EFFECTIVE KNOWLEDGE TRANSFER IN CONSTRUCTION – THE NEED FOR A 'KNOWLEDGE MEDIATOR'

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ABSTRACT

This paper investigates and evaluates the process of knowledge transfer in construction projects. Due to the highly competitive nature in business environments, knowledge transfer between organisations has become increasingly popular in recent years. However, although organisations can realise remarkable benefits by transferring knowledge from one unit to another, successful knowledge transfer can be difficult to achieve. The discussions presented in the paper are mainly based on findings of two case studies. The two cases were selected from Private Finance Initiative (PFI) projects in the UK. According to the case study findings, different stages of a knowledge transfer process can be overlapped, omitted, repeated as well as intermitted and then restarted. One of the significant findings of the case studies was the role of the 'knowledge mediator'. In selected case studies, there were external consultants and expert staff in the form of knowledge mediators. The importance of their roles was frequently highlighted by the interview participants. They were not only facilitating the close liaison between the knowledge source and the receiver, but their role was also strongly associated with practices of translation and interpretation. This combined role of mediator/translator, therefore, appears to be particularly significant for inter-organisational knowledge transfer in PFI projects.

Keywords: Communication, knowledge receiver, knowledge source, knowledge transfer, PFI projects.

1. INTRODUCTION

The paper focuses on one of the major strands of the area of knowledge management, i.e. *knowledge transfer (KT)*. As Abjanbekov and Padilla (2004) explicates, companies nowadays strive to establish and maintain competitive advantage, successful strategy, effective management and efficient use of resources. Therefore, it is argued that knowledge transfer can serve as a powerful catalyst for achieving these goals. However, the mechanisms by which knowledge is transferred need to be further understood and developed. These mechanisms can change due to several reasons such as the type of knowledge transferred, the type of entities (individuals, departments or organisations) involved and purpose of the knowledge transfer process. This paper aims to give an impetus to the current limited understanding of different mechanisms of knowledge transfer through an in-depth investigation of knowledge transfer processes and protocols using a case study approach. Despite the number of research carried out in the area of KM or indeed in the area of knowledge transfer, there is little literature that specifically indicates and acknowledges the significance of inter-organisational knowledge transfer in PFI environments.

The paper firstly introduces the concept of knowledge transfer and its significance in organisations together with a critique of the literature of the various knowledge transfer models and processes. It then proposes a comprehensive knowledge transfer model that is primarily based on the theories of translation and communication. Finally, the paper discusses different mechanisms of knowledge transfer within collaborative project environments focusing, in particular, on PFI projects.

2. A PROPOSED MODEL FOR KNOWLEDGE TRANSFER

The importance of knowledge transfer for successful organisational innovation is a recurring theme in the literature. Knowledge can only be valuable if it is appropriate, accurate and accessible to its users. Therefore, its effective transfer requires a framework of systems, methods and procedures, and an appropriate organisational culture (Karlsen & Gottschalk, 2004; as cited in Cranefield and Yoong, 2005). This paper presents a proposed model for knowledge transfer. This was developed in order to develop one of the main objectives of a research project titled '**Pro**curement **for I**nnovation and **K**nowledge Transfer (**ProFIK**)'. The proposed model is, therefore, named as 'ProFIK – Knowledge transfer model'. The ProFIK model was the result of synthesising different elements of knowledge transfer processes based on: (a) descriptive frameworks and; (b) related knowledge management literature and theories to yield a relatively complete and unified perspective[1]. The developed knowledge transfer model is depicted in Figure 1.

