INDUSTRY DEVELOPMENT - INNOVATION AND TECHNOLOGY DIFFUSION

Full Paper

FACILITATING TECHNOLOGY TRANSFER IN THE CONSTRUCTION INDUSTRY

Dr David Thorpe
University of Southern Queensland
thorped@usq.ed.au

Professor Neal Ryan
Queensland University of Technology
n.ryan@qut.edu.au

ABSTRACT

Cooperative Research Centres produce a range of research outputs that have the potential to be widely applied to industry.

The Cooperative Research Centre (CRC) for Construction Innovation, for example, undertakes research for the construction and property industries. Its research outputs depend on industry acceptance and adoption for their ongoing contribution to these industries.

However, take-up of the new technologies developed by CRC research, particularly in the small and medium sized enterprise (SME) sector, is problematic. Recent research has identified government and industry factors in the take-up of technology and knowledge by SMEs in the construction sector. While solutions can be implemented at government level, much can be done by the industry itself to bridge the gap between research and its implementation.

A research project is being developed to identify and evaluate aids and barriers to such technology transfer; and recommend ways in which it could be better facilitated for the benefit of the construction and property industries.

Keywords: construction, technology, transfer, industry, innovation, adoption
FACILITATING TECHNOLOGY TRANSFER IN THE CONSTRUCTION INDUSTRY

1.0 INTRODUCTION

Cooperative Research Centres (CRCs) produce a range of research outputs that have the potential to be widely applied to industry.

The Cooperative Research Centre for Construction Innovation (CRC-CI), for example, undertakes research in business and industry development, sustainable built assets and delivery and management of built assets, and produces a large number of research outputs. These research outputs are dependent on industry acceptance and adoption for their ongoing contribution to the construction and property industries.

The CRC-CI has a vision that by 2020, the (construction) industry should be taking more responsibility for leading and investing in research and innovation (Hampson and Brandon, 2004, p.7). The Centre has identified a number of industry, research and funding barriers to achieving this vision.

These barriers include the cyclical nature of the industry with expectation for short-term deliverables; shortage of client and industry leadership; limited history of real and timely business deliverables from researchers; self-interest of many of the participants, inability of the industry to foresee the tide of competition (in global or green terms); lack of trust between industry and researchers in sharing vital information; and lack of long-term funding basis for a national R&D centre. It was also observed that the failure of existing research organisations to consolidate the confidence of industry will threaten existing initiatives.

Hampson and Brandon have observed that there requires to be a commitment to collaborative research and innovation, with genuine mutual consultation with industry essential for research and development to make a difference. Importantly, they note that “given that 84 per cent of Australian construction businesses employ fewer than five people each, encouraging more involvement with SMEs (small and medium sized enterprises) is critical in ensuring the awareness and uptake of advanced technologies and management systems to upskill Australian industry.”

(Hampson and Brandon, 2004, p. 10).

Innovation in the Australian construction industry was investigated by Manley et al (2005), who found that although the rates of innovation in Australian construction for “new to industry” innovation were respectable compared with the New Zealand experience, it was expected that for lower levels of innovation novelty (“new to firm” innovation) the industry needs to do better.

Both of these documents suggest that within Australia, there requires to be a concerted, cooperative effort in the construction industry to improve the take-up of innovation, including the results of research. This view is also supported in the international context by the European Constrinnonet project (European Commission 2004), which investigated construction innovation in the European Union, with particular emphasis on the small and medium enterprise (SME) sector, and found that no simple solution exists to address the problem of innovation in construction, and that government policy initiatives are also important in the adoption of technological
improvements.

Therefore, while there is innovation occurring in the construction industry, there is definite room for improvement. This improvement is unlikely to occur without a coordinated effort by the whole industry aimed at addressing the barriers to the innovation process. Government policy initiatives and action by the industry itself are both important in the technology transfer process essential for delivery meaningful innovation to the industry, as is a focus by researchers on meeting the industry’s needs. This is particularly important for the small and medium enterprise (SME) sector, which may lack the resources to take risks on implementing newly developed innovations.

This paper considers the question of facilitating technology transfer in the construction industry in more depth, and proposes research designed to identify and evaluate the main factors at organisational level that aid or hinder the transfer of technology from the CRC-CI to the SME sector of industry, with a view to enhancing this process.

