

Supporting ICT Diffusion in Australian Construction Organisations Through Self-Help Groups

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Background

Construction organisations comprise geographically dispersed virtually-linked sub-organisations that work together to realise projects. They increasingly do so using information and communication technology (ICT) to communicate, coordinate their activities and to solve complex problems. One salient problem they face is how to effectively use requisite ICT tools. One important tool at their disposal is the self-help group, a body of people that organically spring up to solve shared problems. The more recognised term for this organisational form is a community of practice (COP). COPs generate knowledge networks that enhance and sustain competitive advantage and they are also used to help COP members actually use ICT tools. Etienne Wenger defines communities of practice as “groups of people informally bound together by shared expertise and passion for a joint enterprise” (Wenger and Snyder 2000, p139). This ‘chicken-or-egg’ issue about needing a COP to use the tools that are needed to effectively broaden COPs (beyond co-located these groups) led us to explore how best to improve the process of ICT diffusion through construction organisations—primarily using people supported by technology that improves knowledge sharing.

We present insights gained from recent PhD research results in this area. A semi-structured interview approach was used to collect data from ICT strategists and users in the three large Australian construction organisations that are among the 10 or so first tier companies by annual dollar turnover in Australia. The interviewees were categorised into five organisational levels: IT strategist, implementer, project or engineering manager, site engineer and foreman. The focus of the study was on the organisation and the way that it implements ICT diffusion of a groupware ICT diffusion initiative.

Several types of COP networks from the three Australian cases are identified: within-organisation COP; institutional, implementer or technical support; project manager/engineer focussed; and collegial support. Also, there are cross-organisational COPs that organically emerge as a result of people sharing an interest or experience in something significant. Firstly, an institutional network is defined as a strategic group, interested in development of technology innovation within an organisation. This COP principally links business process domain experts with an ICT strategist.

The research project

In late 2001 the Collaborative Research Centre for Construction Innovation commissioned a team of researchers led by RMIT to investigate improved methods of diffusing ICT and improving knowledge management in the construction industry. During 2002, we undertook a survey of 117 people to investigate factors influencing ICT diffusion from three construction industry organisations: a public sector client, an

¹ The research described here was carried out by the Australian Cooperative Research Centre for Construction Innovation

engineering consultant and a contractor associated with the Cooperative Research Centre in Construction Innovation in Australia. These organisations have demonstrated a high level of maturity in using ICT applications in their construction management processes. Each of the organisations cooperated with us to identify experienced ICT users. This study is part of a wider ICT diffusion research project in which a theoretical framework of ICT diffusion and change management literature was drawn upon to enhance our understanding of ICT diffusion. Our survey findings confirm that 11 factors influence information and communication technology (ICT) diffusion for experienced ICT users. We offer a model that consists of 4 groups of categories: management (M); individual (I); technology (T); and environment (E). Our conclusions reinforce the importance of a coherent ICT diffusion strategy and supportive environment. This requires substantial investment in training and collegial learning support mechanisms.

We extended the study beyond the survey using a qualitative research approach to investigate the way in which ICT diffusion occurs at the individual level. Our survey results clearly indicated that collegial support was important for ICT diffusion and so we identified three major companies from the top tier of Australia’s contractors that use groupware ICT applications and who agreed to participate in our study. All three organisations have an annual turnover well in excess of one billion Australian dollars and all have been extensive ICT users for several decades. We used a semi-structured interview approach to collect qualitative data from ICT strategists and professional users in the three large Australian constructors at several organisational levels using a case study approach (Yin 1994). Key contact people within the IT department who understood the research aims nominated interviewees who were asked to identify ICT users already using ICT in their work so that a better understanding of how these organisations approached ICT diffusion can be found. Thus the sample is not a random sample but a purposeful one drawn from ICT professional users, in major construction companies that principally operate in Australia but also do so as global construction contractors.

