Information Paper 9/13

Lessons from AIMC4 for cost-effective, fabric-first, low-energy housing

Part 2: Supply chain development

Paul Cartwright and Christopher Gaze

This Information Paper is Part 2 in a series of four papers about the AIMC4 applied research project, which was created to research, develop and pioneer the volume production of low-carbon homes for the future that would achieve Level 4 (energy) of the Code for Sustainable Homes without the use of renewable energy.

Part 1 introduces the AIMC4 project and describes the process of translating its objectives into innovative solutions to meet the project targets. Part 3 focuses on developing detailed technical specifications for the homes, and Part 4 on understanding value for the end user and making the construction process as efficient as possible.

Part 2 focuses on supply chain development, ranging from the initial search for suppliers for the AIMC4 homes through to their selection, and including the development of a supply chain to help achieve cost-effective volume housebuilding using AIMC4 solutions

This series of Information Papers seeks to draw together the AIMC4 story in one place as a reference point for industry, government and other stakeholders. The lessons learned cover issues that are relevant to the volume production of low-energy homes, which will be important for all builders and developers as regulations develop in the future.

Introduction

This Information Paper focuses on the supply chain development phase of the project, ie the process of working with suppliers to develop products and build solutions to meet the technical specification. In particular, it describes how the AIMC4 consortium collaborated to develop existing and new supply chains through:

Figure 1: An AIMC4 home built by Barratt Developments

- existing sector suppliers, supplemented through a campaign launched at Ecobuild 2010
- a simple online pre-qualification questionnaire process
- an innovative two-stage 'sandpit' process that identified key products (existing, new and still in development) from companies that were keen to collaborate
- the tender specification, which was initially based on generic house types and refined through an iterative process
- cost analysis and further work with the supply chain to make the results applicable to large-volume delivery of housing.

Figure 2 shows how the phases of the exercise were designed to meet the project's commercial targets. At the beginning of the project, most houses being built were still being constructed to the Building Regulations 2006 (England and Wales)[1] or 2007 Scottish Standards[2]. Firstly the baseline cost of meeting the Building Regulations 2010[3] had to be estimated. At that time the use of renewable energy was commonly expected to be the solution to meeting anticipated changes to the English Building Regulations in 2013 (which were predicted to require building to

