savings through managing waste, the prevailing opinion that SWM increases project costs persists (Williams & Turner, 2011). The two interviewees identified the limitations to SWM as being space restrictions on site and the skill level of the actual employees responsible for carrying out the practices capabilities. Interviewee one explained that small companies operate on small sites, and are not able to implement systems such as the segregation of waste as there is only enough space for one mixed skip on site. Interviewee two agreed with the findings from the Williams and Turner study and the Faniran and Caban study, stating that employees are uninterested with the process of managing waste and do not follow instructions issued by management. The reason for this was

explained as being a lack of incentive. Employees do not receive extra pay or recognition for carrying out SWM correctly, even if the company is able to cut project costs as it is an expectation.

The study found that to an extent the management within the company and employees share similar views regarding the implementation of SWM, however, on some issues there is a clear divide in opinion:

- Management identifies attitude towards SWM as a major issue, while employees view it as less of a problem regarding the implementation of SWM.
- There are mixed opinions regarding the amount of training received for SWM.
- Both the manager and employees were in agreement that carrying out extensive SWM is a highly costly practice.
- The increased work load of applying extensive SWM was seen as a deterrent by employees, while the managers within the company did not identify this as being a major problem.
- All parties were in agreement that there is a lack of incentive for the application of extensive SWM on site.
- Managers identified clients as having a strong link to the type of SWM applied on site. The employees did not credit clients as having as much of an influence with the SWM systems used on site.
- All operatives within the company agreed that SWMP's are changed during the construction process.
- There was confusion amongst both the managers and employees as to who was ultimately responsible for the management of waste on site.

Both parties were in agreement that SWM is a costly practice with minimal incentive for its implementation. The managers further explained in the interviews that the quantity of waste produced on the small sites worked on is not enough to require the use of segregated waste streams, and that such a practice would only result in increased project costs. Similarly there was agreement from all of the company operatives that the SWMP would be deviated from during a project, the only difference being the degree to which

it would change. The questionnaire results ranked the clients as the least responsible for the management of waste during a project and the project manager explained that while they are not involved in the project management they do have an influence on the type of system used for the project.

CONCLUSION

Based on my findings to the investigation in to site waste management plans and their implementation on the construction site, all objectives identified were achieved. The paper engaged a range of research methods in an attempt to mitigate the disadvantages of the data collecting system while benefiting from the advantages of both systems (Fellows & Liu, 2008).

The industry perceives SWM in a negatively as it is seen to be a financial burden rather than the cost saving system it is advertised as. Literature has linked operative's opinions regarding SWM as having a direct correlation to the extent to which it is implemented on site. This bodes a problem for the industry as many do not regard SWM as a priority or a particularly beneficial practice, which suggests the development of SWM as being restricted within the industry.

The Government has made attempts to better the management of waste within the construction industry, however, oversights with regards to small scale contractors lead to the redaction of the plan in 2013. Part of the plan's major failings was its inability to reduce the number of fly tipping incidents occurring within the industry, as it is typically small scale projects worth less than £300,000 responsible, which the plan was not targeted at. The level to which SWM is implemented on site is agreed upon by clients and contractors, with government guidance provided under the 2004 DTI Site Waste Management Plan voluntary code. Large scale construction companies typically have a more structured approach to SWM with formalised systems in place. The benefits of implementing SWM are well documented for large scale projects. Operatives within the selected small scale companies feel the large companies are better equipped to implement SWMP's.

The aims established at the onset of the paper were:

- To identify how closely site waste management plans are followed on site.

- To evaluate the principle areas of concern regarding site waste management, identifying the effects and identify possible improvements for SWM within the selected company.

The first aim of the paper was met by initially identifying the SWMP for the studied refurbishment project. The process of managing waste was then observed over a 5-day period, and compared against the initial SWMP. The company implemented a simple SWMP that the employees carried out with alterations as issued by the Project Manager. The second aim was achieved through the field study, questionnaires, and follow up interviews. It was established that a major limitations facing the implementation of SWM for the company was insufficient space on site, along with the operative's attitudes regarding SWM. The effect of these restrictions, lead the company to employee a simple SWMP with the use of one mixed skip for the majority of the company's projects.

The Junior Project Manager refers to SWM as being an after-thought, in order for the process of managing waste within the construction industry to improve it must become part of the construction planning process. For SWM to truly become integrated within the industry, the way it is regarded by industry professionals must change, or the success to which it may be implemented will forever be restricted.

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An investigation into domestic sprinkler systems for the North Kesteven area.

Sharron Routledge[2] and Liz Laycock

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The study compared views and opinions of householders within the North Kesteven area on the use of domestic sprinklers; to determine if new build installation or retrofit would be a desired option. In 2004 a report by Building Research Establishment (BRE) commissioned by the UK Government concluded that sprinklers were not cost effective in domestic premises as the benefits did not outweighing the costs, whereas they were deemed to be cost effective in care homes and high rise dwellings. A report for the Welsh Government, also by BRE in 2012 reached the same conclusion. However the Welsh Government decided that sprinkler installations would be mandatory in all new build and conversions from January 2016. The work found that there was reluctance on the part of insurance companies to offer incentives to homeowners to install sprinklers and that householders were generally only interested in installation if there were no additional costs. Some of the resistance is probably due to a misconception of the levels of accidental activations. With the move towards the provision of lifetime homes and the increased vulnerability of occupants with age this issue will need to be reconsidered.

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Keywords: Cost, Domestic, Fire, Government Sprinklers.

INTRODUCTION

The installation of sprinklers in domestic properties has been a topic of discussion in Building Control for a number of years; this research looks further into the following areas.

- In dwellings sprinklers are not mandatory in England and Scotland, however it would be an easy option to fit during construction.
- Lifetime homes are a Government directive, sprinklers are recommended as desirable for care homes; given an ageing population this should be included in dwellings.
- It is accepted at above 30m a building is classed as 'tall', existing literature states sprinklers are cost effective in tall buildings.

The main issues that have arisen from the literature review are that cost is a major factor into the decision not to have sprinkler systems in single domestic dwellings (BRE 2004). The study will investigate attitudes and opinions of Fire Officers, those within the construction industry and selected householders within the North Kesteven area. This will be used as a primary aim of establishing views as to whether domestic sprinklers should be installed either as new build or retrofit.

RESEARCH METHOD

An extensive review of literature was carried out using text books, Government publications, and published data from professional organisations. The main source of primary data was collected using questionnaires distributed to a number of professionals and selected members of the North Kesteven using open and closed questions along with semi-structured interviews with construction industry professionals to allow the collection of quantitative and qualitative data as outlined by Fellows & Liu (2008: 28). A questionnaire was developed and an initial pilot was tested to allow refinements to be made. A total of 356 questionnaires were sent to residents of North Kesteven using SNAP survey; 154 responses were received.

Aims

- To investigate the value residents of North Kesteven would place on the installation of a domestic sprinkler system.
- To conclude whether new build installation or retrofit is a desired option.

Objectives

- To identify the history of domestic sprinklers.
- To compare the value homeowners would place on a domestic sprinkler system.
- To determine if retrofit or new build sprinkler installation would be a preferred option.
- To establish opinions on domestic sprinklers from Fire Officers, the construction industry and householders.

LITERATURE REVIEW

In England during the period of 2014-15 there were 28,200 accidental dwelling fires in which there were 258 deaths. The majority of these were from people being overcome by smoke or toxic gases. The risk of dying in a fire for people over 80 is more than four times the average, also there is a higher than average death rate in people between the ages of 65 and 79 (Department of Communities and Local Government 2015).

The main causes of accidental fire remain misuse of equipment, these have decreased by 22% in a 10-year period. The biggest fall has been in chip pan fires; these have fallen by 71%. It is reported that 63% of all fire fatalities in the home were the result of accidental causes. In 69% of home fires smoke alarms were present, in 39% of the cases the alarm was raised. Almost 40% of the deaths were in homes where no smoke alarm was fitted (Department of Communities and Local Government 2015). Sprinklers were first used in the 1850's in textile mills throughout New England to protect them from fire. A perforated pipe was connected to the mains and manually operated. Inventors began experimenting with automatic sprinklers in the 1860's with the first one being patented in 1872 by Phillip W. Pratt. Henry S. Parmalee invented the first automatic sprinkler head, he created a better sprinkler system based upon the patent of Phillip W. Pratt (Wormald 1923).

Sprinklers have been widely recognised as an effective means of fire protection to property and life. In Scottsdale, Arizona a byelaw was passed in 1986 that all new build domestic properties were to have sprinklers (Scottsdale 2015). In 2013-14 there were 322 fire-related deaths in Great Britain (Department of Communities and Local Government 2015). Sprinklers in some form or another have been around in the USA since the 1800's at which time business owners had recognised potential loss of their businesses to fire, even back then the focus was on loss of money rather than the lives lost due to fire (Siarnicki 2001).