The focus of the study was on the organisation and the way that it implements ICT diffusion of a groupware ICT diffusion initiative. The research question is directed at understanding how and why observed behaviours took place in diffusing an ICT groupware initiative. It concentrated upon the ‘latest wave’ of ICT innovation facing major construction contractors and the aim was to gain a better insight into how several of the major global players in this industry sector approached ICT innovation. Interviewees presented in Table 1, can be grouped into five levels: IT strategists (senior level management champion and initiative driver) implementers (given the task of encouraging diffusion of the ICT groupware initiative), project managers (responsible for construction teams on projects using this technology), site engineers, and site foremen (both direct users of the technology in coordinating the physical and administrative work being undertaken on-site). The reason for this approach is to gain understanding the factors influencing ICT diffusion from multiple perspectives

Table 1: Categories of interviewee in the three case studies

Interviewee	Case study		
	CSA	CSB	CSC
<i>IT strategist</i>	1	1	1

Implementer (L1)	1	1	1
Project/Engineering manager (L2)	4	1	1
Site engineer (L3)	1	3	2
Foreman (L4)	1	1	1
Total	8	7	6

We mapped the social networks that formed the linkages and illustrate the relationships of people cooperating to solve problems and help each other to better know how to use ICT applications, in this case groupware applications. It is beyond the scope of this paper to fully report on each contractors' form of COP so we have taken one them to illustrate the point.

This company has received several awards relating to construction innovation. The company has strong policy support for improvement of construction productivity and safety. At the time of this study, their commitment to using ICT was project-by-project based. They briefed project participants to provide them with an understanding of benefits of using ICT. After obtaining commitment for ICT use from CSC project managers and other main project participants (such as client, design consultants), the implementer would provide training for project participants and expected CSC users.

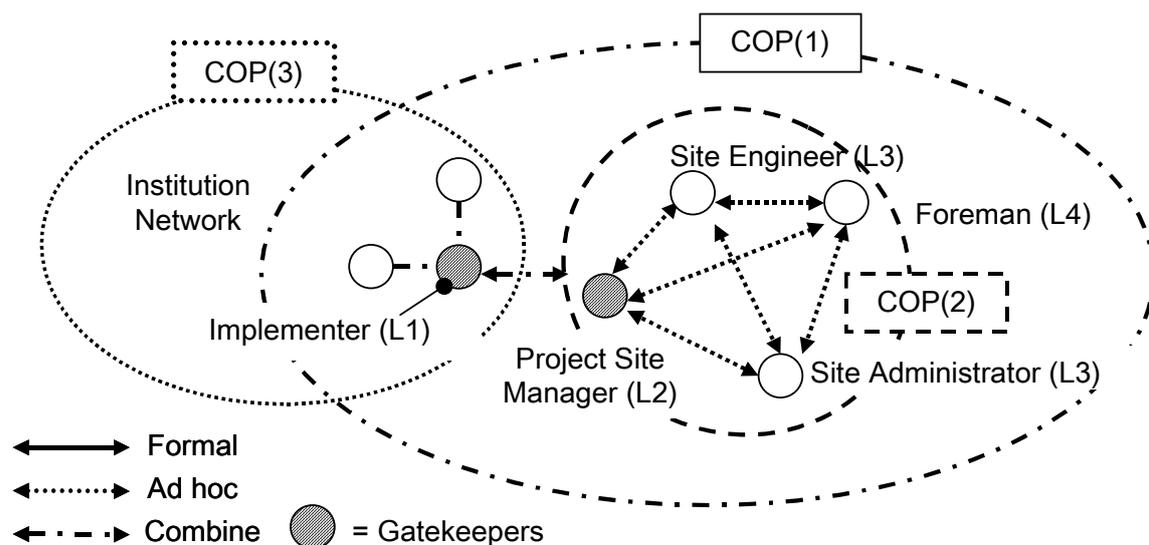


Figure 1: Case study C's community of practice

An external project web service developed the ICT application. The implementer also had a role in facilitating customisation of the ICT application to suit the company's work processes and provided strong support for diffusion of ICT within CSC and other project participants. The strength of COP(1) in Figure 1 (Peansupap *et al.* 2003) is mainly dependent upon the implementer who had the knowledge and background of both the construction and computer context. He started his own communities by providing training on how to use the application for his teams and main project participants.