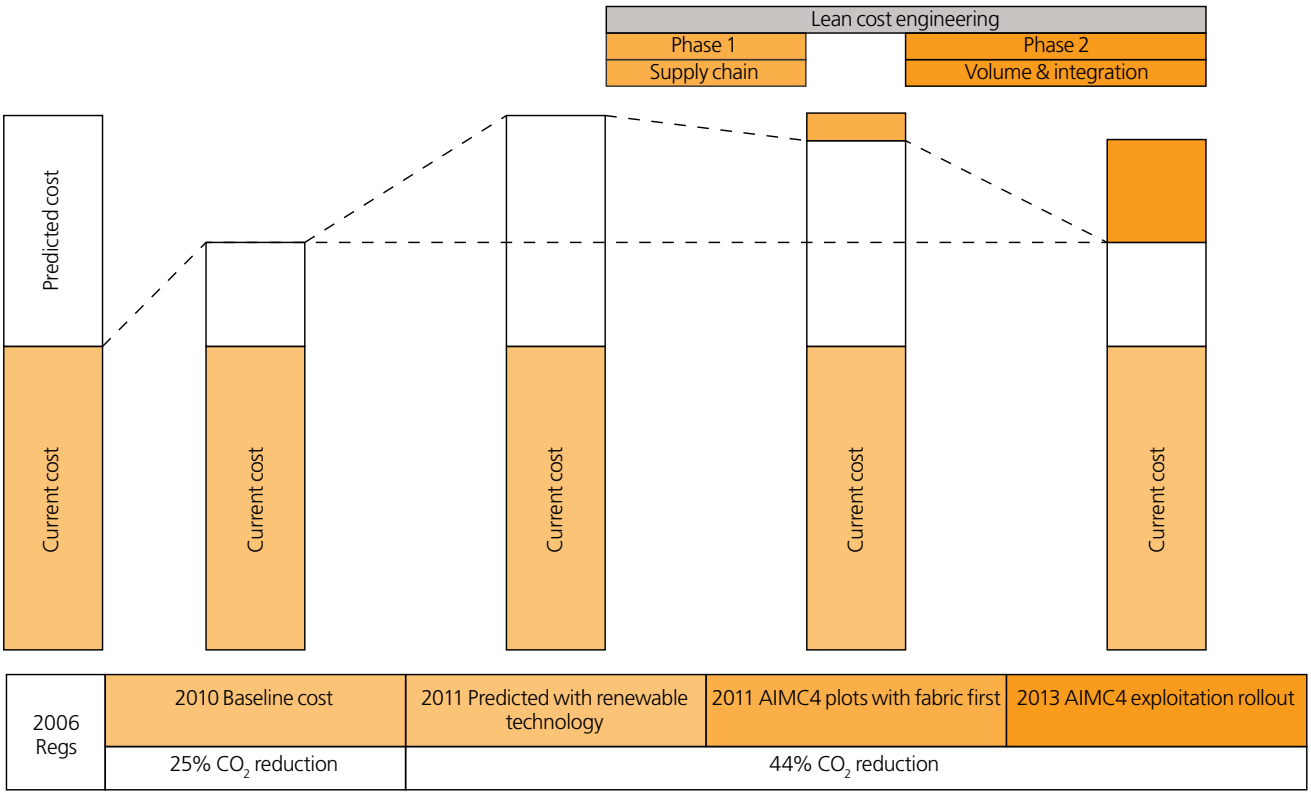

Figure 2: The cost goals

the energy requirements of Level 4 of the Code for Sustainable Homes[4]). However, as the AIMC4 project developed, and the Zero Carbon Hub and government departments started indicating a preference for Fabric Energy Efficiency Standards (FEES), it became apparent how important the solutions being modelled and tested by the AIMC4 consortium would become.

The AIMC4 fabric-first approach aimed to reveal solutions that would be more cost-effective than using renewables, even without economies of scale, and would provide working solutions for FEES-compliant standards. The final approach to achieving the project goal would then be to integrate improvements in the build process and to gain volume discounts on materials and products through supply chain development, to lower costs to meet the target of building Level 4 homes for no more than the cost of Level 3 homes.

The supply chain development process

A new approach to supplier engagement, assessment and final selection was an integral part of the supply chain development process. The consortium had built internal trust, and had to draw suppliers into an open relationship with the consortium and between each other, even if they competed in the same field.

This was a protracted process. Many suppliers were, not surprisingly, sceptical. This work was taking place in the depth of the economic downturn, and suppliers to the construction sector had been hit hard on both volume and price. From the initial 'sandpit' workshops through to final tendering, the consortium saw a gradual development of trust, not simply in working with the three developers, but also a gradual willingness of suppliers to share amongst themselves as the benefits of interactive workshops began to emerge.

Up until the final tendering stage, supplier assessment was carried out through the cross-consortium work groups. This allowed sharing of information to make informed decisions to find value-driven, cost-effective and technically robust AIMC4 solutions. The engagement process is shown in Figure 3.

The supplier search

Seeking out suppliers was an intensive process. Co-ordinated by the AIMC4 communications working group, a number of different marketing channels were developed.

An integral part of the process was the Ecobuild 2010 London conference and exhibition, which provided a launch pad for the supplier search. This exhibition was the ideal forum for engaging with a wide potential supply chain and finding innovative products that had the potential to become part of the AIMC4 solutions. Indeed, the project received expressions of interest from exhibitors of innovative technologies on the Modern Built Environment Knowledge Transfer (MBE-KTN) Innovation Zone, and a number of academics, several of which progressed to the next stages.

Other channels for marketing the project included direct contact with suppliers through existing relationships and supply chains, especially through the developers, the Construction Products Association newsletters, and the MBE-KTN, as well as other non-construction sectors and specialist trade bodies.

Suppliers who expressed an interest were asked to complete a pre-qualification questionnaire.