2.0 RESEARCH IN THE CRC FOR CONSTRUCTION INNOVATION

The objectives of the CRC for Construction Innovation are to enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development; to enhance collaboration between researchers; and importantly to create and commercially exploit tools, technologies and management systems to deliver innovative and sustainable constructed assets to further the financial, environmental and social benefit to the construction industry and the community.

In achieving its objectives, the CRC-CI undertakes research projects under the three related programs of Business and Industry Development; Sustainable Built Assets; and the Delivery and Management of Built Assets. These programs are supported by an information communications and technology (ICT) platform. Each of these programs delivers its outcomes through brochures, papers, reports, and other publications of interest to the industry. Topics discussed in these publications have included improved road pavement data collection, the knowledge advantage in the construction industry, sustainable sub-divisions, automated code checking in the building industry, automated eco-efficiency assessment of commercial buildings (LCADesign) and innovation studies in the Queensland roads industry.

This direct dissemination is supplemented by an educational strategy that sees one clear path to transferring its technology to industry as education and training, including links with vocational education and training, technical and further education and higher education.

(CRC-CI 2005a)

While it is taking positive steps to achieve its vision for the construction industry and is delivering industry-centred research results, the long-term success of the CRC-CI is likely to depend to a significant degree on the extent to which the results of its research are taken up not only by the construction and property industry level but also at the individual firm level. The small and medium enterprise (SME) sector of the construction industry is pivotal in this task, as it is the adoption by this sector of innovations in areas like improved materials, improved management processes, take-up of ICT advances and sustainable practice that will improve the effectiveness and
efficiency of the construction industry as a whole and deliver real changes that significantly impact our economic, environmental and social welfare.

3.0 THE INNOVATION LIFE CYCLE

Transfer of technology from research organisations like Cooperative Research Centres (CRCs) to industry, and particularly to the SME sector, is a complex and often interactive process. While this process can be facilitated by a CRC through its educational strategy and its collaboration between industry, government and research organisations, there are still many hurdles to overcome. These may include factors like the relevance of the research to the industry, the quality of the research, government policy, and a range of industry factors.

However, if the technology transfer (and management) process is not addressed, there is unlikely to be little of the innovation occurring that is needed for success. In describing the process of managing technology and knowledge, Trott (2005, p. 177) observes that one of the fundamental issues for firms is to transform technology into profit. He notes (p. 184) that over long periods firms build up a body of knowledge and skills through experience and learning-by-doing. This can be transferred to competitive advantage (however, it can also be difficult to “undo”, particularly in the case of firms that have built up considerable reliance on the processes and systems they have developed over the life of the firm).

One of the fundamental features that determines successful firms is their ability to identify and exploit technological opportunities. Firms may develop distinctive competencies (often five or six at the most if they want to be world leaders) that distinguish them. These tend to form the tacit knowledge and embedded routines that are at the core of the organisation’s abilities. The ability (in large firms, in particular) for organisations to develop firm-specific competencies that take time to develop and are costly to imitate will to a large degree determine their survival, particularly if the firm can turn technical competencies into effective innovation and generate effective organisational learning. Such firms will often develop a knowledge base that is more than the sum of the individual parts of the firm. The learning organisation is therefore critical in the development of knowledge and is a key component of its innovativeness (Trott, 2005, pp184-202).

Technology has a definite life cycle. Figure 1 illustrates the common technology life cycle known as the “S curve”, with some representative construction technologies and processes plotted on the curve.

This curve shows that the performance (or technological progress) of a new technology increases slowly at first, then as it is becomes more widely adopted and improved, it increases more rapidly until it becomes a mature technology that has reached its physical limits, at which stage the rate of progress slows. The best marginal improvement is therefore in the technology improvement stage. As noted by Trott (2005, p. 187), it is usually at this point that a new technology replaces an existing one (for example, computers using parallel processors building on a previous technology of single processors operating at high speed).
Facilitating technology transfer in the construction industry
David Thorpe and Neal Ryan

Resources, or time
New Invention Technology Improvement Mature Technology Aging Technology

Performance Limit
Investment Decision Framework for Infrastructure Asset Management
LCADesign

Well established materials, processes, systems
Established technologies e.g., mobile phone
Developing innovations e.g., relationship contracting

Figure 1: Technology “S” Curve

The representative construction technologies and processes plotted on Figure 1, working backwards from the most mature are:

- Well established materials, processes and systems that are an accepted part of any building or infrastructure project and which have limited opportunity for further development.
- Established tools and technologies that can be developed further, such as the computer and mobile phone. These technologies are still being improved and are capable of starting a second generation phase of development if there is a significant new technological change (as outlined in the reference from Trott 2005 above).
- Developing innovations such as relationship contracting, which is quite well established in a number of countries such as Australia (see for example Thorpe and Dugdale 2004 which discusses the use of alliancing in local government), but still has the ability to deliver considerably more benefits both in countries where it is an established practice and in other countries.
- New developments, such as the investment decision framework for infrastructure asset management data collection tool and the LCADesign tool for automated eco-efficiency assessment of commercial buildings, both of which have been developed by the CRC for Construction Innovation.

