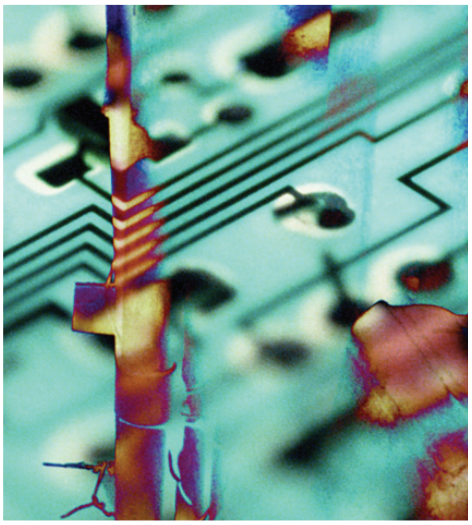
Action learning as an enabler for successful technology transfer with construction SMEs

RICS Research paper series
Volume 7 Number 16

October 2007



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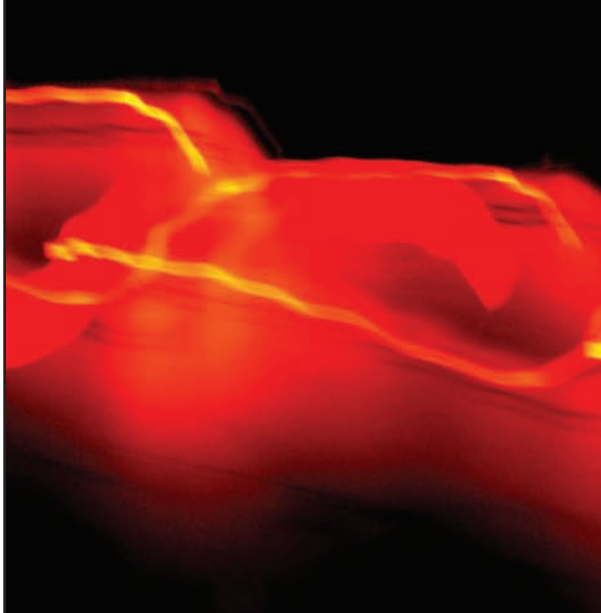

October 2007
ISSN 1464-648X
ISBN 978-1-84219-354-9

Published by:

RICS
12 Great George Street
London SW1P 3AD
United Kingdom

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Abstract

There is an increasing demand for construction companies to adopt and use new technologies. At the same time universities are increasingly being called upon to assist with 'technology transfer' through positive engagement with industry. However, there is little literature investigating technology transfer from the perspective of small construction companies which make up the overwhelming majority of firms in the sector. This paper contributes to this developing area by providing a literature review of technology transfer and proposing a holistic system required for success. Building upon this review it assesses the potential use of action learning as a means of providing this holistic solution and, in so doing, promoting technology transfer and improving the links between higher education institutions (HEIs) and the construction industry. The assessment is made through a literature review of action learning in construction and an analysis of results from the national Construction Knowledge Exchange (CKE) initiative which uses an action learning methodology to assist HEIs in supporting local construction small and medium-sized enterprises (SMEs). The initial results show that this innovative approach, has been successful in creating synergies between academic and business worlds, helping HEIs to communicate more effectively with businesses and vice versa. However, the results indicate that innovations which small construction companies tend to more successfully adopt are those which can contribute to the business in a quick, tangible fashion, and which can be dovetailed into existing organisational capabilities. This is found to be in marked contrast to the relevant literature which depict large companies operating in more complex networks, drawing upon them for new tacit and explicit technologies which support more long term, formal technology strategies, and which often complement some form of specialised internal research and development capability. The implication for policy is that any technology transfer initiatives need to appreciate and actively manage the different motivations and capabilities of small and large construction companies to absorb and use new technology.

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1 Introduction

Improving the performance of the UK construction industry continues to be on the UK policy agenda. As part of this agenda companies are encouraged to make more and better use of new technologies. Technology transfer is a key element of any policy to encourage adoption of new technologies. Whilst it is recognised that HEIs have a central role to play in promoting technology transfer (Lambert, 2003), and some mechanisms exist for this, it is widely accepted in the construction sector that more could be done in this regard (Fairclough, 2002).

There is a growing appreciation, that the new technologies being advocated must meet the needs of all sections of the industry, particularly the 95% or more of the companies that employ less than 25 staff (DTI, 2006). Furthermore policies to encourage the adoption of new technology must be coupled with appropriate mechanisms to develop awareness of the new technologies available, and to encourage and facilitate their appropriate exploitation. As the next section shows, such a system should take a broad view of technology transfer encompassing a dynamic, knowledge-based view of technology transfer, taking into account individual and organisational contexts such that the technology transfer process is conceptualised as an integrated flow of knowledge. A mechanism that seeks to promote technology transfer therefore needs to operate a knowledge-based approach centred at the company level which enables continuous, effective knowledge conversion and creation.

Having acknowledged the consensus that current mechanisms used by HEIs to assist in this process leave room for improvement, innovative approaches to industry engagement should be explored. Given the required emphasis on knowledge conversion and creation for successful technology transfer, action learning (Revans, 1982) is proposed as one mechanism through which HEIs could assist construction SMEs with technology transfer. Action learning is a well-used and well-documented approach to management

The core idea behind action learning is to create small, mutually supportive groups or circles of people who band together to solve real problems or difficulties which are not solved in current best practice

education and development (Botham and Vick, 1998; Mumford, 1985; Pedlar, 1996; Revans, 1983). The core idea behind action learning is to create small, mutually supportive groups or circles (known as SETs) of people who band together to solve real problems or difficulties which are not solved in current best practice.

The aim of this paper is, therefore, to identify those characteristics required for a successful technology transfer system and to compare an action learning approach against these characteristics in order to make an assessment as to whether the practice of action learning matches the theoretical requirements for successful technology transfer. This comparison is then complemented with lessons drawn from previous examples of the use of action learning in construction and the initial results from the Construction Knowledge Exchange (CKE, www.cke.org.uk). The CKE, is a project based at the University of Salford which has used an action learning approach to bridge the gap between industry and academia and so assist construction SMEs to grow their capacity for innovation. Following this, lessons learnt from the project are presented. Finally, conclusions and recommendations for the future use of action learning to promote technology transfer are made.

2 Technology transfer

This section of the paper reviews existing literature on technology transfer and proposes a holistic technology transfer mechanism that requires a wide range of factors beyond technology to be taken into account to enable successful transfer to take place. These factors must all be taken account of if broker organisations such as HEIs are to meet the needs of construction SMEs needs for technology transfer. The following section will therefore examine the characteristics of action learning to determine whether it takes into account these factors and, therefore, whether it is a suitable method of supporting technology transfer.