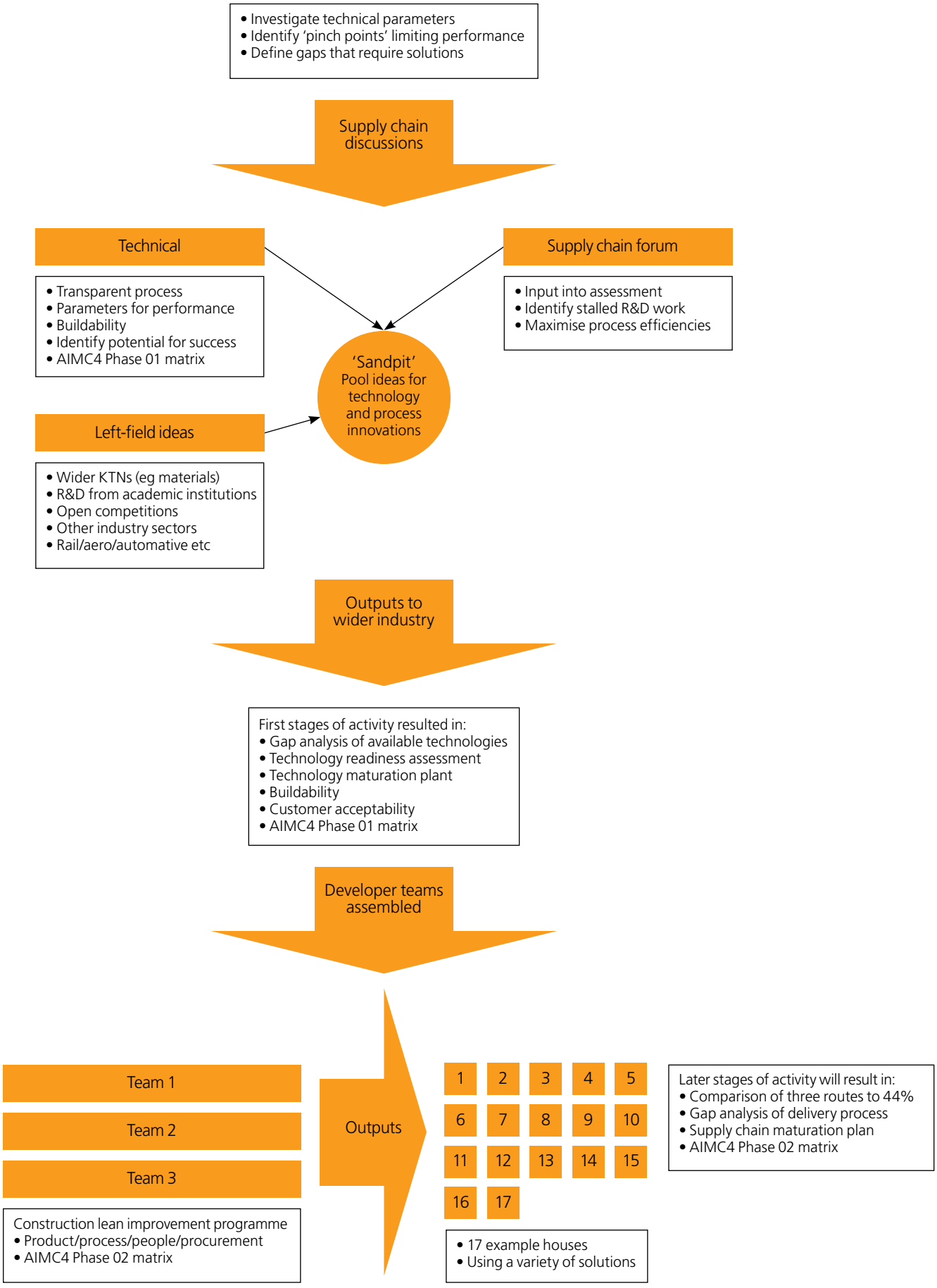

Figure 3: AIMC4 industry engagement process

The pre-qualification questionnaire

Before launching the 'AIMC4 Challenge' to the industry, it was essential to develop a robust process to assess suppliers to ensure their proposed solutions either matched, or could be developed in the short term to match, key ranges of technical and commercial criteria. A simple online pre-qualification questionnaire (PQQ) was prepared with a series of company information, technical, supply chain, commercial and risk-based questions. These included how the products might contribute to the AIMC4 goals of reducing fabric heat loss, or more efficient hot water generation, and whether the products could meet product-specific technical performance criteria; for example, a boiler efficiency of over 92% or a thermal conductivity (lambda value) of an insulation material of 0.02 W/mK or less.