The investment decision framework for infrastructure asset management (for example, Piyatrapoomi et. al. 2004) optimises the collection of road structural data. It has increased the testing interval for falling weight deflectometer testing from 200 metres to between 700 and 1200 metres depending on soil type. This methodology has been trialled by the Queensland Department of Main Roads and has enabled the Department to collect four times as much data for road maintenance for the same level of expenditure. This equates to approximately $4 million of savings for the government on state-wide data collection costs. This project received a High Commendation at the
Facilitating technology transfer in the construction industry
David Thorpe and Neal Ryan

2005 Queensland Engineering Excellence Awards conducted by Engineers Australia (CRC-CI 2005b, pp. 62, 64, 70).

This technology has the potential to be developed for use in a range of asset classes, and therefore is likely to achieve high performance over time. Because it is still in the early stages of development yet has already started delivering monetary benefits, it has been placed in the early stages of the “Technology Improvement” stage of the technology “S” curve. This placement recognises that it has both delivered benefits and has considerable potential to deliver more in future.

LCADesign was developed through the Sustainable Built Assets research program of the CRC-CI, and is “an automated eco-efficiency design tool for commercial buildings that makes assessments directly from 3D CAD drawings” (CRC-CI 2004, p. 54) It is noted that the prototype of this tool is being applied to seven commercial office designs (CRC-CI 2005b, p. 28) and that the University of New South Wales has requested prototypes of this tool for use in their Multi Disciplinary Design Studio postgraduate course (CRC-CI, p. 38). It has been placed at the edge of the “New Invention” stage in the technology “S” curve as it is considered to be still at an early stage of development but has potential to deliver considerable benefit to sustainable development both in Australia and globally.

The adoption of technology also follows a (different) S-shaped pattern to that of the performance based “S” curve. This curve is the cumulative frequency of the percentage of adopters of a technology over its life span. Rogers (1983, pp. 243-247), describes this curve and divides adopters into five categories – innovators, early adopters and the early majority (which together make up those below the mean number of adopters), the late majority and the laggards. In his description, the majority make up those adopters who are within one standard deviation of the mean.

Each adopter has distinctive characteristics. These tend to relate to the risk involved in the adoption. Thus, Rogers (pp. 247-251) notes that:

- innovators are venturesome, prepared to accept setbacks, and play an important role in the diffusion process
- early adopters are a more integrated part of the local social system who are respected by their peers and are often looked to by other adopters for advice
- the early majority tend to deliberate more than the early adopters but adopt new ideas before the average member of the social system
- the late majority tend to be sceptical at first and are not convinced to take up an innovation until most others in their social system have done so
- laggards use the past as a point of reference for adoption of an innovation and often have limited resources and need to be absolutely certain that a new idea will not fail before they will adopt it.

The innovation life cycle is therefore characterised by a number of key points. Firstly, firms tend to build up knowledge and skills over a long time. Secondly, the more successful firms have the ability to recognise and exploit technological opportunities. Thirdly, the marginal advantage (performance or technological progress) of these opportunities is at its least in the early and late stages of the life cycle of the innovation. Fourthly, early adopters have the opportunity to enter the market early and gain maximum advantage from the innovation, while late adopters gain little marginal advantage. Finally, early adopters tend to be risk takers while late adopters tend to be risk adverse. Therefore, selecting the right point in the innovation life cycle at which to adopt and possibly enhance the innovation is a critical judgment issue in the technology transfer process.
4.0 TECHNOLOGY TRANSFER IN COOPERATIVE RESEARCH CENTRES

Cooperative Research Centres bring together researchers and research users in collaborative arrangements to maximise the benefits of research “through an enhanced process of utilisation, commercialisation and technology transfer.” (Department of Education, Science and Training 2005).