There is no doubt that performance improvement can result from innovation absorbed into companies through technology transfer (DTI, 2002; Mitropoulos and Tatum, 1999; DETR, 1998). For the construction industry the assumption is that 'new' technology means new to the company rather than new per se (Sexton and Barrett, 2003, p. 626; Thompson, 1965). However, the creation of effective mechanisms to aid technology transfer requires a proper understanding of technology transfer processes. These processes are complex, varying with company capabilities and processes, and the knowledge characteristics of the particular technologies. A wide view of technology transfer is thus taken, and is understood to be the "movement of know-how, technical knowledge, or technology from one organizational setting to another" (Roessner in Bozeman, 2000, p. 629). Further, it takes a similarly broad view of technology, defining it as the know-how about the transformation (Wilson, 1986) of operational technologies and processes; material technologies; and knowledge technologies (Hickson et al., 1969). To be effective the transfer itself must be both appropriate to user needs (Klien and Crandell, 1991) and associated tacit knowledge (Teece, 1977; Howells, 1996). Further, the emphasis on the embodied knowledge associated with a technology is changing the perspective from that of technology transfer to a wider view of knowledge transfer (Cowen et al., 2001; Amesse, 2001; Gilbert and Cordeyhayes, 1996). This is a perspective that is very much in line with current thinking that economic growth and productivity is driven by knowledge (for example, see EC, 2004; DTI, 2003), and that exploitation of knowledge will increasingly be the key source of competitiveness and client satisfaction in the future (for example, see Raich, 2002; Nahapiet and Ghoshal, 1998).

The design and operation of a technology transfer system should be dependent upon its intended audience – what is suitable for technology transfer with large construction companies may be unsuitable for small construction companies. Large and small construction companies vary considerably and so does the work they do (Lu and Sexton, 2006; Sexton and Barrett, 2003). The 95% of construction organisations employing less than 25 people will certainly have a much reduced managerial capability in comparison to the few large and sophisticated organisations. Solutions for one side of this divide are unlikely to work successfully for the other side. In addition current approaches to technology transfer suffer from the following failings (Sexton et al., 2006):

- Technology transfer mechanisms often have a linear push approach – identifying new technologies, and pushing them in their existing form into construction companies regardless of need (Barrett and Sexton, 1999).
- Current technology transfer mechanisms do not fully take account of company organisational capabilities and processes necessary to enable them to successfully absorb and apply technologies. Experience from the manufacturing sector has shown that this is an important requirement (Adler and Shenhar, 1993).
- There is too much of a focus on technology in current technology transfer mechanisms. Such an approach does not fully take account of the associated knowledge characteristics of the technology in question (Grant and Gregory, 1997). 'Hard' technologies which are characterised by explicit knowledge require very different diffusion mechanisms, organisational capabilities and processes than those required for 'soft' technologies which are tacit in nature.

Successful technology transfer is therefore likely to be dependent on all of the above and so an effective 'technology transfer system' will be dynamic, working with inter-organisational networks, taking into account organisational direction and capability, and the knowledge characteristics of the particular technology. This view of technology transfer is consistent with the move away from sequential models of innovation and technology transfer (Van de Ven et al., 1999). Such an approach views technology transfer not as a simple sequence of phases, rather as a multiple progression of divergent, parallel and convergent paths, some of which are related and cumulative, and others not. Viewed in this light technology transfer will only be effective if all three elements are appropriately focussed and integrated to achieve a specific aim.

The three elements of the 'technology transfer system' are now discussed in more detail, with a particular focus on addressing the unique characteristics of small construction companies and their markets.

2.1 Inter-organisational networks

There are many examples that show that inter-organisational networks assist the development and exchange of knowledge and resources needed to encourage learning and innovation in participating companies (Barlow and Jashapara, 1998; Ebers, 1997; Grandori and Soda, 1995). Indeed, it has been argued that the greater the number of networks that a company is involved in, the greater the likelihood of generating successful innovation (for example, see Ahuja, 2000; Porter, 1990; Pittaway et al 2004). The need for small construction companies to be appropriately involved in such inter-organisational networks is thus especially important, as they often do not have the knowledge and resources needed to develop innovations on their own.

There are two main types of inter-organisational network. First, companies are naturally part of 'business networks' through their normal dealings with their clients and supply chains. These networks can encourage innovation when the companies involved are able to share needed expertise and resources (Bresnen and Marshall, 2000a,b,c; Hauschlidt,

1992). Indeed, successful demand led innovation is often created in this way. The innovation process is therefore in part a knowledge and technology mobilisation process, based on intensive social and economic interaction processes (Hakansson, 1987). In the case of small construction companies, research has emphasised that the structural characteristics of the UK construction industry can restrict large-scale innovation and technology transfer, and that the capacity of small construction companies to innovate is limited where they are unable to form long-term relationships with other companies (Miozzo and Dewick, 2004; Miozzo and Ivory, 1998). Secondly, companies engage with, to various degrees, 'institutional networks', such as educational institutions, government bodies, research institutions and professional associations. Such networks are potentially useful in providing companies with the knowledge and expertise needed for innovation (for example, see Abbott et al., 2004; Hauschlidt, 1992). Professional associations, for example, disseminate a particular body of knowledge to industry via their members, and thus act as vehicles for the diffusion and translation of knowledge needed for innovation (Constrinnonet, 2004; Allen, 1977). A notable example of co-operative inter-organisational networks in the construction industry is provided by the growth of Constructing Excellence Clubs in the UK (Abbott and Jones, 2005). These clubs incorporate the full range of organisations in the construction supply chain in a mutually supportive and learning environment. This would seem to indicate a desire for learning from peers in a manner not catered for by professional organisations and educational institutions.

Clearly then inter-organisational networks are an important factor for innovation and learning and so any mechanism seeking to promote technology transfer should take account of this and seek to work with and strengthen existing networks to promote technology transfer.

2.2 Organisational direction and capability

The motivation and ability of small companies to absorb and exploit new technologies are dependent on their business strategies and organisational capabilities. These strategies and capabilities vary from firm to firm so, corresponding, the motivation and ability to absorb and exploit new technologies vary. Whilst a low number of small construction companies will consciously be at the leading edge of technology most small companies will follow technology (using it, rather than developing it), with a mixed range of internal skills; while other small companies, particularly in labour-intensive industrial sectors, are relatively indifferent to technology. Overall, however, and even among some technologically advanced small companies, there are often considerable barriers which slow the absorption and use of new technologies, especially when compared with larger construction companies. There are many reasons for these problems. Managers of smaller companies list problems of time, cost and technical expertise, process control, management methods, or training as barriers to adoption of technology. Even when external information sources may be present, companies do not always know where to go, who can help, and whom to trust (Hassink, 1996).