Also included were questions to assess the 'nearness to market readiness' and whether assurance/testing regimes were completed or required. The objective was to ensure that suppliers entering the AIMC4 process had the resources to work with the consortium, and had product offerings at a sufficiently viable stage to take forward. Embryonic products that had some interesting potential were kept in reserve, and some were pursued later.

The PQQ was issued in February 2010 and more than 300 suppliers responded – a very encouraging position. The responses were assessed in a formal manner by the consortium partners, resulting in a shortlist of 90 suppliers who were invited to the next stage of assessment. Those who were unsuccessful were given feedback, and a couple did re-enter the AIMC4 marketplace again at a later stage.

The 'sandpits'

The next stage of assessment involved the use of 'sandpits'. These were interactive workshops that provided suppliers with an opportunity to interact with the consortium and with each other to showcase their capabilities in a challenging yet creative environment. Presentations, team exercises, technical and commercial reviews gave each company the opportunity to demonstrate how their product could contribute to the whole house solution.

The first sandpit, held at the end of March 2010, involved the shortlisted 90 potential AIMC4 suppliers that emerged via the PQQ process. The format of the programme was to outline the AIMC4 challenge and clarify which products and services merited further assessment. But, perhaps more importantly, it was also designed to evaluate the 'fit' of the companies themselves in terms of collaborative working with the consortium.

The suppliers were split into teams and were charged with analysing the challenge (Figure 4), identifying the key issues and presenting these back to a panel of consortium representatives and stakeholders including the Technology Strategy Board and NHBC.

Through this intensive process, 50 companies were selected to go on to the second sandpit, held in May 2010. The aim of the second sandpit was to whittle down the list to those who could be invited to increase the depth of collaborative working and eventually tender for the AIMC4 homes. This time, participants were split into their respective sector categories: fabric and insulation; glazing; heating and hot water; ventilation and airtightness; and lighting and controls.

Figure 4: Analysing the 'challenge' in the sandpits

Each product supplier gave a short presentation on their product offering for the AIMC4 challenge and answered questions from fellow participants and the consortium's technical experts, including many BRE specialists. This established a common understanding of how the product worked, what stage of development had been reached, the extent to which each product had been sufficiently tested to support performance claims and its ability to be delivered at the required volumes eventually anticipated. By rating each product against a matrix of technical and commercial criteria, the assessors ensured a transparent process of fair and consistent evaluation.

Finally, companies were placed in 'virtual' design/construction teams. Each was challenged to improve the overall Standard Assessment Procedure (SAP 2009)[5] rating of a given house type cost-effectively in order to achieve the energy efficiency required for Code Level 4 (Figure 5).

The selection of those who were to go through to tendering was based on a wide range of performance criteria. In addition to technical performance, the shortlisted suppliers were assessed against:

- buildability of product/solution
- desire to collaborate across the supply chain to drive lean efficiencies
- ability to deliver to the required quality and volumes
- ability to demonstrate a collaborative pathway for the value engineering necessary to eliminate any cost premium by 2013
- an understanding (or willingness to develop such understanding) of end user needs, plus

Figure 5: Improving a SAP rating in one of the sandpits

- a willingness to participate actively in the wider objectives of AIMC4, including the post-occupancy evaluation programme.

In total, 33 companies successfully progressed through the sandpit stage and were invited to tender for work within the project. Although most of the initial 90 companies did not make it to the tendering stage, the feedback from unsuccessful participants was very positive in that it provided many companies from the industry with the opportunity to understand the forthcoming challenges within housebuilding and to begin to develop and align their product offerings.

The sandpits provided a dynamic process that allowed direct dialogue between existing and potential suppliers and with the consortium, thus facilitating the move towards the lean workshops and tender processes.

Tendering against generic specifications

With a shortlist of 33 suppliers, the process moved into a more detailed process of providing the potential suppliers with a selection of generic house types used by the three developers that they could cost against. AIMC4 technical specifications were developed and the relevant parts distributed to the different suppliers.

The specifications contained a range of values, normally low, medium or high, for the supplier to quote against. Suppliers also had the option to recommend different specifications if they felt these were more cost-effective. None of the suppliers was given the entire specification in order to protect the project's intellectual property.

Halfway through the tender process a mid-tender review was held. This gave a technical and commercial representative of each company the opportunity to quiz the consortium, and the consortium more confidence that the suppliers understood the unusual nature of what was required. This proved to be very valuable and it undoubtedly improved the quality of the final submissions.