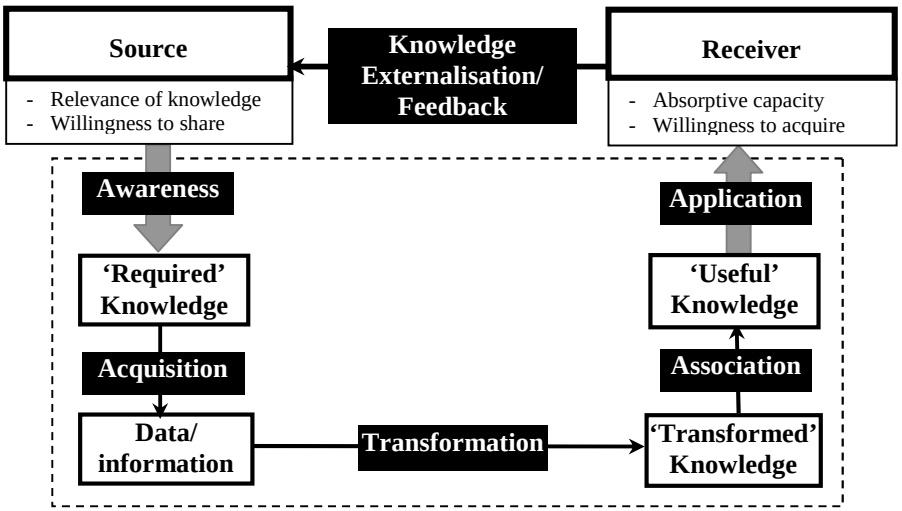

Figure 1: ProFIK – Knowledge transfer model (adapted from Liyanage et al, 2009)

The aforementioned model is mainly built upon two main components that are based on the theory of communication, i.e. the source and the receiver, (Deutsch, 1952; Shannon and Weaver, 1949 - as cited in Carlile, 2004). Apart from the theory of communication, another theory has also been taken into account when developing the model. It is the theory of translation. During a knowledge transfer process the transferred knowledge from one end could easily change its form, shape or appearance at the receiving end. Therefore, there is a need to interpret this transformed knowledge in a meaningful way if it is to be utilised effectively by the receiver. This is where the 'theory of translation' becomes vital. It is a theory that particularly focuses on the 'act of interpretation'. It explains the mechanism as to how knowledge is transformed into a usable form. Taking this into consideration, the process of KT has been elaborated in the model in six main steps. They are, namely;

1. Awareness: identifying where the right knowledge is
2. Acquisition: acquire the knowledge provided that both receiver and source have the willingness and the ability and resources to do it.
3. Transformation: conversion of knowledge in order to make it 'useful' for the receiver where they can produce new knowledge or improve existing knowledge, skills or capabilities.
4. Association: recognising the potential benefit(s) of the knowledge by associating it with internal organisational needs and capabilities
5. Application: utilising the knowledge to improve organisations' capabilities

[1] The full ProFIK model and in-depth discussions relating to the model are given in Liyanage et al (2009).

6. Knowledge externalisation/feedback: transfer the experiences or new knowledge created by the receiver to the source to make the process of KT reciprocal.

3. EMPIRICAL STUDY AND ANALYSIS

3.1 Research design

To identify the validity and reliability of the theoretical model presented above (refer to Figure 1) it was needed to understand the actual knowledge transfer processes occur in practice. Therefore, an empirical research was set up to answer the following research questions:

1. What are the key components of a knowledge transfer process and how are the above key components interlinked with each other?
2. To what extent the key components of a knowledge transfer process vary across different projects and what are the key characteristics that determine its variances?
3. What is the most appropriate structure to communicate and coordinate for the effective transfer and application of knowledge?

The findings presented in this paper, which are based on a case study methodology, aim to answer the aforementioned research questions. The case study codes and the chosen knowledge transfer process in each case study are given in Table 2.

Table 2: Case study details

Case study no.	Case study code	Chosen knowledge transfer process in the case studies
Case study 1	CS1	▪ Unitised cladding system
Case study 2	CS2	▪ Modular construction

The sample for the case studies was chosen from on-going Private Finance Initiative (PFI) projects. PFI was introduced by the Conservative Government (UK) in 1992; however its use only really took off after the election of the Labour Government in 1997. Although the role of PFI has expanded, the majority of public investment (over 85% in 2003) is still carried out by traditional means of procurement. According to Public participation in Local Government Summary report (Birch, 2002), PFI involves extensive risk transfer to the private sector and accordingly greater cost certainty for the Government. In order to ensure this, the project is tightly specified in the contract, defining who bears which risk. Due to PFI's extent of use in the UK compared to other PPP (Public Private Partnership) models and their in-built interrelations, the term 'PPP/PFI' has become moreover a standardised way of introducing many public partnership projects. According to the statistics, there are currently about 800 PPP/PFI projects throughout the UK (Partnerships UK, 2007).

3.2 Research findings - Communication and collaboration in knowledge transfer processes

For each of the case studies outlined above, a number of professionals representing different organisations within the SPV have been interviewed with the aim of identifying how, why and to what extent knowledge transfer processes have occurred in these projects. Subsequent analysis of these interviews has revealed that knowledge transfer is indeed a recurrent process in PFI projects which occurs both formally and informally between and within different project teams. Figures 2 and 3 below describe the chosen knowledge transfer processes in the two case studies.