In addition to these factors, small companies need the organisational capability to absorb and use new technology. This capability is influenced by the level of prior-related knowledge and expertise that exist in the organisation (Cohen and Levinthal, 1990). Therefore, adequate complementary capabilities (for example, see Bröchner et al., 2004; Adler and Shenhar, 1993) are necessary for companies to accomplish many of their key strategic and operational goals for technology transfer.

This desire and ability of firms to absorb and use new technology are very much shaped by their general business and project environments. Research in innovation in small construction companies, for example, concludes that there are two principal modes of innovation: Mode 1 and Mode 2. (Sexton and Barrett, 2003). Mode 1 innovation focuses on progressing single project, cost-orientated relationships between the client and the firm – this mode of innovation is more driven by rapid change and uncertainty in the business environment. Mode 2 innovation concentrates on progressing multiple project, value-orientated relationships between the client and the firm – this mode of innovation is more aligned to improving the effectiveness of a firm's relationship with its clients.

The mode of innovation is substantially determined by the nature of the organisation's business environment. An enabling interaction environment encourages Mode 2 innovation and a constraining environment is conducive to Mode 1 innovation. An enabling environment is one which the firm can influence to a significant extent, so enabling the firm to innovate within a longer term and more secure context. A constraining environment is one which a small construction firm can only influence to a limited extent, constraining the firm to innovation activity undertaken within a shorter and more insecure context.

The strategic horizons and organisational capabilities of small companies, particularly those working within constrained business environments, are very distinct from large, sophisticated companies with, for example, sufficient "organisational slack" or excess resources (Cyert and March, 1963) to be able to support risk-taking and experimentation intrinsic to innovation activity alongside their main business activities, and which are more likely to be exposed to a variety of external stimuli. The absence of slack in small construction companies, therefore, has found to be detrimental to innovation (Sexton and Barrett, 2003)

This sub-section has shown that construction SMEs have different characteristics and needs from large construction organisations. Furthermore their own ability to absorb innovation will vary widely according to their business situation and their own organisational capabilities. Accordingly a successful technology transfer mechanism will need to be flexible and able to respond to company need rather than simply provide a technology push.

2.3 Knowledge characteristics of technology

For successful adoption, the technology together with the knowledge of its use and application must be transferred and developed (for example, see Sahal, 1981). The extent to which new technology can be effectively absorbed is therefore substantially influenced

by the knowledge required to use and adopt the technology being transferred. Two characteristics are especially important. The first is the extent to which the knowledge embodied in the technology is explicit or tacit. Explicit knowledge is systematic and easily communicated in the form of hard data or written procedures. Tacit knowledge is hard to formalise. It is difficult to communicate or share with others as it involves intangible factors embedded in personal experience, judgements and values. Often there will be a strong tacit dimension with how to use or implement explicit knowledge (for example, see Nonaka and Takeuchi, 1995). The second characteristic is complexity. Whether based on explicit or tacit knowledge, some technologies are just more complex than others. The more complex a technology, the more difficult it is to unravel and apply (Gibson and Smilor, 1991).

The key challenge of technology transfer, from a knowledge-based perspective, is how to convert tacit knowledge to/from explicit knowledge, so that it is usefully absorbed by construction companies. This interaction between tacit and explicit knowledge can be fruitfully considered as a process of knowledge conversion and creation. There are four key modes of knowledge conversion (Nonaka and Takeuchi, 1995):

- Socialisation – the sharing of experiences such that tacit knowledge embodied within a technology is passed between individuals, from individuals to the company through the development of culture and shared mental models, and from the company to individuals.
- Externalisation – the conversion of tacit into explicit knowledge about a technology through its articulation and systemisation within the company.
- Combination – the conversion of explicit knowledge held by individuals into explicit knowledge at the company level, then subsequent conversion of organisational knowledge back to the individual in different forms.
- Internalisation – the conversion of explicit knowledge, whether at the individual level or company level into tacit knowledge in the form of individual know-how and organisational routines.

In summary, successful technology transfer needs to take account of the nature of the associated knowledge and in particular its complexity and the balance between explicit and tacit knowledge. The knowledge conversion concept argues that technology transfer is a social process of interactive learning within and between inter-organisational networks, from which a shared language of tacit and explicit knowledge can be developed.

2.4 Summary and implications

For a technology transfer mechanism to be appropriate for small construction companies it must provide a stimulating context such that the companies themselves are motivated to move towards the adoption and use of appropriate new technologies. This, in turn, is likely to be dependent on a combination of their own capabilities and their business environment. For small companies to move very far they must work with their network partners. Technology transfer brokers have a role through networks to feed a company

technology pull up to a point, but small construction companies must then have the necessary strategic direction and organisational capabilities to absorb appropriate technologies and turn them into innovations by driving them out into their networks.

> **For small companies to move very far they must work with their network partners**

3 Action learning as a technology transfer mechanism between HEIs and industry

3.1 Background to HEI-industry engagement

As has been identified above there are multiple factors required for the development of an appropriate technology transfer mechanism. The question can be asked, what is the appropriate role of HEIs within such a mechanism? Given the importance of knowledge and networks in such a mechanism it is appropriate to think of HEIs in terms not only of technology development but as co-developers of knowledge and an integral part of companies wider inter-organisational networks. However for HEIs and small construction companies to work successfully in this way they must change the relationship which normally exists between industry and universities. Although there is a long history of many forms of collaboration it is still far from the norm to strategically and deliberately seek relations that will permit the transfer of technology, co-development of knowledge and diffusion of innovations.

3.1.1 Multiple Forms of Engagement

In seeking to develop an appropriate engagement mechanism between HEIs and industry it is useful to firstly review existing models. Engagement between industry and higher education institutes (HEIs) currently takes a number of different forms. Each one may be driven by different purposes, objectives and ultimately, outcomes. There is an increasing amount, and many different types of engagement that occur which facilitates knowledge transfer between the higher education sector and industry. From a UK perspective, types of engagement identified (Lambert, 2003) include:

- personal contacts and staff exchanges such as visiting professors/guest lecturers or industry secondments;
- business support and consultancy;
- collaborative and contract research; and,
- establishment of joint ventures, licensing agreements and spinout companies

Most academics are engaged in teaching and/or research, but does this meet the needs of technology transfer? An interesting industry based model for knowledge transfer is provided by an executive director of Hewlett-Packard (Johnson, 2003) who proposes that in an economy where the last remaining source of competitive advantage is the development and implementation of new knowledge, companies should develop a 'knowledge supply chain' just as they are used to developing conventional supply chains. This conclusion, which resonates with the previously described importance of inter-organisational networks, is illustrated in Figure 1 below.