Every year hundreds of people suffer injuries or die in fires. There is clear evidence sprinklers can be effect in stopping fire spread and extinguishing them. (Cheshire Fire & Rescue Services 2016) There have been initiatives to encourage sprinkler use, for example by the Cheshire Fire & Rescue Services leaflet 2016, and the campaign started in March 2012 by Derbyshire Fire & Rescue providing £20,000 funding towards retrofit sprinklers, offered to local councils or housing associations on the basis they would match the funding up to the same amount. At that time ten local authorities had committed to the scheme, and the funding was used to retrofit sprinklers in dwellings that had been identified for vulnerable persons at risk from fire. Following the success of the project in 2013/14 a further £200,000 was set aside by Derbyshire Fire & Rescue Services to extend the scheme. (Derbyshire Fire & Rescue 2015)

Reports commissioned

The three government reports into the installation of domestic sprinkler systems are summarised in Table 1, 2 & 3 while their reported effectiveness is shown in Figure 1.

Study	Effectiveness
Building Research Establishment (BRE) Office of the Deputy Prime Minister (ODPM) Study 2004	Death 70% Injury 30% Damage 50%
Fire Sprinkler Association (FSA)Critique of ODPM Study	Suggested above range should be 85% - 100%
BRE Study for Building Standards Division (BSD) 2008/09	Deaths 90% Injury 61% Damage 75%
BRE for Chief Fire Officers 2012	Deaths 90% + (62% elderly care, 30% disabled care) Injuries 51% - 73% (lowest for children and disabled) Property 87% - 93%
BRE for Welsh Assembly Government 2012	90%- 100% deaths (63% care homes and sheltered) 62% - 64% injuries 88% - 93% damage

Figure 5 - Effectiveness of sprinklers (Optimal Economics 2015)

Despite the conclusions of the report, Environment Minister John Griffiths announced plans for all new and converted domestic buildings in Wales to be fitted with sprinkler systems. He said "We must seek to prevent avoidable death and injury from house fires and need to accept that there is a cost to introducing sprinklers in new properties". Mr Griffiths said with the introduction of sprinklers a predicted 36 lives and an estimated 800 injuries would be prevented between 2013 and 2022. The report found during the same period the cost per life saved of the sprinklers policy would be £6.7 million. "*According to UK fire statistics (2001 to 2010), there are an average of 2168 fires, 17 deaths and 503 injuries in domestic premises in Wales every year. ... These proposals are significant and important in taking forward fire safety. Wales will be at the forefront of reducing fire risk and cutting the number of avoidable deaths and injuries caused by fires in domestic premises*" (Government 2015)

Commissioned by	Office of the Deputy Prime Minister (ODPM) UK Government		
Report title	The effectiveness of sprinklers in domestic premises		
Work undertaken	BRE	Date	2004
Statistical analysis of data from USA and Canada showing links between risk of death, injury and damage caused by fire, forming a basis for the effectiveness of sprinklers			
Cost benefit analysis using a range of domestic situations including different height buildings, the analysis showed the costs of installation, provision of water supply, annual maintenance costs and the reduction of property damage.			
18 controlled fire tests were carried out to examine how effective the sprinklers were including a comparison of situations with and without sprinklers.			
Experiments a further 8 lounge fires inside a two storey house with a loft conversion and 29 compartment fires with and without sprinklers were tested, the aim was to study the effects of sprinklers with differing fuel types and measure the effect of the sprinklers in the suppression of smoke (Figure 2, Figure 3). The ignition source for these tests was a candle placed too close to the television			

Table 4 - Summary of 2004 UK Government report

Commissioned by	Welsh Government		
Report title	Cost benefit analysis of domestic sprinklers for Wales		
Work undertaken	BRE	Date	2012
The value of a statistical life used in the report is based on Department for Transport "willingness to pay" figure taken from the Green Book.			
Finding: sprinklers are not cost effective in single occupancy houses, shared houses, hostels and sheltered houses			

Table 3- Summary of 2012 Welsh Government report

Commissioned by	Scottish Government		
Report title	A9588006 – Review the cost Effectiveness of Sprinklers in Domestic Properties		
Work undertaken	BRE	Date	2015
‘identify whether the introduction of sprinkler systems could demonstrate value for money for Scotland when compared with the value typically put on a statistical life in other sectors (e.g. health and transport) of around £1.6m and fire a fire injury around £20,000’			
Data collected on the costs and risks of fire in dwellings in Scotland. These were obtained from Scottish Fire & Rescue Services.			
Assessment of effectiveness of sprinklers in preventing death, injuries and serious property damage in fires.			
The existing literature on sprinkler effectiveness in the prevention of death, injury and damage to property was reviewed. The cost benefit analysis was measured using reduction in deaths, injuries and property damage that would be prevented by installing sprinklers. The prevention of deaths and injuries were given a monetary value using the Governments Green Book.			

Table 2- Summary of 2015 Scottish Government report

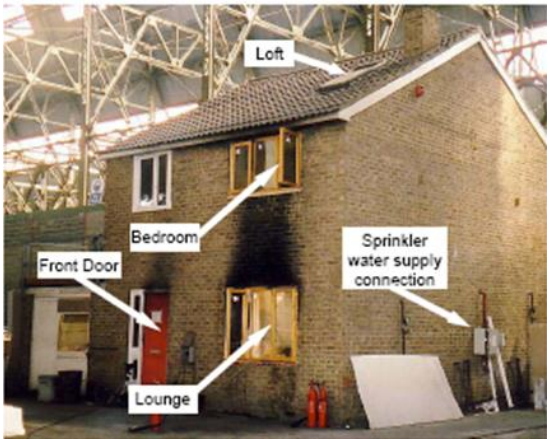

Figure 2 - Photograph of test house (BRE 2004)

Figure 3 - Ignition source for test fires (BRE 2004)

The combined results from the three reports are presented below;

Findings of the UK Government Report

- Sprinklers proved to be effective in the potential reduction of casualties.
- Sprinklers were found to not be a complete solution, slow growing fires were an issue.
- Closing doors were found to be effective in controlling fires in connecting rooms, by allowing time for escape.
- Smoke alarms activated in half the amount of time it took for the sprinklers to activate and well before conditions became life threatening.
- Sprinklers were found to be cost effective in domestic care homes and tall blocks of flats.
- They were deemed not to be cost effective for other dwellings unless installation and maintenance costs were minimal, and/or trade-offs provided to reduce costs, putting a monetary value on human deaths and injuries (BRE 2004).

Findings of the Scottish Government Report

The report recommended that sprinkler systems would likely be cost effective for particular elements of the community (for example people living in deprived areas, single men, older people and people with drug and alcohol problems). The recommendation was made that sprinklers be installed in new social housing flats, single person household and new bedsits in HMO's for those identified. The report reinforced previous research findings that the installations of sprinklers in single family dwellings were not cost effective, however progress in achieving cost reductions would strengthen the case for the installation of sprinkles (Economics 2015)

Outcomes from the Welsh Government Report

The Welsh Government has made amendments to Building Regulations, Approved Documents B volumes 1 and 2, with new regulations and guidance. The amendments have arisen from the Domestic Fire Safety (Wales) Regulations. The requirements apply throughout Wales from 1st January 2016 and apply to all new build and change of use applications forming:

- New houses and flats

- Care homes
- Rooms for domestic purposes (other than hotel, hospital, prison or short stay leisure hostel)

RESULTS

Questionnaires and Interviews

A response rate of 43% was generated from the 356 questionnaire distributed. Several misconceptions were identified from the return indicating that the public is not fully informed about sprinkler systems in general. These responses included 17.5% who believed that in the event of the activation of part of the system, all sprinkler heads activated. Additionally just under a quarter (23%) thought that sprinklers were likely to cause the same amount or more water damage as a fire fighters hose (the actual figures for a sprinkler system is approximately 30 – 40 litres per minute and a fire fighters hose is 1000+ litres per minute).

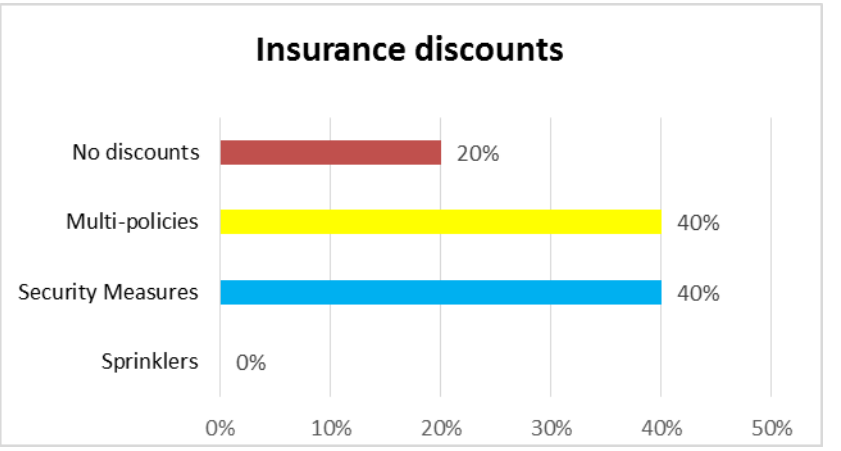

Figure 4 - Insurance discounts offered

The fire officers interviewed were of the opinion that sprinkler installation costs for new build were relatively in line with other new buyer incentives (e.g. the inclusion of carpets), but felt that occupiers needed to be educated on the benefits of sprinkler systems and recognise why they were needed before any mandatory requirements were put into place. Insurance companies were contacted to ascertain if they would offer any financial incentives for sprinkler systems as suggested in the literature, the responses received

showed they were more concerned with properties being broken into than catching fire (Figure 4).