In addition to COP(1), the implementer, interacts in COP(2) a COP of colleagues. Several COP(2) existed for collegial help and they have a positive influence on novice engineers who did not receive any training sessions to develop skills and be able to

use the ICT application. A COP(2) member mentioned that his senior engineer helped him use the ICT application. The project manager also encouraged and helped his sub-ordinates by providing advice on ICT use. Although he has limited knowledge, he tried to resolve problems regarding its use through the implementer.

COP(3) is the organisation-wide network for each business group. CSC started the technology centre with its key functions being to promote and expand a range of ICT technological innovations into business units (BUs). The centre aimed to improve work performance, safety, and quality in construction work processes. It consisted of people who were 'the experts' from different BUs across the organisation. They dedicated time to meet every 3-4 months. The technology centre provided support and advice to BUs on adopting ICT innovation initiated and was supported by all BUs.

This example shows that COPs vary in their form and function and that they can be harnessed and shaped to help diffuse ICT knowledge.

Relationships of COPs Within an Organisation

The three case studies showed that COPs can help construction firms diffuse ICT knowledge by COP members sharing experiences and insights and helping each other to solve problems related to their ICT use. These relationships play a significant role in linking several communities together. From our case studies, the institution of COPs has the complementary role of sharing the message of potential and realised ICT benefits through construction business managers. For example, one senior construction manager may need to find a solution to improve their work business processes. Members who have an experience on ICT capability may suggest a solution to the manager. At this stage, the solution may be a preliminary concept to improve the business process. Within institutional COPs, this intra-relationship can help members be aware of the availability of current ICT tools or to develop interest in the use of an ICT application. Facilitators of an institutional community of practice (who provide leadership and support) should comprise key representatives, such as top management, to reinforce ICT diffusion throughout the organisation. Such people provide policy drivers. Perhaps a senior quality manager who is involved in improving construction processes could be appropriate, likewise senior project managers who have practical experience in the field or perhaps senior IT managers who have a strong background of IT knowledge contribution. These representatives may have significant roles in connecting and linking COPs and facilitate knowledge sharing between COPs.