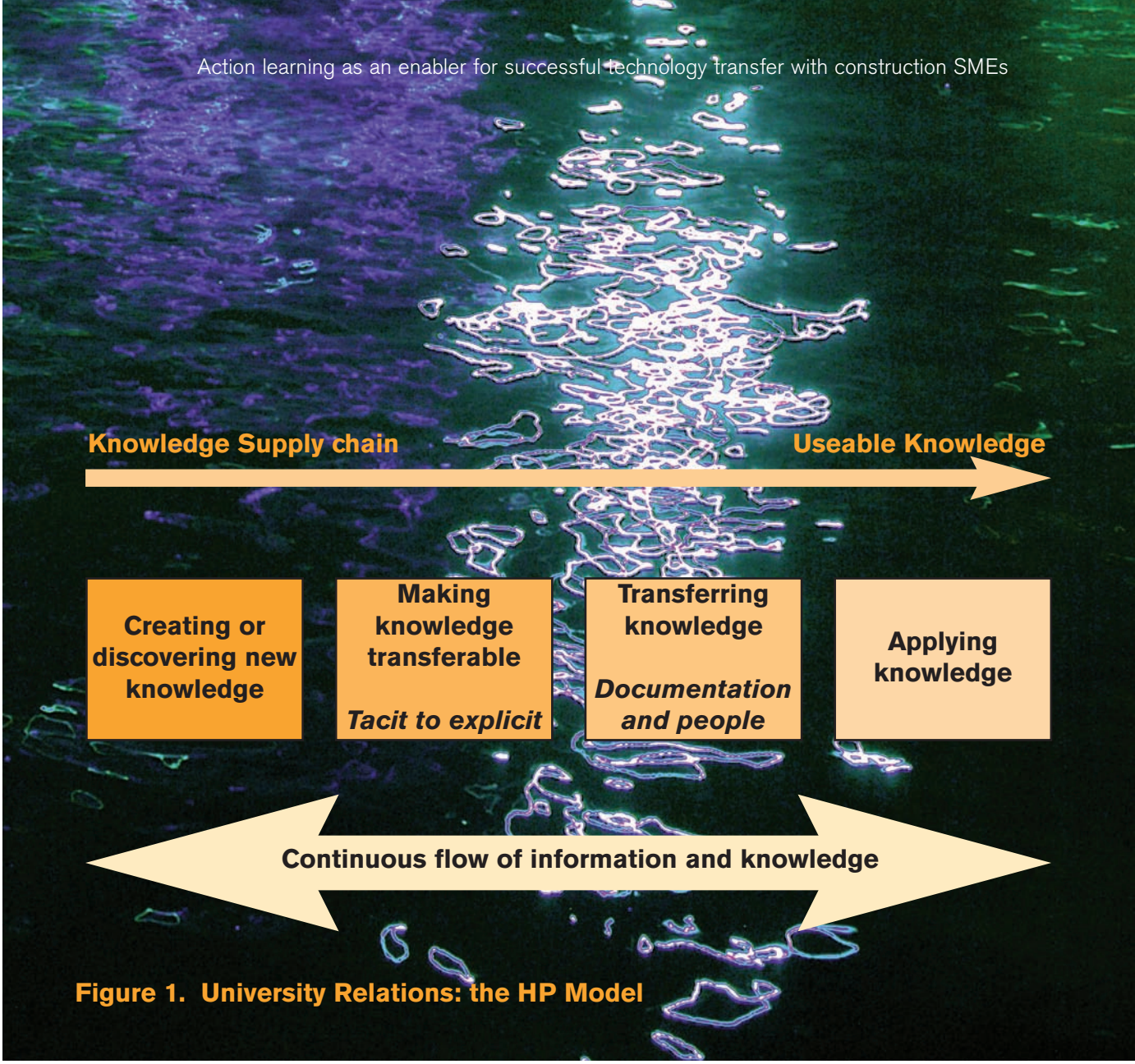


Figure 1. University Relations: the HP Model

The aims of the Lambert Report and the HP Model are laudable but before HEIs can start to engage meaningfully and take their places in these knowledge supply chains they must first begin to understand the needs, motivations and abilities of the companies that they want to engage with. The companies must also be clear as to what they can expect from universities. In other words, a common understanding must be developed. The HP Model is notable as it shows that in order to do this, there must be a continuous flow of information and knowledge up and down the supply chain. Looked at from this perspective the model is far from linear, and as knowledge flows up and down the knowledge supply chain, no one party should be considered as THE expert, rather all are all experts in their own fields. For this flow of information and ideas to take place, it has been proposed that interaction needs to be facilitated through brokerage (Abbott and Allen, 2005). Action learning as described in the next section is offered as a fruitful brokerage mechanism.

3.2 Action learning

A holistic view of technology transfer has been proposed, and that HEIs need to examine different engagement mechanisms to take this into account in order to assist with technology transfer. This section outlines the principles of action learning as one mechanism that can assist in this process. Results from the Construction Knowledge Exchange (CKE) initiative which has successfully used an action learning methodology to broker engagement between HEIs and construction SMEs to assist them to develop their capacity for innovation are used to compare practical results with the literature and hence draw

conclusions and make recommendations for the use of action learning to promote successful technology transfer.

3.3 What is action learning?

Action learning is a method of problem solving and learning in order to bring about change for individuals and their organisations. It was developed by Reg Revans (Revans, 1982), who described it as:

> *"a means of development, intellectual, emotional or physical, that requires its subject, through responsible involvement in some real, complex and stressful problem, to achieve intended change sufficient to improve his observable behaviour henceforth in the problem field. 'Learning-by-Doing' may be, perhaps, a simpler description of this process."*

It was Revans' belief that managers learn best from each other, working on real issues. Members work together in small groups (sets) of between six and eight people, discussing important organisational problems or issues. Importantly, they take action and learn from the effects of these actions in both a supportive and challenging way. Research and activity conducted at the University of Salford has shown that action learning has great relevance to very broad fields of practice and professions. It embraces the notion that professional people learn best when they are compelled to face and solve real problems and develop ideas in the company of like-minded people who are also trying to resolve their own similar issues. Pedler (1996) says that:

> *"Working in small groups, people tackle important organisational issues or problems and learn from their attempts to change this…where each person presents their 'status report' or current understanding of their problem, whilst other members listen, express support, make suggestions, but above all pose questions. This may lead to questions which the person may not have considered for themselves. The aim is to find those questions which lead to the person questioning themselves. When this happens it is a process which can lead to questioning insight."*

Action learning can be viewed as a powerful triangulation of three distinguishable learning experiences, which lend themselves to critical monitoring and evaluation. These three angles of learning in action learning were described by Botham and Morris as Work, Set and Information. At the centre of all this was the constant need for monitoring and evaluation. See Figure 2.