CONCLUSION

The literature review examined the history and performance of sprinklers, and reviewed the outcome of sprinklers fitted in both the USA and UK. The BRE Report showed when fires were started in rooms where sprinklers have been installed, the conditions within those rooms never reached a point where lives could be lost.

Fire Officers felt that sprinklers would reduce the amount of lives lost in fires, with constant cuts by Government to public services, especially in rural areas where time to respond to fires is generally longer than in a city, the fact that sprinklers are proven to be effective should be considered. Some Fire Authorities were found to have already begun promote the fitting of sprinklers in homes for people that have poor mobility for example the elderly, where they perhaps cannot respond to audible devices.

Insurance companies, although possibly standing to benefit from widespread use of sprinklers are not currently actively incentivising their installation. While householders were in favour of having a sprinkler system if no cost was involved, they were not in favour of mandatory installation in existing properties; and they were divided on whether a sprinkler should be fitted in new build.

It appears that they only way for sprinklers to be incorporated in dwellings in the UK is for them to be made a mandatory requirement as insurers, homeowners and those in the construction industry are either ignorant of the potential life-saving properties of having a sprinkler system installed, or have no desire to incorporate them into dwellings. One of the perceived barriers is the initial cost of installing the system, despite the fact that sprinklers are beneficial to life safety. If sprinklers became mandatory, installation costs would fall, as in all cases where anything is provided on a large scale.

The BRE 204505 report suggests that sprinklers were only found to be cost effective in tall blocks of flats and domestic care homes and not in other dwellings, even though they were proven to save lives, a positive way forward would be for installation costs to be reduced by subsidy, insurance companies offering discounts, the public being made more aware of the significant benefits and dispelling the myths, persuading developers to incorporate sprinklers without the requirement of legislation.

Dwellings are now required to be lifetime homes, if care homes would benefit from sprinkler systems, it is clear that dwellings would, given the fact we live in an ageing population, as people become elderly, their response times to evacuation from fire would be slower. It is clear therefore that the routine installations of domestic sprinkler systems outside Wales are unlikely to increase unless there is considerable change in public opinion leading to increased demand. Any significant change is only likely with the introduction of mandatory legislation as enacted by Wales and the effectiveness of this will need to be reviewed.

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AN INVESTIGATION TO CONSIDER THE PERCEPTIONS OF IMPORTING STEEL FOR UK CONSTRUCTION PROJECTS

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The influence of imported materials within the UK has been discussed at length, with published data strongly indicating that the levels of imports are rising. The potential issues which have been raised in the literature about imported materials regard quality and safety. The fact that the volume of imported materials is increasing suggests that they may actually offer advantages to UK construction. The focus of the work was on the perceptions related to the importation of steel and whether this offers advantages to the industry. The findings indicate that home sourced materials were perceived to offer good quality and lower risk. However the most important priority was that of low cost, leading to an acceptance of the identified risks of possible time delays or of lower quality products which require additional management and planning to ensure project success.

Keywords: benefits, construction, cost, home-source, imports, planning, quality, time.

INTRODUCTION

It has been reported that the UK steel industry is struggling to compete with unrealistically cheap foreign markets (BBC 2015), indicating that the obvious rationale behind importing is the opportunity to be as cost effective as

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possible and maximise profits. With construction being subject to multiple constraints and strict contractual guidelines, importation seems a very difficult process to include. There are many complications in importation, including; transportation, insurance, entry processes, inspection and control (Goldsmith 1989) - before the materials are used as part of a construction project. With these complications in mind, the author assessed the perception of professionals on the interaction of imported steel with the supply chain management of a construction project. The aim was to determine possible benefits of importation, the author focuses on steel as this material is among those commonly imported. The focus of steel has been chosen due to significant changes in the UK steel industry, and foreign markets. An additional reason is that steel is such an integral part of UK construction, and is prominent within many projects. The rationale of sourcing local materials was also explored. This research offers some insight into how importation may affect current construction within the UK.

RESEARCH METHOD

A review of a broad range of literature took place to allow assessment of current initiatives within sourcing materials and provide a comprehensive understanding of existing knowledge to develop the area of study (Naoum 2013). A questionnaire was constructed in order to acquire appropriate data (Brace, 2008) which was circulated to a sample of construction professionals to identify their priorities when considering importing steel. Before distribution this survey was piloted to ensure that questions were easy to answer and the data created would contribute positively towards the study (Fellows and Liu 2008). The final questionnaires was sent to a combination of approximately 100 Buyers, Supply Chain Managers and Procurement Directors working in a variety of sectors and locations within the UK to gain a broad understanding. The specific professionals were found using LinkedIn, and messaged through the same website. In total 30 questionnaires were returned and these were used to organise follow up interviews, which allowed the researcher to gain a more in depth understanding of respondent opinions. The interviews were semi-structured, giving freedom to probe desired areas (Naoum 2013) by expanding on previous questions, whilst still following the planned interview to maintain a degree of focus. The analysis of both primary and secondary data began whilst the data was being collected. This logical approach allowed the full consideration of what the data meant to the ongoing study and allowed the main trends and differences to be identified (Naoum, 2013).

LITERATURE REVIEW

The project is described by Levy (2010, p3) as the method by which you "*get from point A to point B … [which] … has several different options*". When considering importation there are common procedures that are part of importing in general; such as transportation, insurance, entry processes, inspection and control (Goldsmith 1989). However, importing materials for construction requires an assessment of how these procedures integrate with a construction project and the potential outcomes..

The Process of Importing Building Materials

Importing building materials is complicated and therefore a review of the process has been undertaken to provide a better understanding of the relative advantages and disadvantages of importation (Table 1.)

Current Trends in the UK Steel import

An indication of the influence of imports on the current UK construction industry was developed. The steep rise in imports in the recent years has been expected for some time, as EC Harris' UK head of property Simon Light predicted in the international construction costs report in 2013. He suggested that contractors will import high end materials from the Far East to reduce the overall cost of projects (Stothart, 2013). This reaffirms that a significant cost advantage can be gained through importing materials. In very recent months there have been indications of the UK's steel industry downsizing, such as UK steel workers losing their jobs (Bowler 2015), although this is not directly linked to output capacity. The rise in imports in a similar period is shown in Figure 1 and Figure 2. This increase in imports signifies that there are advantages for imported goods (the most obvious being cost).

Additional logistical implications	Goldsmith (1989) states that importation begins by assessing capacity to import (Goldsmith 1989) as there are significant challenges to a contractor regarding the transport, documentation and financing required to deal with oversees suppliers
Monitoring Global Markets	Cottier and Elsig (2011) highlighted the need to monitor international markets. As Goldsmith (1989, p12) explained research is needed to demonstrate that that the material offers some advantage to the project which may be cost based or others.
Considering the Product/Service	The market, supplier and product identified by provisional selection need further assessment before the purchase is confirmed (Goldsmith 1989). This requires processes such as quality control and time considerations (Zuckerman and Biederman 1998).
Payment	Payment terms are more complicated for imported goods due to the different standards, and require further documentation and procedures to take place. Additionally return policies differ (Zuckerman and Biederman 1998) and some providers may not allow returns.
Transport and Entry	After payment, the contractor discusses shipping with the provider and in this the contractor may not have a choice as the supplier could have their own methods in place (Cottier and Elsig 2011). Given the many methods of transportation, and where the contractor has a choice, the method must suit the product and the project time frames and cost allowances. There are also fairly rigorous and precise inspections required upon entry into the country. Zuckerman and Biederman highlight this (1998, p206) as they describe that "the weight of each piece, the dimensions of each piece, the shipping date, the order number" all need to be inspected.

Table 1 Summary of factors to be considered for importation

Reasons for the Rise in Imports

Steel is a vital material within the majority of UK construction. When a project requires large amounts of steel, and with UK materials expensive against global materials, it is easy to understand why one might import. China is a key export market, where economic slowdown and low demand has resulted in over production, leading in turn to Chinese producers seeking cheap export markets (Bowler, 2015). Figure 3 shows the decrease in the price of Chinese steel. Bowler (2015) states that "*in 2014 the UK imported*

687,000 tonnes of steel from China compared to 303,000 tonnes the year before". There are strong indications that cost is a driver for the trend to increase imports. In recent years there has been a decline in UK steel production (Bowler, 2015). Figure 4 illustrates global steel production (UK steel production is just outside the top 10 producers shown).