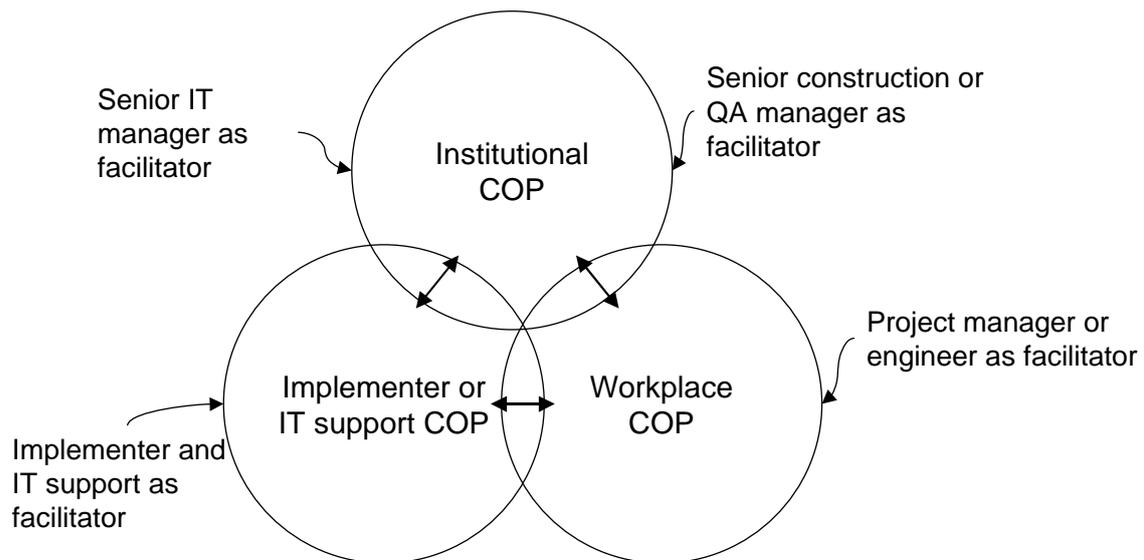


Figure 2: Three types of COP within an Organisation

Figure 2 illustrates that the first relationship in attempting to integrate or link COP within an organisation is the connection between the institutional COP and any COP facilitated by the ICT implementer or IT support groups. A senior IT manager can play an important role in linking these two COPs. If the senior IT manager is a member of these two groups then he/she can work with IT members to seek more technical information on how to best apply ICT applications to improve construction work processes. Groups of implementers or IT support personnel may share their technical experience with senior IT managers and this in turn provides feedback to COP members within the institutional COP. On the other hand, the decision adoption of ICT application to support the business need may depend on several business constraints in which groups of implementers or IT support staff may not have sufficient experience. Therefore, the relationship between these two groups may help IT people to understand business operation realities, which in turn provides a suitable ICT application for business needs to address the issue of improving such processes through the use of ICT supporting infrastructure. Meanwhile, people in business units can improve and updated their understanding of ICT application knowledge.

The second relationship is a connection between the institutional COP for any project manager or a collegial COP that may be based around workplaces. It could be suggested that a senior quality manager or senior construction manager can play an essential role in linking these two COP. Experienced construction managers² may help share their experience of how to encourage colleagues to use ICT applications. The experience may be useful to business managers in adapting strategic management plans or to improve ICT implementation strategy. Some experience may be useful in highlighting best practice knowledge where BUs receive help on decision-making for future projects. Senior construction managers may also learn from business planning people that could have a positive impact on their future projects. For example, if a construction firm successfully used web-based project management tools, then this

² It should be noted that experience relates to relevance—it is probably that younger organisational staff may have considerable ICT use experience to share with older staff and older staff may have deep insights from their industry experience on how best to apply ICT tools in a practical manner.
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message may be fed through a COP in which business managers and construction managers can learn and share options about how to best diffuse these tools.

Finally, the connection between ‘Implementer or IT support COP’ and the ‘Workplace COP’ (see Figure 2) can help people share experiences of combining both construction and IT technical knowledge. Most members in Workplace COPs have high levels of experience of construction procedures and processes. Thus, sharing this construction experience with members of Implementer or IT support COPs should be helpful for improving ICT application to suit users’ requirements. On the other hand, knowledge about ICT applications also helps members of Workplace COPs to understand limitations associated with ICT applications. Linking COP types can improve mutual understanding of ICT innovation support staff and operational users to help each party improve their application of ICT rather than blaming each other for poor implementation of any ICT initiative.

Implications For The Construction Industry

COPs are already ‘out there’, they exist informally and our research indicates that they can be an effective tool for ICT diffusion and knowledge sharing. Smart companies should consider investing in COPs and supporting them in a variety of ways. One effective start is to champion a COP to help with any ICT application being diffused and to ensure that those involved in its establishment and maintenance have administrative support and preferably time as part of their work plans to nurture and sustain the COP.

Another implication is for companies to accept the two-way nature of inter-organisational COPs where advantage gained through tapping into expertise of its competitors through effective COP participation yields benefits as well as encouraging its employees to respond to COP requests for help. For many organisations, there is an immediate official reaction to fear loss of intellectual property as if any help would diminish the firms’ competitive advantage. On the contrary, the literature indicates that participation in such cross-organisation COPs builds deposits in a trust bank within the COPs so that any such investment is more than fully repaid one way or another.

In summary, the evidence from both the literature and our extensive study, that COPs are effective tools for innovation diffusion—they exist, they are in most organisations and if recognised and nurtured they can yield significant returns on effort, most of which is voluntary.

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