Figure 2. Botham & Morris Learning Triangle

The first angle is a focus on the learning experience from work. It is recognised and sustained as how the individual observes and records his or her own actions and

experiences gained from the actions of others engaged in a work setting. The second angle focuses on the learning experienced from participating in an action learning set. Again, the experience is carefully monitored by observation and recording. As the set challenges and questions the learning experience gained from work and the set, the focus is increased. The third angle is a focus on learning gained from information such as books, papers, courses, seminars, workshops, or whatever the individual believes is informing his or her mind.

The precise activity involved in action learning can vary with the context. However, the key features that comprise the activity

involved in action learning are shown in a recent study conducted within the higher education sector as being (Pedler et al., 2005):

1. Sets of about 6 people
2. Action on real tasks or problems at work
3. Learning is from reflection on actions taken
4. Tasks/problems are individual rather than collective
5. Tasks/problems are chosen independently by individuals
6. Questioning as the main way to help participants proceed with their tasks/problems
7. Part of an existing programme
8. Facilitators are used

The following section compares these characteristics with the theoretical characteristics identified as being necessary for successful technology transfer.

4 A comparison between action learning and technology transfer

In order to predict if action learning can be a useful approach for technology transfer it is useful to compare the theoretical requirements that have been identified in Section 2 as necessary for successful technology transfer with the characteristics of action learning. The requirements for technology transfer have been characterised as taking account of:

- Organisational direction and capability
- Inter-organisational networks
- Knowledge characteristics of the technology

Whereas action learning is characterised in the Botham-Morris learning triangle as a combination of:

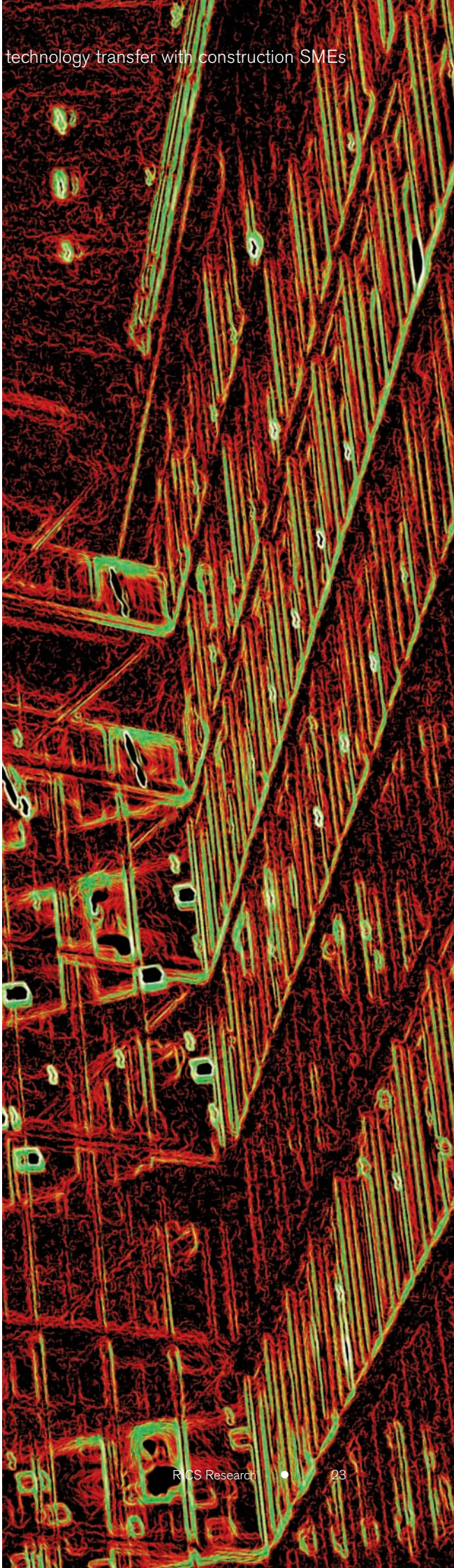
- Work
- Set
- Information

There is clearly a strong resemblance between these characteristics. The table below takes this comparison further.

The table below would seem to indicate a striking relationship between the requirements of a successful technology transfer strategy and the support offered by action learning. Just as the balance between organisational direction, inter-organisational networks and knowledge characteristics would vary

Technology transfer	Action learning
Organisational direction and capability. The motivation and ability of small companies to absorb and innovate from new technologies are dependent on business strategies and organisational capabilities.	**Work.** Actions taken from the set are always placed in an organisational context through their application in a work setting. The organisational context is recognised and sustained as the individual observes and records his or her own actions and experiences gained from the actions in the work setting.
Inter-organisational networks assist the development and exchange of knowledge and resources needed to encourage learning and innovation in participating companies.	**The Set.** The Action Learning set provides its own network, so that the learning experience is enhanced through participation in the set. The composition of the set is therefore very important. The set could be drawn from an organisation's business network, its institutional network or consist of organisations that are initially from outside of either.
Knowledge characteristics of technology. The extent to which new technology can be effectively absorbed is therefore substantially influenced by the knowledge required to use and adopt the technology being transferred.	**Information.** The third angle of action learning is a focus on learning gained from information such as books, papers, courses, seminars, workshops, etc. This angle has a clear relationship with the knowledge characteristics of a particular technology.

dependent on the nature of the technology so too could the balance between work, set and information in an action learning setting. In order to further test this proposition the next section examines the workings and characteristics of a group of action learning sets created and facilitated by the University of Salford in the Northwest of England.



5 Lessons from the Construction Knowledge Exchange Project

Many research programmes have been conducted involving action learning sets within businesses, particularly within SME groups. However, their use in construction has been limited. Previous examples of action learning in construction include:

- Innovation and Culture Change within a Medium-Sized Construction Company: Success through the Process of Action Learning– This was a programme which was funded by the ESPRC Innovative Manufacturing Initiative, the ADAPT programme of the ESF and George Harding Limited, Bournemouth. Here, action learning was used to help promote innovation and culture change within a medium sized construction company (Davey et al, 2004).