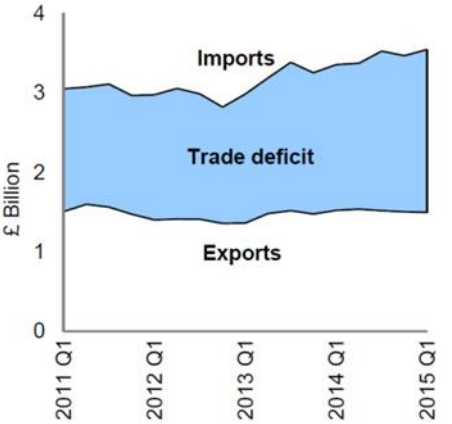

Figure 1 Exports and Imports of Construction Materials, UK (Source www.gov.uk, 2015)

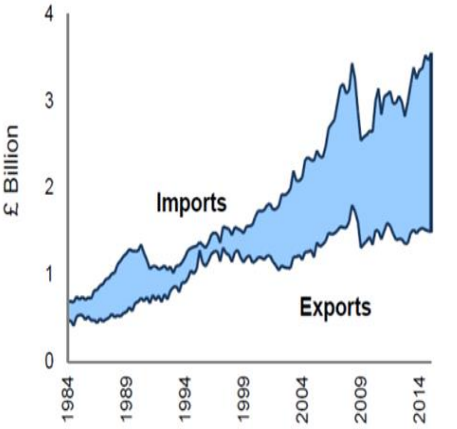

Figure 2 Exports and Imports of Construction Materials, UK 1984 to Present (Source: www.gov.uk, 2015)

Figure 3 Price of Steel Mar 2012-Oct 2015. Source BBC (2015)

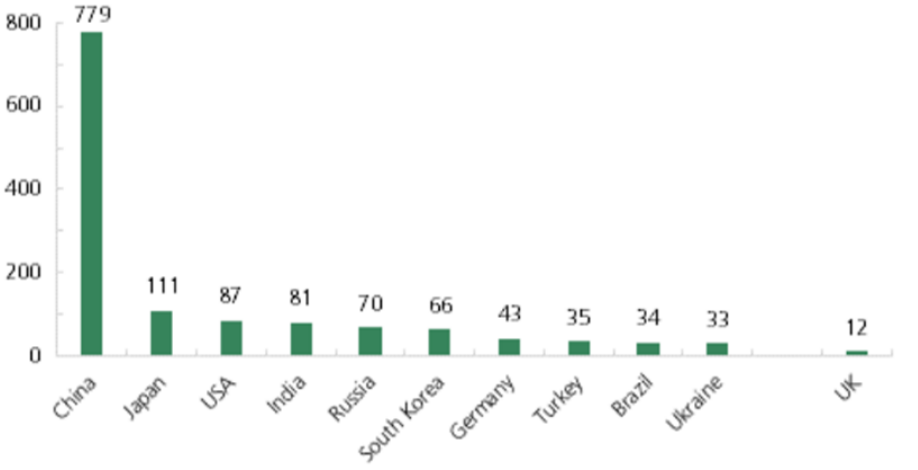

Figure 4 Steel Production, million Tonnes - Top Ten Producers in 2013, and UK (Source: Parliament,2016)

Considerations of Quality When Importing

The quality of the imported steel is often questioned. In 2015 the Australian Steel Industry issued a warning regarding the quality of Chinese steel (Cooper 2015) and the need for quality control. Cartlidge (2011, p138) had already noted the question of differing standards for materials entering the UK from

outside the EU. Steel has numerous standards and grades (El-Reedy 2013) and the appropriate grade must be chosen for the type of construction. Chinese steel is anecdotally quoted as an example of a material which may not be tested to these standards. If true this requires an understanding from all parties and reaffirms the value of quality control, to ensure that the project reaps the advantages. Tangible benefits of importing can only be achieved if appropriate assurances are in place.

Supply Chain Management

Supply chain management is the coordination of materials and their delivery to specific construction projects (O'Brien et al 2014). Successful supply chain management relies heavily on effective linkages and organisation (Pryke 2009). This successful link may be much more difficult when the supplier is on the other side of the world, and has very different ways of supplying to what the purchaser may be accustomed to. Whilst using London's (2008, p88) four main themes of supply chain management: "*distribution, production, strategic procurement and industrial organisation*" it is clear again that these aspects would be much more difficult when importing. Increased organisation is required to ensure successful supply chain management in this case.

Considerations of Time When Importing

Successful importing depends on more than just cost effectiveness, as timing is an important element (Zuckerman and Biederman 1998). A cheap project would not be successful if it was late due to long lead times; and if a quick solution with a supplier is required due to unexpected failures when importing, it could be very costly, as short lead times means premium cost (de Treville et al 2014). Wilmot-Smith states (2009, p209): "*in default of completion by that date the contractor must pay damages to the employer for the breach of contract*". With such strict time constraints and timing being such a crucial element of importing (Goldsmith, 1989) complication could result in increased costs to the contractor. Time within a construction project is crucial, so if importing materials affects time in a negative way, then it is not advantageous.

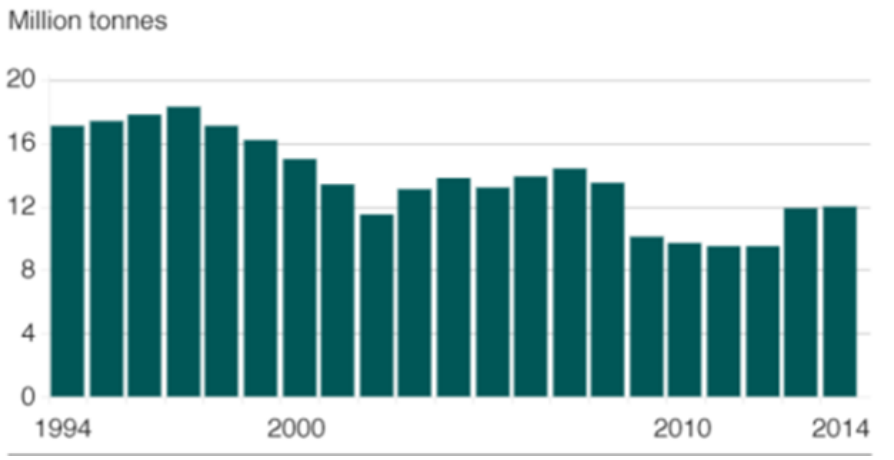

Figure 5: Steel Production in the UK, 1914-2014 (Source: BBC,2015)

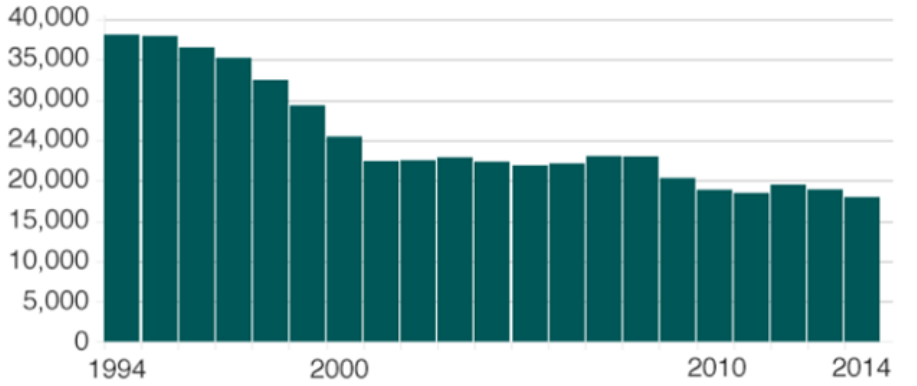

Figure 6 Workers Employed in Steel manufacturing, 1994-2014 (Source: BBC, 2015)

Advantages for Home-Sourced Steel

Within the UK there are limited public initiatives to locally source building materials. Time issues, potential cost implications, quality standards and organisational problems have already been discussed, but there are further reasons to home-source steel. Figures 5 and 6 indicate that that a move to restore UK production and become a global competitor may also reverse the trend of a drastic decrease in manufacturing jobs. It should be noted however

that these figures refer to total steel production and not to the type of steel produced, relevant due to the high volumes of 'special' steels manufactured in the UK.

An initiative involving Laing O'Rourke and 21 partners were recently granted £22.1m to help support Research and Development and Capital Investment as part of an advanced UK based manufacturing initiative, involving modular construction. The scheme targets lower costs, lower emissions, the creation of jobs and lastly a 50% improvement in the trade gap, through decreasing imports (Laing O'Rourke 2015). With all these targets interlinking, they show rationales behind the development of materials and modules locally. Another potential reason to home-source is emphasis on ethical considerations leveraged by government policy. Ethics are a key part of any construction project (Cartlidg, 2011), and may result in a desire to increase UK employment, which are affected by material imports. There are numerous reasons to home-source materials that haven't been discussed until now. These include; lowering environmental impact, saving client costs, improving the quality of the construction, and creating UK jobs.

RESULTS

The purpose of the questionnaire was to reaffirm and expand on opinions developed within the literature review. These opinions are more deeply considered in the follow up interviews.

Construction Priorities

From the data collected, the majority of participants see cost as the first priority, quality second, and time third (Figure 7), but this is not an opinion held by all participants. While interviewees 1 and 3 chose cost, quality, and then time in the interview, Interviewee 2, identified quality, cost, and finally time due to fitness for purpose requirements. Interviewee 1 explained cost as their priority as it is the most important part of value, and that time was their lower priority due to it being easier to keep to , and if necessary manage. Interviewee 3 believed cost and quality were linked as good quality material which is still good value can be sourced. They then added "*once you've established quality, the cost is the second key driver*".

