

Academic consultancy - Final Report

Skills development for innovative insulation technologies

Industrial partner: Kishorn Developments (www.kdltd.co.uk)

Executive Summary

With the current aim for a low carbon economy in the UK it becomes imperative to ensure that there are adequate skills available to support meeting this aspiration. As such, the UK government has developed a Low Carbon skills agenda that emphasises rapidly developing and delivering specialist skills that are needed to enable the adoption of new technologies. This paper reports on knowledge and skills identified from the trial of an innovative Canadian insulation technology in Aberdeenshire. The trial was carried-out successfully and it was funded by the Scottish Government and the European Regional Development Fund. Semi-structured interviews were conducted with the industrial partner in the project and the house owner, in addition to drawing on the authors' experience. It was found that in the absence of a formalised way for collecting comprehensive information on insulation job, in that particular project, a worksheet is paramount for supporting effective project management. Moreover, the distinctive team roles and responsibilities should be set-out from the outset of the project. Setting-up a local forum for knowledge exchange and mutual learning could be also a plausible way forward to support learning amongst SMEs who are still building their capability in the deployment of innovative insulation products in the market.

1. Introduction

Soaring energy prices has meant that consumers should rationalise their usage and reduce their demand. Equally important is enhancing the energy performance of the current housing stock to reduce the reliance on polluting fossil fuels and thereby reducing the levels of carbon emissions, in addition to addressing fuel poverty. Indeed building insulation is one of the key requirements for a low carbon design and refurbishment. It follows that the rapid development and delivery of specialist skills solutions is needed for emerging sectors and technologies¹ (Meeting the Low Carbon Skills Challenge, 2010). The aim of this project is to identify the skills needs for the adoption of innovative insulation technologies. This research consultancy (**Part 3**) is an extension to two previous projects – as shown below:

Part 1: Testing a new method for cavity wall insulation in a Scottish house – **SME: Craigie Levie** – Feasibility study (*Completed*)



Part 2: Monitoring building fabric and internal environmental behaviour of a recently insulated historic building – **SME: Kishorn Development (KDL)** – Feasibility study (*Currently under-way* – *Dr Amar Bennadji*)



Part 3: Skills development for innovative insulation technologies- **SME: Kishorn Development (KDL)** – **Consultancy** (*Dr Mohamed Abdel-Wahab – HWU*)

¹ Low Carbon Skills, 2010, available at: www.bis.gov.uk/assets/biscore/corporate/docs/l/10-849-low-carbon-skills-consultation.pdf

2. Scope of work

Part 1 of the project involved the successful trial of an innovative Canadian insulation product for the insulation of a historic listed building in Aberdeenshire, namely the Bogendollo House, Historic Scotland Building ID: 51386, which is located in Fettercairn. The trial generated a lot of interest locally and there was a press release² to mark this key milestone for insulating a part of a historic listed building without interfering with its historic features. Part 2, which is currently underway, involves of the monitoring of the building fabric after the successful application of the insulation material. The scope of this report is concerned with Part 3 with an overriding aim of providing an understanding of the skills needs for innovative insulation technologies. It is argued that the application of innovative insulation technology should take a multi-disciplinary approach as it should not only be limited to the technical (hard) issues, but also to the softer issues, and in-particular work management and building-up the skills capacity, in tandem with testing and applying the technology, in order to support the wider adoption of the technology in the future.

3. Findings and discussion

3.1 Work management: an insulation job worksheet

An insulation job worksheet outlines fully what is required in the job along with a tentative cost estimate which would help to support effective communication and aid good project management. *'The guys would know what to expect when they go there and become more productive as well'* said the managing director of the insulation company. It was developed through discussions with the industrial partner in the project and comprises of the following sections:

- 1) Site location
- 2) Description including historic features
- 3) Current energy rating of the building
- 4) Project manager name
- 5) Access route (using Google maps), site layout (including positioning of the rig), and traffic control arrangements (*if applicable*)
- 6) Method statement for application of insulation (*including an estimate of material volume to be used*)

² *'Insulation trial offers new hope for historic buildings increased energy efficiency'* Source: www.edinburghsciencetriangle.net