- CIOB Funded Action Learning Sets in the Construction Sector – As part of the UK construction industry's drive to improve learning and performance. This project involved four action learning sets from the SME sector of the construction industry. One set member commented that action learning had taught him (Davey et al., 2004):

  "a very different way of thinking about relating to people. It's very difficult to explain to outsiders, but action learning sets are very strange. There are no formal rules. There is no hierarchy. No agenda. You don't have a chairman. And, to begin with, this is difficult to cope with, especially giving people space to talk. Action learning helps you do your job better because it helps you relate to people in a much less formal way."

- Action Learning for Construction in Porto Alegre, Brazil – Formoso, Lantelme and Hirota's research into action learning amongst construction workers in Brazil helped develop managers' competence with respect to innovation for wealth creation in construction. Asking the right kind of "penetrating questions" was recognised by set members here as being the key to unlocking better working practices for innovative and constructive change (Formoso, et al, 2004)

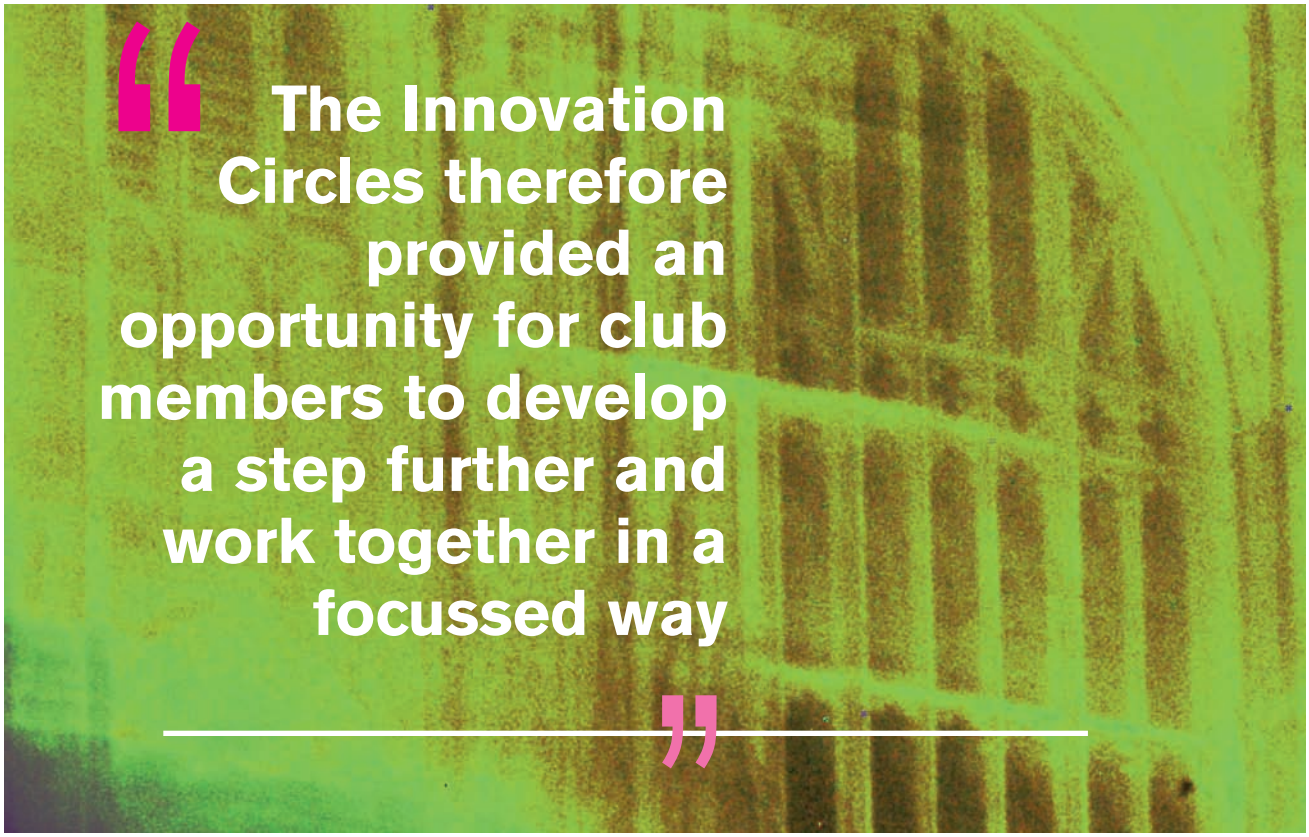
Building upon these successful experiences of action learning within business settings, it was decided that this would be the most effective way to progress small learning groups within the Construction Knowledge Exchange project.

5.1 Action learning and Innovation Circles in the Construction Knowledge Exchange (CKE) project

The University of Salford was successful in its bid for a Construction Knowledge Exchange in August 2004. This is one of 22 national knowledge exchanges that have been created by the UK Higher Education Funding Council across a range of disciplines. The project has the aim of promoting knowledge exchange between industry and universities in the UK construction industry and aims to promote and enhance engagement in activities that establish industry needs, capture and share knowledge

and build capacity and resource through enabled networks and links that reach out to all levels of business and higher education. In order to achieve this aim working with existing networks and linking them to the activities of regional universities is a priority.

A primary mechanism for the CKE is the Action Learning through an approach entitled Innovation Circles – the term coined to describe action learning sets or groups dedicated to improving innovation performance. From the outset the CKE approach was to use Innovation Circles to assist local SMEs by offering additional support to existing institutional networks rather than to try to create new networks. For example, there had been a long standing collaboration between the University of Salford and local Constructing Excellence Clubs (Abbott and Jones, 2005). The clubs provided an opportunity to test the Innovation Circle approach. The University of Salford, as part of the CKE Project, set up Innovation Circles as a natural progression to help businesses and academics work together in a more meaningful way and to focus individual members in small groups using an action learning methodology. The Innovation Circles therefore provided an opportunity for club members to develop a step further and work together in a focussed way, forming deeper



relationships and to learn more about individual working practices. The groups are facilitated by experienced action learning facilitators and have emerged as energetic forces focussing on real life problems and issues within the construction industry. The results suggest that action learning works particularly well in SME groups as participants feel that they are learning with and from their peers. The key is that set members work together on their issues or problems, take action on them and reflect on the learning from taking these actions. The facilitator plays a key role in monitoring the agreed actions. Members have a sense of accountability to the set to take action and report back to the set at the next meeting. This is consistent with the principles of Action learning which is based on the premise that (Pedler, 1996):

> *"There can be no learning without action and no (sober and deliberate) action without learning."*

The Innovation Circles created through the CKE promote the development of inter-organisational networks. Initially, the Innovation Circles were established with companies that were already members of an 'institutional network' in the form of Constructing Excellence clubs. Nevertheless, once the Innovation Circles were set up, members needed to get to know each other and discuss issues which were important to them and their businesses. This process also takes time to evolve, as members need to gain confidence before disclosing to others, details about their businesses. The facilitator plays an important role in the formation and smooth running of the sets, particularly in the running of these business groups, if the facilitator is also an experienced business practitioner. This helps "broker" communications between businesses and academia and goes a long way to establishing the vital links necessary when trying to promote dialogue and research between industry and universities.