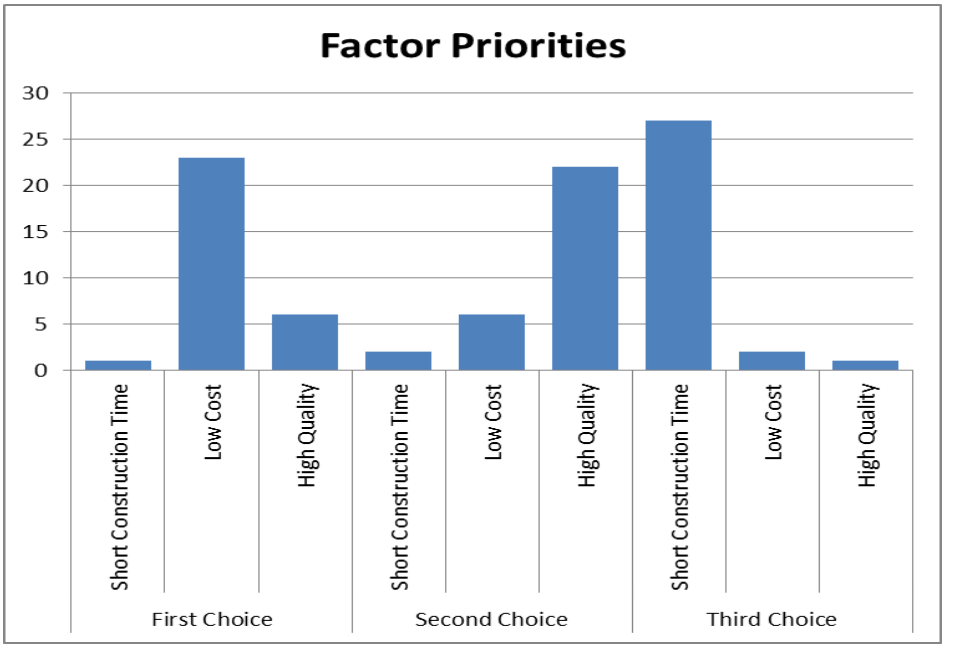

Figure 7 Factor Priorities

Scorings of Imported Steel

The cost factor of imported steel has been rated comparatively highly, with 43% of the participants rating cost at either 9 or 10 (Figure 8). This indicates that whilst certain factors of imported steel are not great, the cost certainly is. This reaffirms previous opinions developed in the literature review, of cost being the main benefit of importing. All interviewees agreed that the main benefit of importing was the cost factor, but also stated that in their experiences of exporting the service was of good quality. Interviewee 2 summarised this with *"they were much cheaper and they were good quality"*. Interviewee 1 gave a very interesting insight into service; as their foreign suppliers were involved in the project during the design, risk analysis and value engineering. They experienced cost benefits whilst also receiving good service and a quality product. This was similarly echoed by interviewee 3 as their supplier was involved early, ensuring quality through samples.

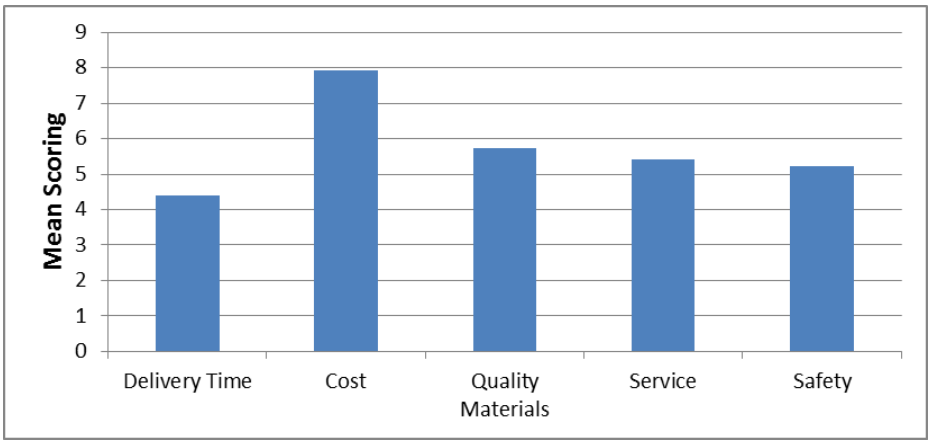

Figure 8 Scoring of Imported Steel

The interviews showed that thorough organisation, planning and co-ordination allow a successful importation due to good service which in turn enables lower cost and good quality materials.

Scorings of Home-Sourced Steel

It is clear to see that the majority of home-sourced steel factors are rated much higher than imported materials. It has been understood already that, standards, regulations and services are perceived as being better quality in the UK - as confirmed by the research. However, as cost is rated lower, contractors who see economic efficiency as a priority may overlook the possible higher standards in order to save money (Figure 9). When reviewing the benefits of home-sourcing steel, all three interviewees gave very similar answers, which revolved around logistics and local materials being easier to quality assure. Interviewee 1 summarised this, stating *"it is a much easier transaction as you can be there quickly, whereas going to India is a much longer journey*". However, whilst the benefits of home-sourcing are certainly there, all three had imported materials out of choice. Therefore, the main advantage they stated (cost) when importing must sometimes outweigh the benefits of home-sourcing.

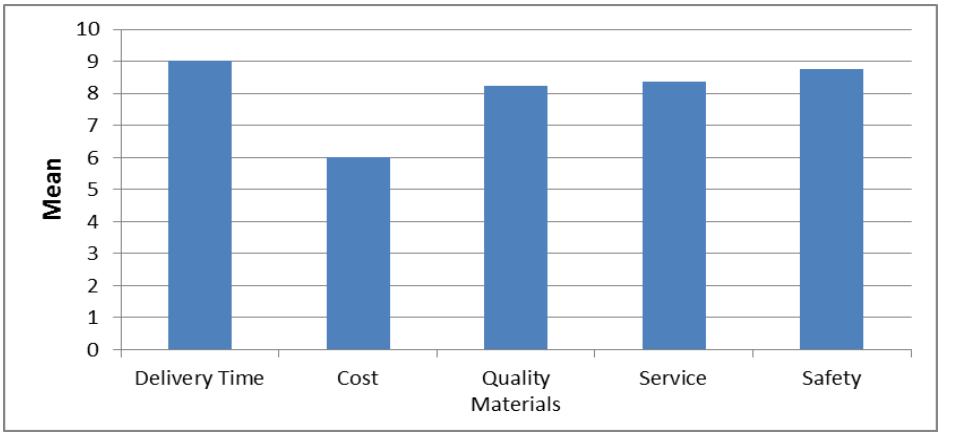

Figure 9 Scorings of Home-Sourced Steel

The Risks of Importing

The data received shows that almost all of the respondents agreed or strongly agreed that there are risks (Figure 10) associated with importing and Long Lead Time was given a high expectation rating (Figure 11). Despite this, importation is still occurring suggesting that the risks can largely be overcome through appropriate planning. On being asked when importing is most appropriate, Interviewee 1 said that there isn't a typically appropriate project, but said "*a key requirement is understanding the programme"* and *"having confidence in the plan is more important"* strengthening the view that importing is successful when preparation is thorough. Interviewee 3 gave a similar answer, as they stated that *"you have to understand the supply chain"*.

In the questionnaire the three interviewees had scored numerous factors of imported steel relatively low compared to home-sourced steel. Interviewee 2 scored the quality of imported materials as low, and stated that poor quality steel *"terrifies"* them, and it could lead to *"hundreds of deaths"*. This is the main reason they tend not to import, as they couldn't ensure quality. Interviewee 1, had similar view on the quality of imported steel, but had robust procedures in place including *"an end to end quality review system in place"* to make sure purchases were of good quality. As well as this, in China, known for poor quality steel, they *"opened a quality control office"*.

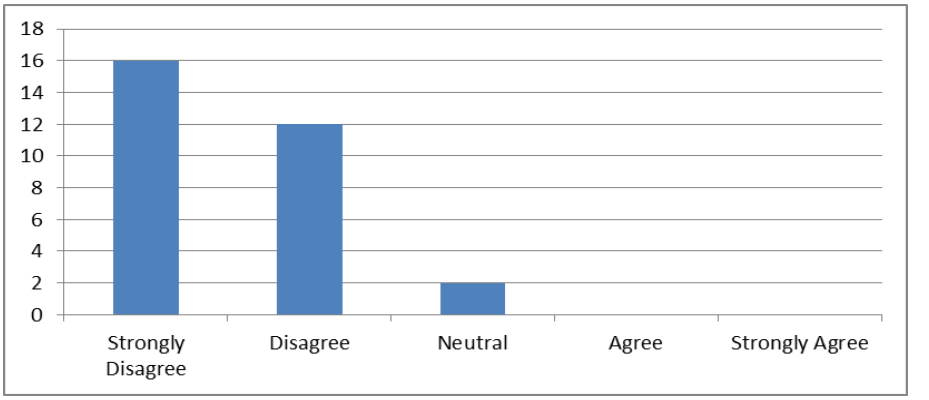

Figure 10 Responses to question: "There are No Risks Associated with Importing"

Interviewees 1 and 2 also discussed issues of service, but both agreed that they can be overcome. Interviewee 1 summarised this with *"you have to acknowledge them* [the issues] *at pre-qualification and plan correctly".* There are poor perceptions of foreign imports in regards to the quality, but interviewees 1 and 2 have proved that they can be overcome, if the resources are available. With regard to the assessment of whether the extra organisation was worth the potential benefits, Interviewee 1 stated that the cost benefits are usually worth the additional planning. They added that *"a cost benefit analysis"* usually takes place before hand, to ensure that importing is the best option. Interviewee 3 had a similar opinion, as it is *"a business case"*. They described that there is a risk, but if the cost benefit is big enough then the organisation is worth it.