- 7) Risk assessment and **H&S** issues (Occupant's experience/concerns – *information to be captured through a formal interview*)
- 8) Cost/benefit analysis
- 9) Tentative work programme (Gantt chart)
 - Team roles and responsibilities
 - Additional resources required (*if any*)
- 10) Problem statements along with proposed solutions
 - i. What is required to be done
 - ii. Occupant's experience/concerns.
- 11) Insulation job evaluation

The above headings would form the basis of a template which is going to be used by the SME in future jobs. It will be instrumental for addressing the casual work practices in the construction industry. The purpose of the worksheet is to: 1) support knowledge capturing and sharing to aid the effective management of the project; 2) enable effective management and communication between the project team and provides an opportunity for developing and researching solutions to anticipated problems before commencing work on-site; and 3) support future learning and inform future decisions for similar projects by constructing a database. The job worksheet becomes instrumental when considering the need to overcome the low quality of preliminary surveys to assess scope for insulation, the lack of standards relating to quality of remedial works to walls in advance of cavity filling, lack of recognised technical guidance in filling hard to fill cavities including guidance on the detailed design to mitigate cold-bridges [1].

The insulation job worksheet would be a starting point for constructing a database, which currently does not exist, of historic buildings that were successfully insulated. The database would provide information that could be grouped by building typologies and perhaps recurring themes or problems would be used as a basis for providing future training and thereby advancing the knowledge in that area. Indeed this should provide a valuable resource for companies operating in the insulation business.

Not only will the worksheet help in capturing project-specific knowledge, it can further support building the capability of deploying the technology widely, apart from the product specific training. Research shows that learning from experience through adopting a systematic approach would allow designers to gain effective feedback on their work performance in a project [2]. It follows that a thorough ‘Insulation job evaluation’ becomes imperative in order to support future development and thereby enhancing project performance.

Companies should thus invest time and resources in order to capture this knowledge and overcome barriers such as lack of time, lack of money, pressure of work, reluctance to criticise and a need to progress swiftly to the next project were given as reasons [2]. It has to be noted that a formal evaluation of the insulation job has not been conducted to-date as the project is currently still being monitored and but it is an area that warrants future investigation.

Finally, an insulation job worksheet could form a part of a wider process for managing insulation work, which would include the following phases: Assessment worksheet → Start-up Meeting → Interim review meeting → *Final meeting to report* → *Performance monitoring and evaluation* → *Evaluation and aftercare service to address any arising matters*.

3.2 Generic team roles definition and training

It is contended that the current skills in the industry could be adaptable to the current requirements of the insulation market. The problem is that there is slow pace of adoption for innovative insulation products due to lack of awareness and investment. Building and adapting the current skills in the industry, such as project management skills, to meet the needs for pursuing insulation jobs would not be an issue. Generic team roles, viewed in the context of this, project should be also considered as shown in figure 1 below.

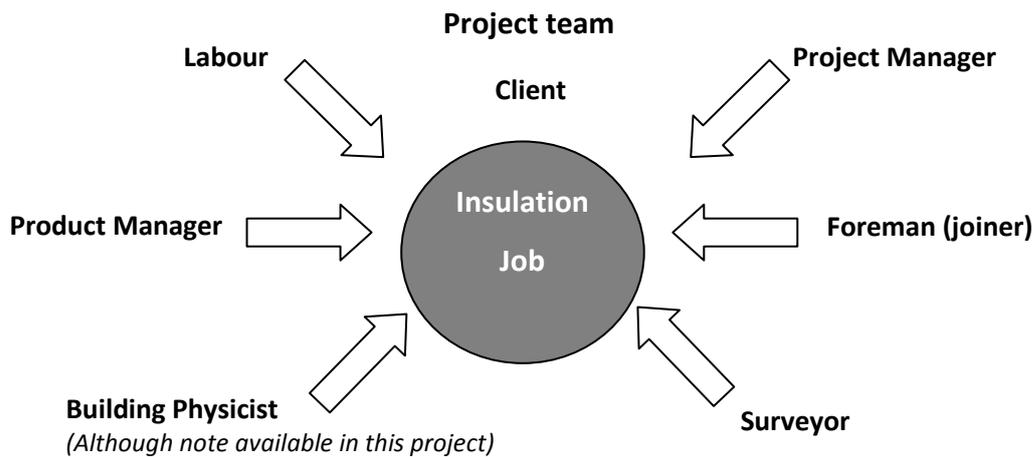


Figure 1: Team roles formulation

The team should collaborate in order to formulate a process for the application of insulation materials and complete the project successfully. Each team role is subsequently discussed.