CRCs funded from 2002 onwards are required to develop and implement a commercialisation plan that maximises the benefits to Australia of publicly funded cooperative research, measured in terms of economic, social, and environmental outcomes. National benefits may be demonstrated through a range of measures, such as financial gains, productivity gains, export development, development of strategic industry clusters, enhancement of Australia's skill base, consumer and user benefits, and a range of other measures.

Through their employment of a large number of knowledge workers and their research and development activities, CRCs possess and develop considerable knowledge – both tacit and explicit. Sullivan (2000, pp 162, 163) expresses this concept as the knowledge and know-how possessed by human capital and the organisation’s intellectual assets (commercialisable intellectual assets and supporting intellectual assets – organisational structure, managerial methods, operational methods and procedures). The commercialisable assets (or intellectual property) form the technology that is transferred by the CRC. The tacit knowledge possessed by its people may assist this process.

Sheen (2005) surveyed 62 CRCs in an extensive study of managing intellectual property and licensing with respect to CRCs. He observed that there is a need for CRCs to have a better understanding and practice of commercialisation opportunities, particularly through the involvement of third party commercial interests. He added to Sullivan's model of intellectual asset management the components of relationship, project management, agreements and licensing.

It is important that CRCs measure and communicate the benefits from their research. A report that reviewed the framework for measuring the outcomes of the CRC program (Garrett-Jones and Turpin, 2002) noted that the most universal measure used by CRCs for the strategy for utilisation and application of research outputs was the extent to which users are prepared to engage and pay for expertise within the CRC (this was often a good source of income). Other measures included the number of spin off companies (often small) and licensing of intellectual property (such as patenting and the licensing of patents). The report observed that particular indicators will carry different importance for different Centres.

The Commercialisation and Utilisation Plan Guidelines for the CRC Programme (Department of Education, Science and Training, 2004) sets out how national benefits can be demonstrated and describes the development of the commercialisation and utilisation plan (including intellectual property) for the CRC. This plan should include sections on market potential and monitoring, the strategy to realise the value of intellectual property, and measuring and communicating national benefits.

In summary, it is important that CRCs are able to transfer the technologies they develop to the particular industry that they serve. Typically, the core members of a CRC have the resources to be innovators and early adopters of this technology. Other
large organisations would also have the resources to evaluate these technologies. There may be fewer of these resources possessed by the SME sector.

Successfully achieving technology transfer in a way that delivers maximum benefit to Australia therefore requires a careful balance between a range of factors like research, development, project management, industry relationships, education, training, industry assistance and effective commercialisation practices. Doing so in the construction industry is a key challenge for organisations like the CRC for Construction Innovation.

As part of its technology transfer, the CRC-CI has developed an education and training program across its participant group and the industry. Its activities have included industry breakfasts; partner and industry workshops; and the uptake of CRC applied research outcomes into the curriculum of university partners. The CRC-CI has also published industry reports (such as the “Sustainable Subdivisions – Energy-Efficient Design” report) and industry-focussed booklets designed to provide access for the property, design, construction and facility management sectors to its research (CRC-CI 2005b, p. 3).

The principal strategy that the CRC-CI has used for the SME sector is to work with industry and professional associations (such as the Australian Construction Industry Forum ACIF) to deliver information sessions through breakfast sessions or half-day industry forums. This interface has also included end-user involvement in selected activities, such as trialling ICT analysis tools. The CRC reported that there were four industry workshops in 2004-05. One of its dissemination tools to the SME sector is the use of seminars to disseminate a range of innovation studies through periodic industry presentations (CRC-CI 2005 b, pp. 3, 11, 13, 59, 63, 69).

5.0 ISSUES IN TECHNOLOGY TRANSFER IN THE CONSTRUCTION INDUSTRY

The above discussion illustrates the importance of effective technology transfer as early in the innovation life cycle as possible. This is particularly important, in the construction industry, for the SME sector on which so much of the industry relies for delivery of its projects. This section elaborates some of the specific issues in this technology transfer process, and in doing so builds on the discussion in the introduction to this paper by Hampson and Brandon (2004, p. 10), who identified a number of industry, research and funding barriers to achieving the vision of the CRC-CI - that by 2020 the industry should be taking more responsibility for leading and investing in research and innovation.