Figure 11 Responses to the question "Factors which you would Expect when Importing Steel (e.g. from China)" 1 Never Occurs, 10 Always Occurs.

Current Initiatives to Reduce Importing

Respondents were asked to reflect on current initiatives and whether the drive to reduce foreign imports was to increase UK jobs. While Interviewee 1 stated that it is a moral thought, it does not affect their decision. Interviewee 2 offered a very similar opinion, as they declared that construction *"isn't about the socialist agenda of protecting jobs, there are cheaper alternatives"*, consolidating the priority of profit maximisation.

The Tangible Benefits of Importing Building Materials

Throughout the interview, interviewees 1 and 3 were very positive regarding importation, and it was very clear that they believed there were advantages when importing as long as there were well organised procedures in place. Interviewee 2, selected "Neutral" on the questionnaire, as*"it works both ways"* i.e. has both disadvantages and advantages.

DISCUSSION

The Advantages and Disadvantages of Importing Steel

The literature review listed many advantages and disadvantages to importing steel, with those relating to cost, time and quality being very clear. One of the main reasons for 'cost' being emphasised is the fact that UK materials are becoming much more expensive due to the pound strengthening (Bowler 2015). This coupled with the fact that high-end materials are available for very low costs in foreign markets (Stothart 2013), and cost benefits in importation. The questionnaire data showed that 24% of respondents believed that imported materials were cheaper than home-sourced materials, a finding reiterated by all interviewees.

In regards to quality, the literature review indicated that they are major issues of importing. Warning signs regarding the quality of steel imports were noted (Cooper 2015), and it became clear that not all imports were of the same standard of UK materials. Using steel as an example, rigorous and technical inspections take place, using highly advanced devices and systems (El-Reedy 2013). However these processes have time implications, if the project is late due to longer importation processes, damages have to be paid (Wilmott-Smith 2009) negating the initial cost benefits. The questionnaires highlighted time and quality as two major disadvantages of importing but also that participants expected these disadvantages enabling them to prepare for them to some extent and potentially avoid them by adapting their processes.

The Effects of Importing

A successful importation will require numerous resources to ensure the additional procedures are completed, an assertion with which 93% of participants agreed. Despite this, they still chose to import, indicating that they take on the extra issues and risks, and that the additional duties and resources required become part of the project. This opinion was consolidated in the interviews, as participants described additional work at pre-qualification, extra specifics in the contract, and additional resources abroad to control quality and discard language barriers. Interviewee 3 highlighted the need for extra resources, by the fact that "otherwise it's just a leap in the dark". Importation has numerous effects on a construction project, and additional resources are required to deal with these effects if a successful importation is to take place. The potential effects can be positive or negative, and triangulation shows that the extent of them completely relies on how they are managed and prepared for.

Current Volumes of Imported Building Materials

National statistics indicate that foreign steel imports are becoming an increasingly large part of construction; whilst UK produced materials are decreasing. Between 1984 Q1 and 2015 Q1, imported materials have increased at an average of 3.3% per quarter (www.gov.uk 2015)In the questionnaires, 87% of participants agreed that importing building materials offers benefits. The interviewees identified the slowdown in UK steel production, indicating the large volumes of steel imports as affecting UK production. Interviewee 2 stated that reducing imports "is something we don't do very well", highlighting once again that the large volumes of imports are set to continue.

Summary

The cost implications of importing are highlighted as a key finding. Other findings from the investigation are summarised as follows.

Current Volumes of Imported Building Materials

- Large quantities of building materials are being imported to the UK.
- Between 1984 and 2015 imports have increased at an average of 3.3% per quarter.
- Due to the pound strengthening, the price of UK building materials is rising.
- Imports are increasing due to the cost benefits of doing so.
- Foreign markets offer a much cheaper alternative.

The Rationale to the Choice of Imported and Home-sourced Materials

- There are less time issues when home-sourcing materials.
- The logistics of home-sourcing are much simpler and there are fewer risks
- Home-sourced materials are considered to be of better quality than many imported materials.

The Individual Possible Benefits that Importing Materials Can Offer

- Certain providers also offer excellent service, providing benefits from start to finish.

- Importing offers few individual benefits, but cost is perceived by many as the most important benefit.

Current Initiatives to Reduce Imported Building Materials.

- There are limited initiatives to reduce imported building materials due to the advantages of importing.
- Initiatives that are in place revolve around the need to increase UK production and the creation of UK jobs.
- The initiatives also aim to reduce the trade deficit.
- These factors would not influence most professionals as it is not a priority.
- Cost is much more influential than the ethical reasons behind initiatives to reduce imported building materials.

CONCLUSION

In regards to the purpose of the study, a reliable conclusion can be made. Importing materials certainly does offer tangible benefits to UK projects. A common misconception is that whilst importing does offer cost benefits, the quality of the project will suffer and will take longer to complete. The paper shows however that quality can be assured although with an increase in resource required and additional planning to ensure that the materials will arrive on time and to standard. Trends indicate that imported steel is becoming a bigger part of UK construction, due to the cost of home-sourced materials rising and falling production combined with decrease in foreign markets and an increased level of surplus steel coming to market. In the near future this trend is set to continue. Ethical issues are clear regarding importing and the subsequent decrease in UK production but have little influence on professionals as construction is ultimately a business, and as long as the project does not suffer, low cost is always the best option. The main benefit of Importing materials is cost, and by understanding the challenges of importing there is a potential to create new realms of quality service.

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MANAGING THE UNKNOWN - A PLAN TO MANAGE WORKLOAD FLUCTUATIONS AND OPERATING RESOURCES IN A PROFESSIONAL PRACTICE.

Ben Carter[4] and Liz Laycock
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Change affects companies in all industries, a business's ability to forecast and manage change are critical to its long terms success. This research aimed to acknowledge the causes and frequency of change and develop methods by which a company operating in the construction industry could manage its workload and operating resources. Through reviewing existing literature and conducting primary resource specific to the nature of the company the research was able to tailor its proposal with the aim that its implementation provides a positive benefit to recipients. The main findings of the study were that whilst both internal and external causes of fluctuation impact on workload and operating resources and that the frequency of fluctuation is varied, there are methods by which these fluctuations can be managed through the introduction of company processes and procedures. In summary, a company's ability to manage change and fluctuation in workload is dependent on its ability to ascertain the nature of changes it is likely to experience and to ensure its operating practices reflect these changes.

Keywords: Operating Resources, Workload, Change, Management

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INTRODUCTION

It is well established that the construction industry is prone to fluctuations in output (Rhodes 2015), these fluctuations are caused by factors ranging from national economic performance and government policy on a macro level, to seasonal patterns and the availability of finance on a micro level (Barrett 1993). The extent to which these causes impact on the stability of individual companies varies, depending on which sectors of the industry a company operates in and, more specifically, the processes and procedures a company maintains to manage such fluctuations. Forecasting fluctuations and planning to manage change are therefore critical to the long term success of any business in the construction industry. The research conducted was a case study specific to one company operating within the construction industry in an attempt to develop a workload management plan that could be proposed for implementation as part of a its strategic management plan. The aims of the study, specific to the company, were as follows:

- Establish the extent and common causes of fluctuation in workload at a selected company.
- Identify existing management methods/techniques and assess whether these methods are suitable for use within the company.
- Determine any common suggestions as to how workload fluctuations could be managed within the company and any barriers to implementation.
- Propose a management tool/strategy to assist in the monitoring/forecasting of workload at the company.

The study identified existing methods of workload fluctuation management used within the industry and identified the causes of workload fluctuation the company experiences. Through further research the study was able to assess the suitability of existing methods for implementation and acknowledge potential barriers as well as develop a proposal tailored specifically to the needs of the company.

RESEARCH METHOD

A comprehensive review of literature relating to the topics of change, strategic and human resource management was undertaken to provide the

researcher with a level of information on aspects of management that apply to the subject area. A company profile was developed in order to determine the characteristics of the business and to ensure the final proposal was bespoke, recognising key details with regards to the nature of the business and existing procedures. This information was used to develop primary research that was tailored specifically to the aims of the study in the form of questionnaires. The primary research enabled the researcher to identify the current causes of workload fluctuations, potential solutions to reduce the impact of these causes and specific details relating to both topics.

The questionnaire defined terminology where relevant to minimise the risk of ambiguity and was deliberately distributed to a selective sample, all employees of the studies company, to maximise the validity of the responses and the chance of success with any future implementation. Consultation with other construction professionals during the development of the proposal made it possible for the study to acknowledge existing management techniques in practice and for it to draw on these when adapting and refining the proposal. It was recognised that the nature of the study limited the extent to which the results it sought to provide could be applicable to a wider audience however, it was considered the research methods utilised were appropriate considering the aims of the study were specific to one company.