- 1) *Project Manager (PM)* = oversees the entire work in the project and undertakes initial assessment as per the aforementioned job worksheet. He or she will ensure that project activities are completed successfully, on-time and on-budget.
- 2) *Consultant surveyor* = works with the project manager to undertake the initial survey and would focus on formulating the process for applying the insulation material in collaboration with the project manager. In other words, he or she identifies what needs to be done for successful application of the insulation material, in light of the constraints of the project, such as accessibility to the wall cavity. Moreover, he or she should carry-out a cavity inspection during the site surveying phase. Only when Cavity information has been verified, can a well informed decision be made on the most cost effective strategy to be employed to insulate the walls defined as “Hard to Treat” Cavities [1].
- 3) *Product manager* = have an expertise in the technical properties of the insulation product³ being applied. He or she will be able to provide advice on optimum performance of the product, in-line with the manufacturer’s specifications, given the constraints of the project.

³ The insulation product used in this project was water-based spray foam which expands.

- 4) *Two labourers or installers* who are also known as rig operators or spraying team (one for setting-up and monitoring the production process of the insulation material (which is created on-site) and the other for spraying and monitoring the foam as it goes into the cavity. It has to be noted that there is a potential for using imaging devices to see how the cavity is being filled as the foam expands to detect any potential problems (perhaps a camera attachment to the hose that relays an image back to a visual control panel in the rig as opposed to relying on radio communication could be considered for future projects).
- 5) Semi-skilled joiner carries-out preparatory and remedial work in addition to installing the data loggers for monitoring the performance of the building after the insulation material is applied. A foreman joiner was not required on this job as it was a relatively small project, but may be required for bigger jobs.
- 6) *Building physicists* (although not used in this project) is someone to understand the humidity and ventilation side of things in buildings. He or she can bring a fundamental understanding of physics to improving the design of building fabrics and surrounding spaces. Low carbon designs seek to reduce unwanted heat losses and gains by adopting appropriate standards of insulation and air tightness [3].

‘The insulation job is different from a normal project as it requires different mode of working where the team has to be engaged in discussions to come-up with the most appropriate way for applying the insulation’ said the managing director of the insulation company. The process for applying the insulation material in this project has not been used before, due to the historic nature of the building, and that’s why the Product Manager and Consultant surveyors had to work closely together.

SMEs tend to have an emphasis on multi-skilling where an employee tends to play more than one team role. Whilst there was not a formal foreman joiner, the surveyor and PM had to play that role. It is also worth noting that the size of the project and complexity of the building will determine if one person would be required for each distinctive team role. According to the Household Energy Efficiency (HEE) Skills Review, a broad overview of skills requirements for insulation comprises of: application of existing skills to new materials, installation skills, materials knowledge, and multi-skilling in a range of insulation technologies [4].

Generic skills across the HEE include: communication skills, technology awareness, quality standards and certification, project management and leadership, access to career and training information, Health and safety. Clearly, the findings in this case study is consistent with the HEE Skills Review as the aforementioned team roles has addressed skills requirements for insulation, for example the product manager would have an extensive material knowledge and labourers would have installation skills.

However, the issue of multi-skilling in a range of insulation technologies is not applicable to the results presented by this case study since the insulation material applied was product-specific and hence the skills required were related to a given product. It is interesting to note though that with the upcoming UK Green Deal scheme, Energy Assessors would provide advice to clients on upgrading the energy performance of the buildings in line with the scheme requirements. As such, they have to have an understanding of a broad range of insulation and renewable technologies available in the market in order to better inform their clients on the most appropriate and cost effective measures to be taken to enhance the energy performance of the building.