Blayse and Manley (2004) identified six main factors that influence innovation in the construction industry – clients and manufacturers, the structure of production, relationships between individuals and firms within the industry and between the industry and external parties, procurement systems, regulations/standards and the nature and quality of organisational resources. Innovation in this sense tended to be the actual use of a nontrivial change and improvement in a process, product, or system novel to the institution developing the change, within the broader product system. The authors noted that the identified influences can be strategically managed to maximise innovation outcomes. Partnering and alliancing approaches to project delivery, use of innovation brokers in adding value to knowledge bases, and enhancing knowledge flows and performance-based regulation in generating alternative building and construction proposals were the three most novel findings of their paper.
Facilitating technology transfer in the construction industry
David Thorpe and Neal Ryan

As previously discussed, the Constrinnonet project (European Commission 2004) found that no simple solution exists to address the problem of innovation in construction. While this report focused on issues in the European Union (EU), much of its content would be applicable in countries like Australia.

The basis for this project was an OECD finding that construction was among the more traditional sectors of the economy, with a relatively low research and development performance, and yet accounted for about 7% of the working population and contributed over 6% to national GDP figures. It was populated predominately by SMEs. The sector also struggled with a complex, fragmented structure and poor reputation. At the same time, its level of investment in research and development was generally less than 0.5% of company turnover, and yet there appeared to be no lack of public services generally available or economic support for research training and development.

The objectives of the Constrinnonet project were:

- To study the mechanisms behind successful innovation and develop strategies to help transfer these into practice.
- To examine how various service providers in the market can assist in spreading these mechanisms to construction SMEs.

It consisted of two phases – a six-month definition stage and a 2.5 year implementation stage aimed to enhance know-how on the mechanisms behind successful innovation, develop and test actions for improved innovation support and exchange this information with various stakeholders trans-nationally.

In addition to its conclusion that no simple solution existed to address the problems of innovation in construction, the project also found that business support was identified as the most relevant mechanism through which to promote innovation in SMEs of the construction sector, and that European governments and their agents had generally failed to engage with the vast majority of construction SMEs in crucial areas. At the regional level, there was a marked absence of focus on construction in innovation support mechanisms or business development services.

Recommendations were made for EU-level and national/ regional level policy, service providers and SMEs (and big companies). Policy issues included initiating specific innovation efforts for construction in the EU, developing statistics about construction, innovation in business support, and regional initiatives. Among the recommendations for service providers were to focus on innovation in construction and business practices, identify regional resources and avoid “one-size-fits-all” solutions. It was also found that more could be done by the industry itself to bridge the gap. While the construction sector should share some common objectives and strategies, each SME needed to identify a clear and concise benefit it can get from involvement in common activities.

The above studies and reports on the construction industry all show that improving innovation in the construction industry is likely to be best facilitated by a coordinated response by government (which are often both regulators of the industry and major purchasers of products of the industry), researchers and the industry itself (which tends to be fragmented, often committed to delivering a project within a relatively short time span, and has a high proportion of SME organisations). An important component of the innovation process is the transfer of technology from researcher to industry, and there is unlikely to be any one best way of undertaking this process.
6.0 SUMMARY OF THE ISSUES

Technology transfer in the construction industry, which in turn leads to the changes and improvements in processes products and systems that characterise innovation in the industry, is a complex process involving a wide range of participants.

While some of the factors impacting on this process can be addressed by researchers and government, a significant feature in this technology transfer process in the construction industry is the nature of the industry itself. Factors like the cyclical nature of the industry, its conservatism, its fragmented nature, the inability of the industry to foresee the tide of competition, and lack of trust between industry participants in sharing information can all be barriers to the knowledge transfer process. The difference in emphasis in the types of innovation that might best serve a particular segment of industry is a further complicating factor.

One of the potentially more significant factors is the quite small resource base possessed by most organisations in the SME sector, which limits the risk they can take in adopting innovative processes, products and practices. Lack of resources can also impact on the time that firms in this sector can invest in learning new processes or learning the skills to adopt a new technology.

Thus, while the CRC-CI is taking significant steps in involving industry (including the SME sector) in the dissemination of its research, industry factors and the lack of resources possessed by the smaller participants are likely to make it difficult for them to adopt a number of the research outputs. They might perceive, for example, that the investment decision framework for infrastructure asset management is the province of larger organisations, or that the LCADesign tool is of use to a large consulting firm but has little relevance to a small organisation. As such tools, or modified versions of them, have potential benefit for a number of individual organisations and the industry as a whole, this perception requires to be overcome.

This is important when viewed in the context of the innovation life cycle, as smaller organisations are therefore likely to be late majority innovators or even laggards unless they are quite sure of gaining a return on their investment. As the industry as a whole depends on the performance of the SME sector for its welfare as a whole, the early take-up of innovations by the SME sector is an important issue that requires further investigation.