LITERATURE REVIEW

Strategic Management

Henri Fayol identified forecasting and planning as being one of the seven principles of management, the purpose of these actions being to "*give firms an outward and forward looking perspective, so that changes can be anticipated and, at least, accommodated, if not capitalised on*" Barrett (1993). The benefits of these actions were acknowledged by Ansoff (1984) as providing a tool to "*position and relate the firm to its environment in a way which will ensure its continued success and make it secure from surprises*". The study focused in depth on business level strategic management, which is concerned with "*competing for customers, generating value from the resources and the underlying principles of the sustainable competitive advantages of those resources over rival companies*" Rees and Smith (2014). In the context of the study, strategic management related to ensuring the company is conscious of and makes informed decisions regarding workload and resource, both current and future, to deliver against the business objectives. As noted by Smyth (2011), professional practices are typically

cash generating organisations as opposed to asset rich; one of the keys to business success is therefore managing workload and the associated revenues they generate during periods of fluctuation in workload. The study had identified reasons why workload in the construction industry is cyclical, it also identified that the industry typically follows a 'boom and slump' pattern, as opposed to gradual rises and falls, shown in Figure 1.

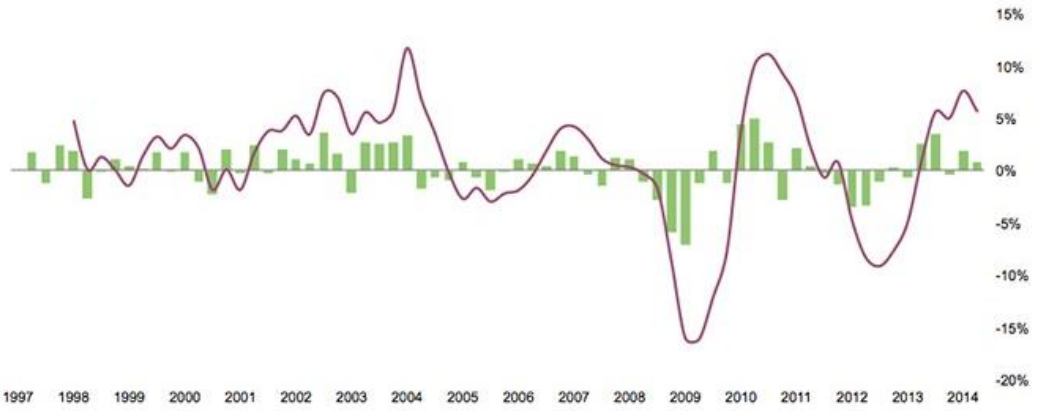

Figure 1 Example of 'boom and slump' pattern in UK construction industry – Quarterly and yearly rates of output change (ONS, 2014).

It is considered that in order for a company to maintain success over the longer term, practice management during the 'boom' period should include the creation of cash reserves typically facilitated by the moderating of profit taking, for these to be drawn on during the 'slump' period. One of the main benefits of this action is that during the early stages of a slump and constriction in work streams and associated revenues, the business is better placed to manage the requirement to reduce staff numbers and pay. This aids in maintaining the morale of those still in employment and preventing a more chaotic situation regarding resources whereby employees perceive unemployment as inevitable and seek alternative employment to mitigate personal risk. The restricting of expansion during the 'boom' period is also noted as a prudent action as this results in less of a drain on cash reserves during the slump period, it is noted that the financial benefit of this is often debated as a matter of integrity when compared to a strategy of 'hiring and firing' to suit levels of secured work however a 'hiring and firing' strategy is likely to have a detrimental impact on the morale of employees during a slump period (Figure 2).

Figure 2. Example of practice management experiences and actions over the economic cycle (Hedley Smyth 2011).

Human Resource Management

Thompson, Scott and Martin (2014) state "Organisations should evaluate whether resources are being allocated to those products, services and activities which are most important for the organisation as a whole". The study focused on human resource from the perspective of performance however Banfield and Kay (2012) note that performance has "*no precise or agreed meaning*" and that it can include concepts such as productivity and effectiveness. The primary resources at the company are human in the form of the professional and administrative staff it employs and the knowledge and experience they possess, therefore the performance of the businesses human resources are critical to its continued ability to perform. In order to maintain this ability the business requires employees to generate results. Results, defined by Shields (2012), are "*those tangible and intangible outcomes from work behaviour or activity that management deems desirable and valuable in*

achieving organisational objectives"; and are generally seen as covering six categories:

1. Product or service quantity
2. Product or service quality
3. Financial outcomes
4. Timeliness
5. Innovation
6. Stakeholder reactions

Gilbert (1978) stated that the main factors that affect a person's performance are:

1. Knowledge
2. Skill
3. Environment
4. Motivation

The study noted factors 1 and 2 but did not conduct further research on them during the literature review on the assumption that the company employees possess at least the general knowledge and basic skills required to fulfil their roles. Further research was undertaken on Environment and Motivation as it was considered these factors have strong links to workload management and operating resources.

Environment:

The work environment can be described as the surrounding conditions in which an employee operates, it can include both physical conditions i.e. the office building and other factors such as work processes or procedures an employee is expected to adhere to. The environment in which an individual works can have a considerable effect on their morale and thus ability to perform, an article by Yankov and Kleiner, (2001) found that high employee morale is typically associated with workplace stability, supportive managers and clear roles, whilst insufficient staff levels, lack of managerial support and workers feeling they have no voice in the workplace were common themes in organisations with low levels of employee morale. Environment in the context of this study related more to processes and procedures than physical conditions however the study recognised that the proposed management tool/strategy has the potential to impact on the working environment and therefore it had to be proposed in such a way that maximises the potential positive benefit i.e. streamlining of existing procedures and minimises any negative impact i.e. loss of productivity.

Motivation:

The environment in which an employee operates can, in part, contribute to their levels of motivation and therefore their ability to produce results. Pinder (1998) defined motivation as "*a set of energetic forces that originate both within and beyond an individual's being, to initiate work-related behaviour and to determine its form, direction, intensity and duration*".

Classic motivation theories identify a number of 'high order' and 'low order' needs as to what motivates an individual, these are shown in Figure 3:

Hierarchy of needs (Maslow)	Two-factor theory (Herzberg)	Job characteristics model (Hackman and Oldham)
Higher-order needs:	**Motivators:**	**Intrinsic factors:**
• Self-actualisation • Ego/esteem	• Achievement • Growth • Recognition • Responsibility	• Skill variety • Task variety • Task significance • Autonomy • Feedback
Lower-order needs:	**Hygienes:**	**Extrinsic factors:**
• Social • Safety • Physiological	• Work relationships • Supervision • Work conditions • Pay	• Relationships • Job context • Work conditions • Pay

Figure 3. Classic motivational theories - 'high order' and 'low order' needs (Shields 2012).

Shields (2012) suggests that the constant thread across the classical theories is that motivation is "*a by-product of the quest to satisfy our needs as people and workers*" it is also noted that on this basis the factors that motivate employees will change according to their personal needs.

The study did not attempt to directly influence employee motivation however the proposal will attempt to improve the general operating of the business and it is noted that indirectly this may have an impact on employee motivation.

Change Management

Change management as a concept can be explained as managerial work that "*copes with the changing patterns of resource input and knowledge available to work organisations and the shifting demands made upon them by the parties with which they deal*" Watson (2002). Tichy (1983) identified four main causes of change, summarised as:

1. Environment – Shifts in economy, competitive pressures and legislative changes lead to demand for strategic change.
2. Business Relationships – Developments in new/existing relationships require change in the organisational structure.
3. Technology – Shifts having an impact on content of work.
4. People – New entrants to organisations with different educational or cultural backgrounds that require change.

Lynch (2012) notes that "*there is a need to define more precisely the causes that apply to a particular organisation*" and that in practice this will "*prove more useful when it comes to managing strategic change*". Handy (1989) states that "*those who know why changes come waste less effort in protecting themselves or in fighting the inevitable*", this could be interpreted as, for companies who, as part of a strategic management plan attempt to forecast change, there could be as many benefits as drawbacks to the change, this point being of paramount importance relative to the aims of this study. Kreitl et al (2002) notes that firms engaged in growth typically experience uneven workloads as continuously targeting potential clients and identifying future pipelines of work runs alongside existing workload that may include repeat business from clients. Issues caused during growth periods include under capacity of resources, a consequence of which was recognised by Hedley-Smyth (2011) citing Bayer and Gann (2006) as "*some projects are allocated resources that lead to other projects in the overall work portfolio experiencing missing deadlines and stressed working*". The study was focused on the management of change to some extent entirely; it aimed to identify the reasons for change (fluctuation in workload) and the reasons for these changes (causes), and then attempted to manage these changes through the development of its proposal.

RESULTS

Objective 1 - Establish the extent and common causes of fluctuation in workload at the selected company.

The study was able to identify a number of details relating to workload fluctuations and their causes within the company. It was determined that the workload of employees at the company was 'below average' consistently for only a minority of respondents, 'average' for approximately a quarter of respondents and 'above average' for the majority of respondents between October and December 2015 as documented in Table 4.

Wk Nr	W/C Date	Below Average		Average		Above Average		Total
		Nr	% of wk total	Nr	% of wk total	Nr	% of wk total	
1	28-Sep	2	25%	2	25%	4	50%	8
2	05-Oct	1	14%	3	43%	3	43%	7
3	12-Oct	1	13%	2	25%	5	63%	8
4	19-Oct	1	13%	2	25%	5	63%	8
5	26-Oct	1	13%	3	38%	4	50%	8
6	02-Nov	1	13%	2	25%	5	63%	8
7	09-Nov	2	25%	1	13%	5	63%	8
8	16-Nov	1	13%	1	13%	6	75%	8
9	23-Nov	1	13%	0	0%	7	88%	8
10	30-Nov	1	11%	3	33%	5	56%	9
11	07-Dec	1	11%	2	22%	6	67%	9
12	14-Dec	0	0%	4	44%	5	56%	9

Table 4. Workload levels throughout researched period, each response as a percentage of total responses per week (source: Author).