There is a need for integration of insulation-related skills into current occupations as opposed to creating new occupations with complete new team roles [4]. Indeed an understanding of the generic team roles would help in informing future application of insulation technologies as well as help in identifying possible training requirements – which could draw on the portfolio of projects populated through the initial site assessment worksheet which was discussed above.

3.3 An overview of training

In order to deploy innovative insulation technology, there is a lot of preparatory work involved, starting from capital investment, training, and approvals from the British Board of Agrément (BAA). This section focuses on the training aspect which is primarily product-specific training that provides an awareness of the product after which participants can become approved installers. The initial training developed by the company involved both classroom and on-site training.

‘We trained the guys who do the insulation for us. It should not be difficult finding the guys to do it. KDL is an approved installer and they are a part of an approved network of installers. They were trained specifically on how to use the Canadian insulation product and the equipment’ said the insulation company director. He further explained that *‘the training they undertake prepares them well for what they are going to expect. But they are learning all the time. We sit down and talk down through jobs that have been done and if they have issues they will raise it with us and if we don’t know how to tackle it then we can bring someone from the parent company’*.

Notwithstanding the product-specific training, it is the onerous on approved installers to tailor the foreign product to the local context (in terms of complying with regulations, sourcing required materials and suppliers who are able to provide the equipment for constructing the rig). The rig construction using the specifications provided by the product developer presented a challenge and it was a case of learning on the job or in other words ‘learn-as-you-go’. Now the company knows how to go about the rig construction which would be transported as trailer requiring driver’s licence – Heavy Duty Vehicle (HDV) licence 7.5 tonnes.

In addition to the on-job learning, the workforce involved an insulation job can further or advance their learning through conducting a formal training needs analysis as stipulated by the ‘Low Carbon Skills knowledge or competency Area’ [5]. The training needs analysis involves individuals reviewing their current role and identify if there are gaps in their existing knowledge and work towards addressing those gaps, i.e. being a self-learner and a *reflective practitioner* by identifying opportunities for skills development.

Training needs can include acquiring knowledge of building regulations, carrying-out energy assessments using Standard Assessment Procedure (SAP)⁴. Therefore, skills development and learning should not end after the initial training has taken place but an on-going training and development is required which could be formalised through the training needs analysis tool developed by RIBA.

⁴ *The Standard Assessment Procedure (SAP) is DECC's methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin energy and environmental policy initiatives* (Source: Department of Energy and Climate Change -www.decc.gov.uk/en/content/cms/emissions/sap/sap.aspx)

4. Conclusion

Training for insulation is regarded as a major skills gap and in-particular for harder-to- treat properties. The report has provided a basis for advising the industrial partner on the skills needed in terms of the generic team roles in an insulation job, which can indeed provide guidance from the outset of the project to aid effective project management. The advice in terms of training strategy is that product-specific training is insufficient and that other areas of training are required to support the successful application of insulation technologies, as mentioned above.

Having skills versus the deployment of those skills successfully is crucial - hence the need for a database to capture the lessons learned as we move forward with the application of innovative insulation materials. With only a handful of approved installers of innovative insulation technologies in Scotland, and the market is still evolving, there is a need for setting-up a forum for learning, knowledge exchange, and sharing good practice amongst SMEs working in the field of insulation technologies. The identification of generic team roles and training associated with the insulation of a Scottish listed building is only the first step for developing an understanding of the skills needs for that process.

Each of the aforementioned team roles should be subjected to an in-depth skills needs analysis which would be then mapped-onto current training provision. Indeed the industry must organise itself to articulate its skills needs to government so that funding can be prioritised on the most appropriate qualifications and training that are most needed by the industry [6].

5. Recommendations to the SME

1. *Use an insulation worksheet as a tool for managing future projects*
2. *Conduct an in-depth project evaluation*
3. *Construct a database for insulation projects*
4. *Carry-out a training needs analysis in order to identify skills gaps*
5. *Consider application for funding to support training through grants such as the Low Carbon Fund or ConstructionSkills training grants.*

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Note: *A paper was produced which is entitled "A case study of insulating a historic listed building in Scotland". The paper was submitted to the International Journal of Low Carbon Technologies and is currently under review.*

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