The conclusion of the generic tendering process resulted in a shortlist of suppliers that each of the developers could choose from for their respective development sites; these suppliers had made it to what was known as the 'AIMC4 marketplace'. These suppliers then formally tendered for the actual AIMC4 homes. Successful suppliers then went through a lean design assessment process (see Part 4).

Final tendering for the AIMC4 homes

The final tender process was completed by a shortlist of 25 suppliers going through the traditional commercial and legal processes of tendering for a construction project, but with an expanded set of assessed deliverables as identified in the PQQ and generic tender processes.

The consortium sought to use a range of suppliers for the 17 prototype AIMC4 homes in order to be able to compare their performance and their products. It was also essential to identify as wide a range as possible of fabric-first solutions capable of further development for the eventual delivery of large numbers of low-carbon homes.

Commercial analysis and further developing the supply chain

Although cost models were created prior to construction taking place, it was not possible to be absolutely confident about the true and fully inclusive costs of some elements (including any additional works required to facilitate the new product) until the houses had actually been built. The additional costs for each of the houses were broken down into fabric and airtightness, windows and doors, ventilation and heating and hot water. This revealed that at the time of completion the AIMC4 houses built in masonry or timber frame to an AIMC4 specification were more cost-effective than if renewable energy had been used to achieve the same standard of energy efficiency .

The final phase of the supply chain development process was to embed lessons from the lean analysis of the build process (see Part 4) and to examine how to use economies of scale to reduce the costs of materials and products in the supply chain. Product design and integration can make the build process more efficient and cost-effective, but this does require close collaboration with suppliers.

Once the supply chain group had fully assessed the cost breakdown for each element, the products were categorised as either established products, where the individual developers would separately engage their supply chains, or newer products, where no developer has a competitive advantage and collaborative working is appropriate and beneficial. This final phase of the project to fully develop the value chain and inspire innovation is ongoing.

Lessons learned

The key lessons learned from this intensive and meticulous supply chain process are:

1. The key to product innovation lies with the individual companies in the supply chain but this can be nurtured through broad and effective collaborative processes.
2. Bringing developers together to provide volume can instigate a step change in supply chain innovation by stimulating that collaboration.
3. Considerable attention needs to be given to developing customer-focused specifications for individual products that require significant interaction with the home occupier. Making products user-friendly has often been overlooked by suppliers and developers.
4. When tender processes are significantly different from the norm, a mid-tender interactive review is likely to be very valuable in achieving good outcomes and preventing the need for re-tendering.
5. Fully comprehensive costs will not be known until after the housebuilding process has been completed and analysed.
6. New products require greater analysis for buildability and integration within the built form as labour costs can increase/decrease compared with traditional methods (this will be explored further in Part 4).
7. Greater supply chain interaction is required throughout the development process, eg between suppliers, between suppliers and designers.

References

1. Department for Communities and Local Government (DCLG). The Building Regulations 2000 (England and Wales). Approved Document L1A: Conservation of fuel and power in new dwellings. London, DCLG, 2006.
2. Scottish Government. The Building (Scotland) Regulations 2004. Technical Handbook, Domestic, 2007. Edinburgh, Scottish Government, 2007.
3. Department for Communities and Local Government (DCLG). The Building Regulations 2010 (England and Wales). Approved Document L1A: Conservation of fuel and power in new dwellings. London, DCLG, 2010.
4. Department for Communities and Local Government (DCLG). Code for Sustainable Homes: technical guide. London, DCLG, 2010.
5. Department of Energy and Climate Change (DECC). SAP 2009: The government's standard assessment procedure for energy rating of dwellings. London, DECC, 2009.

Acknowledgements

The writing of this Information Paper was funded by BRE Trust. Stewart Milne Group, Crest Nicholson plc, Barratt Developments plc and H+H UK Ltd funded the publishing of this series of papers.

Technology Strategy Board
Driving Innovation

BRE, Garston, Watford WD25 9XX
Tel 01923 664000, Email enquiries@bre.co.uk, www.bre.co.uk

BRE publications are available from www.brebookshop.com, or IHS BRE Press, Willoughby Road, Bracknell RG12 8FB
Tel 01344 328038, Fax 01344 328005, Email brepress@ihs.com

IP 9/13 Part 2, September 2013
ISBN 978-1-84806-336-5