Employees reported that they experienced frequent fluctuations in this workload, 78% experienced fluctuations daily with the remaining 22% experiencing them weekly. Considering the findings of the literature regarding change and the capacity of resource, it was concluded that a consistently above average workload level coupled with frequent fluctuations in workload could be impacting on the businesses ability to perform over a sustained period. It was however recognised that the research was limited to a twelve-week period, that this could not be representative of operating levels annually and that the research period may have correspondent with a peak in workload levels at the company. The potential causes of fluctuations in workload were split into two categories, those that the business contributed towards (internal) and those that were generated by others (external). It was considered different types of causes would likely require alternative approaches to manage and that identifying the source of the cause was therefore fundamental to the studies ability to address them.

Cause	Points	10	9	8	7	6	5	4	3	2	1	0	
Ref	Rank	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	Score
2	Internal Cause (Change) – Revisions to allocated workload at short notice	3	2		3	1							75
4	Internal Cause (Resources, human or otherwise) – The availability of resources required to assist in completion of a task		2	4	2								64
6	Internal Cause (Allocation) – Variation in workload allocation over time e.g. periods of heavy workload / periods of light workload	1				1	7						51
8	Respondent Added Cause - Lack of internal diary coordination								1				3
9	Respondent Added Cause - Insufficient resources									1			2
													195
1	External Cause (Client) – Time related demands e.g. tasks to be completed at short notice	5		2	1		1						78
3	External Cause (Client) – Workload related demands e.g. clients advising of revisions to proposed work stream programmes		3	3	2	1							71
5	External Cause (External parties) – Information provided e.g. Lack of information requires more time to complete a task than forecasted		2		1	6							61
													210
7	Respondent Added Cause - Imbalance between client work volume and resource							1					4
													4
	Respondents	9	9	9	9	9	8	1	1	1	0	0	409

Figure 5 Causes of workload fluctuation, total score of causes split between internal / external cause (source: Author).

By allocating a score to each cause in line with its frequency ranking, the study was able to identify those causes that impact more / less on workload. Splitting these causes into the internal / external groupings, the study determined that whilst external causes scored a slightly higher total overall than internal and that the range of individual causes scored between 51 – 75, no single cause or source of causes scored highly enough for it to be determined that it was the single main cause of fluctuation in workload at the company (Figure 5).

Objective 2 - Existing management methods/techniques and assess whether these methods are suitable for use within the company.

The literature review provided the researcher with details of existing management techniques, notably Gantt charts and arrow diagrams however the level of information that could be obtained was not considered sufficient for the study to use it in isolation. Arrow diagrams were considered for implementation during the literature review stage of the study, whilst it was noted they could provide a benefit for the sequencing of events for individual projects, they were considered unsuitable for implementation within the management proposal as the format of these diagrams do not provide the required levels of flexibility for a company whose workload is varied in duration and one that requires several layers of information to be presented and easily interpreted for the document to be beneficial to the user. With Gantt charts it was established that in their basic format they provide not only a visual overview of activities over time but also that their format would enable supplementary information to be included in the document and that these features could form the basis for this format of tool to be utilised within the proposal.

To supplement the information gathered during the literature review stage, the study consulted with industry professionals in an attempt to establish the extent to which the theories were already being or could be used in practice as well as any additional methods by which businesses operating in the construction industry manage their workload and operating resources. These consultations established that Gantt charts are widely used in the planning of not only on-site activities but also business management within the industry. The study recognised a number of features already in use that could be of benefit to the company including the ability to visualise not only current and future volumes of workload and resource commitment but also the intensity of these commitments and the ability for these commitments to be categorised. The consultation process also highlighted the limitations of a Gantt chart when used in isolation, for example they cannot be relied upon to encompass all elements of business management that a company operating in the construction industry has to consider. In addition to this it identified other management processes currently in use that were deemed relevant to the study including:

- The allocation of resources being specific to a particular workload to improve communications and operating efficiencies.
- The holding of meetings at a suitable frequency to facilitate the sharing of information and discussion of topics that cannot be communicated visually.

- The ongoing review of workload and resources to ensure commitments deliver against business objectives.
- The standardising, where feasible, of internal operating practices to minimise the time cost of resources operating across varied work streams.

Objective 3 - Determine any common suggestions as to how workload fluctuations could be managed within the company and any barriers to implementation.

The study asked respondents for suggestions on action that could be taken in an attempt to manage the causes of workload fluctuation identified in objective 1, it was considered that the respondents were best placed to make these suggestions as they were informed on the relationships between the company / its clients and the existing internal process at the company. With regards to causes originating externally, whilst a number of respondents considered that no action was possible, based on the fact that as a service provider, the requirements of the client would always be the primary driver of actions at the company, other suggested actions included:

- The employment of additional resources – on the basis this would increase overall capacity which, if current workload levels were maintained, would improve the resources ability to react to / manage unforeseen events / requests.
- Improve internal processes / procedures relating to prioritisation of workload / managing of workload conflicts and internal / external communication.
- A review of the internal approach to client engagement including number / nature of clients and levels of confirmed workload.

Suggestions regarding internal causes included:

1. An improved balance between workload and resources i.e. supplementary resources / reduction in workload or a combination of the two.
2. Streamlining of resources / lines of communication specific to a particular work stream i.e. lead professional / administrative resource.
3. Improved internal communication – Through the introduction of a centralised tool and frequent general forum for monitoring / managing of workload and resources.

It was considered that there were no specific barriers to any of the above suggestions being implemented regarding both internal and external causes, however the study noted the requirement for each suggestion to be tailored specifically, not only to the business aims at the company but also its current processes, noting that any actions could result in change and the potential to impact on current operating arrangements. All were considered further in objective four.

Objective 4 - Propose a management tool/strategy to assist in the monitoring/forecasting of workload at the company.

In developing the proposed management tool/strategy, the study considered the findings of the literature review and primary research as well as the information it had obtained whilst compiling the company profile on the company. The study acknowledge the potential limitations of restricting the proposal to one format as established in objective two and therefore included both a management tool and strategy proposal for implementation. The details of each being summarised below:

Management Document:

Excel workbook in Gantt chart format to provide a visual representation of workload over time. Provides the ability for all workload to be included in one document and easily interpreted. The document includes an overview of all confirmed and tentative workload over six months to consider the volume of workload and frequency of fluctuation as well as formatting to denote where information is to be confirmed / contains discrepancies. The study proposes that this document forms the basis of workload management practise at the company and is supplemented by the strategy proposal.

Strategy Proposal:

Monthly Team Meetings:

To facilitate the sharing of general information, meetings proposed to acknowledge that not all considerations that must be made relating to workload / resource can be done so by the use of a document in isolation. Meetings proposed as monthly to consider the availability of resources.

Professional & Administrative Resource Allocation:

One professional and one administrative resource to be allocated as the lead for each work stream at the company, the professional lead being responsible for undertaking the majority of projects and for the internal / external communication relating to that work steam. The administrative resource being

responsible for all administrative tasks and for compiling of information associated with that work stream. Strategy proposed on the basis it would improve operating organisation and efficiency. The strategy also proposed that at least one additional administrative resource be trained in the operating systems for each work stream. It was acknowledged that this required a time commitment to accomplish but it was considered that this action would enable shortfalls in administrative resources to be overcome i.e. employee holiday.

Fluctuations in Workload:

The strategy proposed that when fluctuations of a short term nature require supplementary resources, the lead professional resource for each work stream is responsible for ensuring all information required to undertake a particular task is available to ensure fluctuations are managed with a degree of order. Perceived fluctuations of a long term nature are to be acknowledged by the lead resource and discussed with the company management to determine actions required.

Client Appraisal:

The study determined that an internal appraisal of existing clients should be undertaken in order to ensure current and forecasted commitments deliver against the medium / long term aims of the business and whether any action relative to these aims is required by the company management.

CONCLUSION

The aim of the study was to develop a management tool/strategy that could be implemented to assist the company in managing workload fluctuations and operating resource. The study undertook a literature review to develop an understanding of information associated with its aims and objectives, whilst an appropriate level of specific information could not be obtained, the review established a number of aspects of general business management that applied to the study and were deemed to require further consideration. Each aspect explored provided information for and direction to the proposal as well as making the researcher aware of some of the limitations as to what the proposal could seek to achieve from the perspective of overall company management.

The data obtained enabled the study to establish the extent and common causes of fluctuation in workload at the company as well as suggestions on

how workload fluctuations could be managed as specified in the studies objectives, in addition it facilitated the researcher to identify any common themes and those strongly supported by existing resources. The study therefore considers that objectives 1 - 3 were completed to a satisfactory level but notes that the research was limited in that reasoning behind responses could not be determined and that with hindsight this may have been of benefit to the study overall. Objective 4 was completed having reviewed the findings of objectives 1 -3. The studies proposal was presented in an alternative fashion to that originally intended in that it was possible to deliver against objective 4 and propose a management tool/strategy for implementation however further research has been recommended prior to implementation.

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