The Innovation Circles have been very well received. Overall 23 Innovation Circles have been created in the region with the involvement of 169 construction SMEs. The action based focus of the Innovation Circle offers a new dimension from the normal events and assistance offered by partner organisations. Examples of the benefits that members feel they are receiving from their involvement include:

> *"It has taken me away from the day-to day job and made me think more about how do things better – It has really been worthwhile taking 2/3 hours out for each of these meetings and I am determined to continue with this time out to get things done."* Managing Director, Small Contracting Company

> *"It worked for me at a practical level and came at just the right time with my job role of training planning, helping me to move forward with the company training plan."* Senior Manager, Small Contracting Company

> *"Small is better – you feel more at ease to ask questions relevant to us as a construction business."* Company Secretary, Small Contracting Company

Innovation Circles with universities network partners have gone from strength to strength with all areas of the North West of England being included in Innovation Circle activities. After initial groups were created with Constructing Excellence clubs further groups were jointly created with the Construction Industry Training Board (CITB, now ConstructionSkills). These groups have in common the fact that members are brought together by the CITB with an agreed goal in mind – either the completion of a training plan or the gaining of Investors in People status. Members work together to deal with the implementation issues and the circles have proved to be extremely useful in this regard.

Three of the Innovation Circles created are 'Women in Construction' Groups which have also progressed well. These Circles deal with general business issues of concern to the individual group members. Examples of issues raised and solved within these Cicles include the construction industry taxation scheme for sub-contractors, dealing with absenteeism and recruitment. These groups have a common factor of bringing together women from middle and senior roles within construction SMEs. To this extent they share a common bond and a common goal of business improvement. That being said the nature and scope of this improvement is not limited.

Three of the Circles have dealt with issues relating to technology and its implementation. These were an Intelligent Buildings group; an advanced CAD group and a Modern Methods of Construction (MMC) in Housing group. The first two groups held very effective initial meetings which led to further action between individuals that had been brought together by the group. However, no further meetings of the group were held. The MMC group is an extension of a major private house builders R&D group and as such has continued to meet monthly for 18 months. This group is involved with the build of a series of innovative homes using the latest construction technologies with an emphasis on sustainability. It has kept its focus as a result of the project and at different stages of the project the composition of the group has varied. Additional work for the University (production of factsheets for each of the 40 plus innovations in the homes and VR modelling of the houses) has accrued and so the group has been successful at bridging the gap between the university and industry.

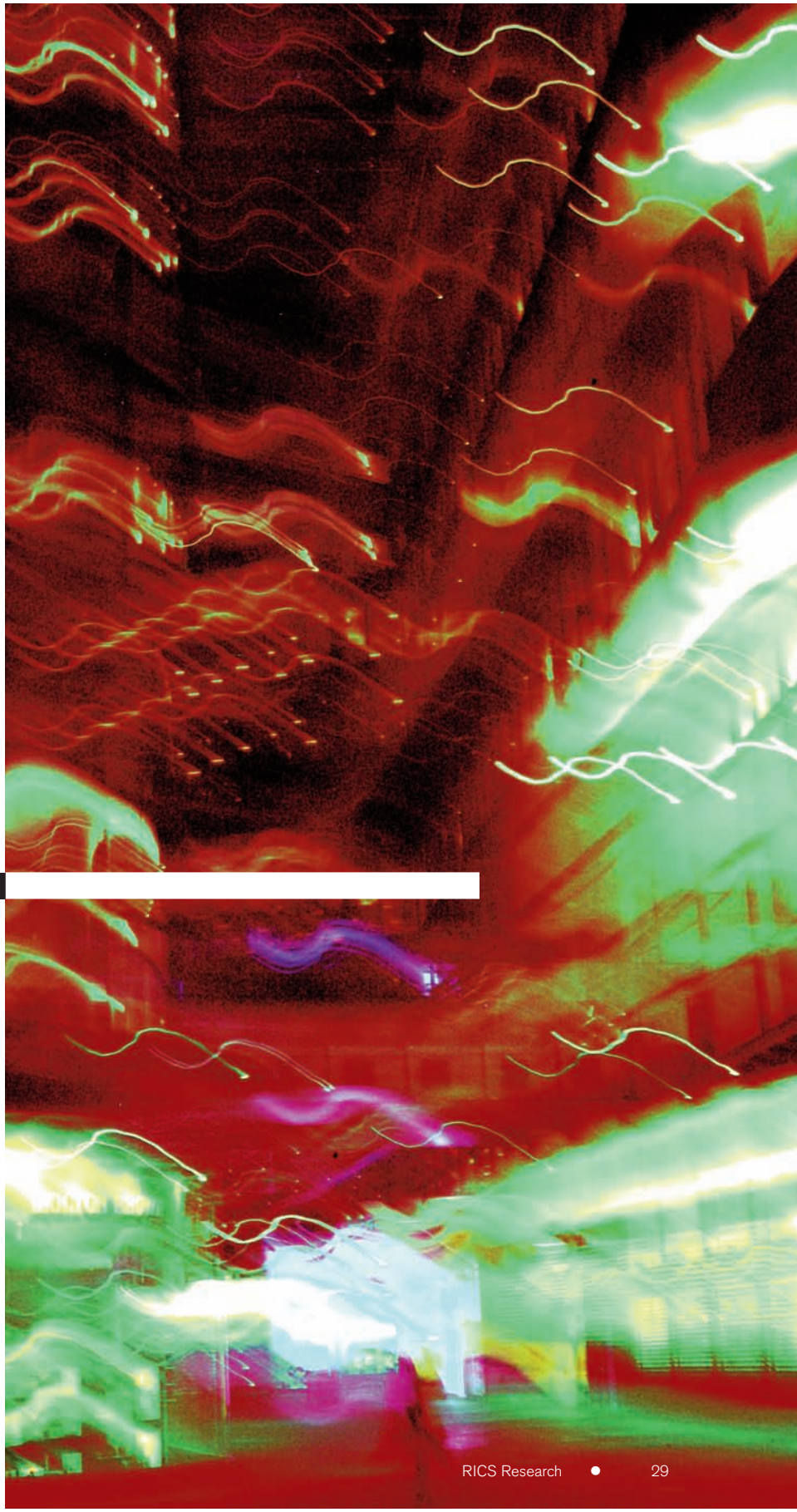
Examples of discussions within the Innovation Circles include generics issues such as recruitment, marketing, employment contract law and appraisals systems, along with the more construction specific topics such as partnering, off site manufacturing and lean construction.