Finally, there is the important aspect of commercialisation for the CRC partners. Researchers and their financiers expect and are entitled to fair compensation for their efforts, both to undertake existing research and to be encouraged to undertake new research. On the other hand, making innovation expensive will leave many firms in the SME sector out of the technology transfer cycle. Achieving a good balance between these competing requirements, and timing the transfer of technology to be of most benefit to the industry, are essential.

In summary, there is unlikely to be one single best approach to the technology transfer process in the construction industry. If this process is to be better facilitated, a way needs to be found that commits all the key participants – industry, government and research organisations like the CRC-CI – to a shared view of innovation in the industry that delivers an outcome that is optimum for the nation, the industry as a whole, and the individual people and organisations in the industry.
7.0 RESEARCH INTO THE TECHNOLOGY TRANSFER PROCESS

In order to better facilitate the transfer of technology from researchers to the construction industry, a research project is being developed to identify and evaluate aids and barriers to technology transfer for the SME sector of the industry and recommend suggested improvements to the technology transfer process for the benefit of the industry.

The main proposed components of this project are:

- Assess the benefits (and the perceptions of the value of those benefits) that SME firms could expect from more quickly evaluating and adopting the results of CRC-CI research.
- Evaluate the aids and barriers to technology transfer from the CRC-CI to individual SME firms.
- Review strengths and weaknesses of the existing technology transfer process from the point of view of the SME sector of the construction industry.
- Recommend improved ways of facilitating this process.

It is expected that this research will be based on the innovation life-cycle and technology adoption cycles, and will evaluate a number of factors in the technology transfer process. These will include industry attitudes, level of support available, aspirations of partners in the CRC, government policy, type of research project and its outputs, intellectual property considerations, and management of the technology diffusion process by the CRC. The industry wide factors identified by Blayse and Manley (2004) will be taken into account.

Wherever possible, this research will use a case study approach to investigate the diffusion of new technologies developed by the CRC for Construction Innovation to industry, using available data supplemented by interviews and questionnaires of a range of industry participants. CRC for Construction Innovation case studies may be supplemented by research undertaken in other engineering related CRCs and research organisations.

This research aims to develop a process to assist the take-up by the construction industry of the outputs of research from CRCs and other research centres.

8.0 CONCLUSION

The transfer of technology from research organisations like the CRC-CI into the construction industry, and it particular its SME sector, is quite complex, involving a network of researchers, sponsors of research, clients, consultants, contractors, trade and industry associations, and other parties. While there have been successes in achieving this transfer, many innovations take time to be accepted by the industry. The SME sector, which traditionally lacks large resources and tends to be quite conservative, is particularly slow to take full benefit of advances in technology that are not immediately apparent.

Overlaying the technology transfer process are the benefits and risks organisations can expect to obtain from adopting innovations; the innovation life cycle; and fair compensation for researchers and their financial supporters. Government policy decisions and industry wide factors are also likely to impact on the technology transfer process.
Organisations like the CRC-CI have successfully adopted a range of strategies for this process, including industry presentations, involvement of industry in the innovation development process, and making close links with industry associations. However, there needs to be further research into overcoming industry factors like expectation of short-term deliverables, fragmentation, lack of trust and the need for global competitiveness both economically and environmentally, if maximum benefit is to be achieved for SME organisations.

Studies have shown that there is no one single answer, and that technology diffusion in the construction industry involves the active participation by all those involved.

In order to better facilitate the transfer of technology from researchers to the construction industry, a research project is being developed to identify and evaluate aids and barriers to technology transfer for the SME sector of the industry and recommend suggested improvements to the technology transfer process for the benefit of the industry.

REFERENCES


CRC-CI 2004, Cooperative Research Centre for Construction Innovation Annual Report 2003-04, Cooperative Research Centre for Construction Innovation, Brisbane, Queensland


CRC-CI 2005b, Cooperative Research Centre for Construction Innovation Annual Report 2003-04, Cooperative Research Centre for Construction Innovation, Brisbane, Queensland


Hampson, KD and Brandon, P 2004, Construction 2020: a vision for the construction and property industry, Cooperative Research Centre for Construction Innovation, Brisbane, Queensland.

Facilitating technology transfer in the construction industry
David Thorpe and Neal Ryan

Innovation Survey, Cooperative Research Centre for Construction Innovation, Brisbane, Queensland.