5.2 Summary of results

Flexibility has been an essential element in helping businesses come together in Innovation Circles. This has meant that the university has accommodated network partners' needs by offering additional support to existing members. For individual group members "time is money" so it has been important to accommodate both location and suitable meeting times to ensure maximum attendance at meetings. Project evaluation reports reveal that thus far, the concept and principles of Innovation Circles has been well received throughout the North West and has provided a means for all partners involved in the construction sector to work together in

small groups in a more focused way. Action learning has provided an excellent means by which these groups are run and ensures that action is taken on issues and problems raised by set members and continuous learning becomes a natural part of professional development and business improvement. By working in this way the university sector has been able to begin to work in response to a pull from industry rather than the traditional push mode and this would seem to enable the flow of ideas up and down the knowledge supply chain.

“...continuous learning becomes a natural part of professional development and business improvement”



6 Conclusions

In drawing lessons for how the method could be used to encourage technology transfer it is useful to reflect on the types of groups that evaluations have shown have proved particularly successful. The first category of groups are those that have come together with each individual having already decided to take a common action. These groups therefore are concerned with effective implementation of a chosen solution rather than determining the appropriate solution. Group members share their experiences on what has and has not been successful which proves to be invaluable.

Furthermore the group provides a mutually supportive environment, a concept referred to as 'partners in adversity' (Revans, 1983) and further detailed in a construction environment by Davey et al (2004), which provides the encouragement and support to see a task through to the end. In technology terms there would seem to be many opportunities where this approach could prove useful primarily where there is a low complexity of required knowledge but a large degree of benefit that could come from socialisation and internalisation of tacit knowledge. Or, in Botham and Moriss's terms an emphasis on the work and set sides of the learning triangle rather than the information side. Suggested examples of this include 'effective electronic communication', 'making the most of a website', 'improving onsite efficiency'.

The second type of successful group is that where the individual members share a common bond or interest whilst not necessarily solving a common problem. If that common interest is of a technical or functional nature (e.g. responsibility for IT within an organisation) then the group is likely to be able to work in areas that require a higher complexity of knowledge drawing upon externalisation and combination and making more use of the information side of the learning triangle. Here issues relating to the introduction of new technologies into an organisation could usefully be tackled. Suggested topics that individuals within a group could tackle include adoption of wireless communication, IP telephony, onsite communications.

The third group where there has been success is that which is dealing with project specific issues. The MMC group for example came together in this way. This group differs from the previous two in that it is led by one partner who has involved different members of its supply chain at different phases of the project. Here there is a strong incentive for participation by supply chain members to ensure future work and by employees of the lead company as the project is around a key future development for the organisation of the company. This has proven to be a highly effective group at generating a large number of innovations. When complex knowledge and information has been required external 'experts' have been brought into the group to determine action and retained within the group during implementation. This has proved a good means at developing an external knowledge supply chain for a company that has had little internal experience of the technologies in question. Here it is important to repeat that this is a company led initiative within which the university has become involved as one of the external experts. Such a group is unlikely to be

formed as a result of a university push rather the university side has had to be able to respond to company need. Further it is worth noting that this has only been possible because of the HEIF funding through the CKE and would have been very hard to achieve through conventional teaching or research funding.

The success of the Innovation Circle approach is, of course, predicated on its appropriate design and operation. Drawing upon results reported elsewhere (Lu, et al., 2007), potential problem areas and corresponding strategies to overcome them, can be structured into context, content and process considerations.

- Context: There is a need for 'up front' relationship building activities with managers/owners of SMEs to develop their initial awareness of the benefits of academic-industry engagement through, in this case, Innovation Circles. This marketing phase is essential to forge an attractive, strong foundation from which to build meaningful engagement.

- Content: There is a need for the academic team to listen carefully to industry to form sets composed of participants which share similar business problems. This will foster collective motivation and capability to share information, lessons and solution to effect change in participants' firms. Further external information fed into the sets should explicitly address the problem area in a tangible and accessible fashion.

- Process: First, the action learning facilitator should have appropriate knowledge and experience for a given Innovation Circle. The facilitator plays an important role in the formation and smooth running of the Innovation Circles and it helps, particularly in the running of these action learning sets, if the facilitator is also an experienced business practitioner. This helps "broker" communications between businesses and academia and goes a long way to establishing the vital links necessary when trying to promote dialogue and research between industry and universities. The research findings also revealed that most of Innovation Circles had four to five planned meetings, each took place every 3-4 weeks and lasting 2-3 hours. The first "taster" meeting needs to explain the purpose of the group and introduce the members to each other. In the second meeting, the group needs to initially discuss the actions from the first group before moving on to a group discussion about how the sets chosen problem area affects their businesses. This process takes time to evolve, as members need to gain confidence before disclosing details about their businesses to others. The third meeting should focus on what the group members have in terms of skills and what they need, identifying any skills gaps. External adviser on-site visit might be arranged if needed in the forth meeting. For example, a scheduled visit from a CITB-ConstructionSkills training adviser was to help the companies with the completion of their plan. The fifth meeting is a

closing session. A number of the innovation circles are still continuing after a period of twelve months. Second, the facilitator needs to explain the deliverables which must be achieved to satisfy the academic partners' requirements. There is a critical need, therefore, for benefits to follow to both practitioner and academic participants alike.

In conclusion, the action learning approach has proven to have the potential (if properly designed and implemented) to be an effective mechanism for brokering engagement between university and industry. It has been successful in particular aspects that are required for successful technology transfer. It supports the need for inter-organisational networks and is also successful in responding to the organisational direction and capability of the participating companies. The Innovation Circles themselves have to be flexible enough to respond to these needs. For the future it is likely that different types of Circles would be appropriate to different types of technology transfer. Of particular importance in this regard is the complexity of associated knowledge required for successful implementation.

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October 2007/100/RICS Research/40379/Sterling

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