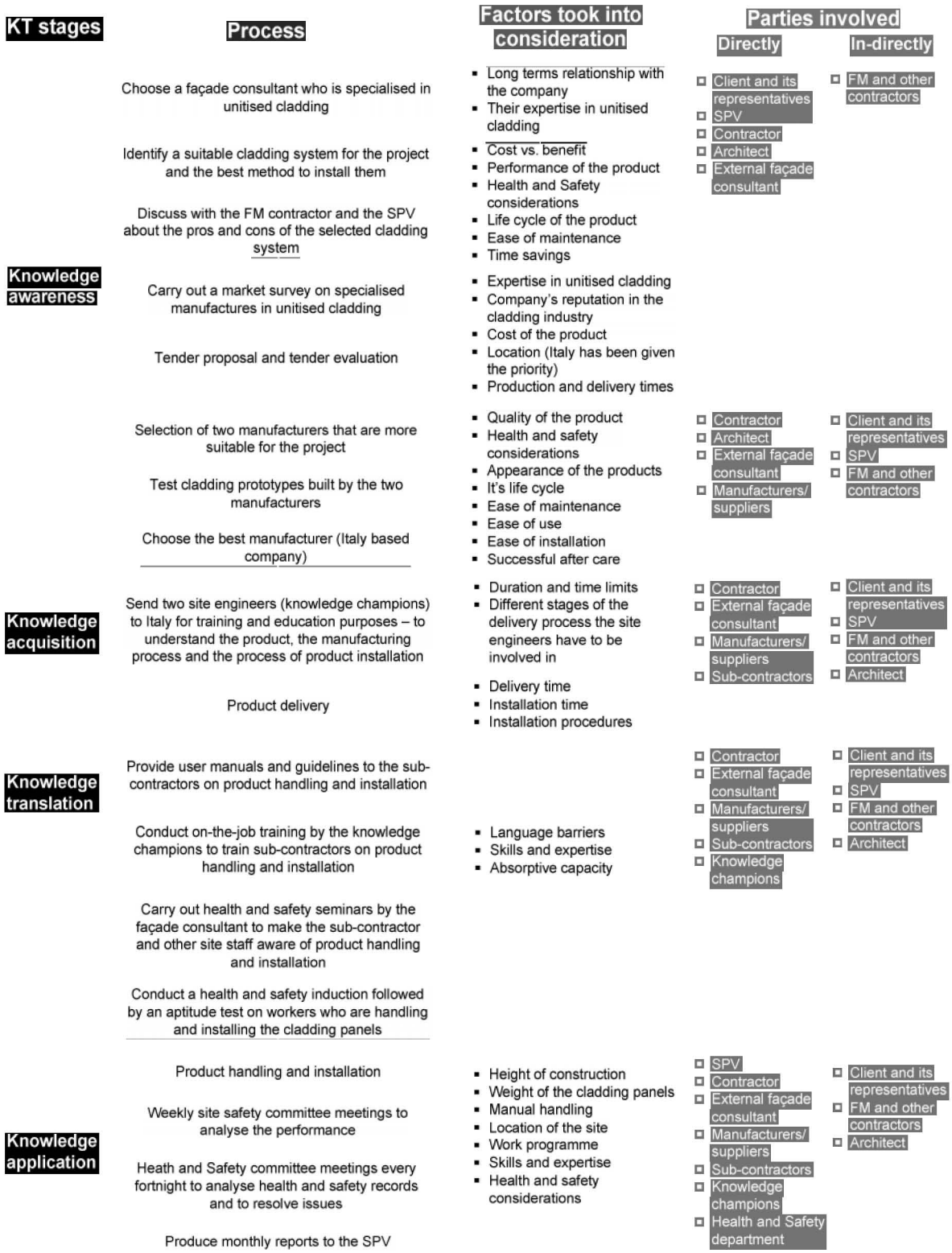

Figure 2: KT process – Unitised cladding system (CS1)

KT stages	Process	Factors took into consideration	Parties involved: Directly	Parties involved: In-directly
	Compare the detail design against available cost and time to identify suitable method of construction for the project	▪ Work programme and time savings ▪ Cost vs. benefit ▪ Health and Safety considerations ▪ Life cycle of the product ▪ Ease of maintenance	☐ Client and its representatives ☐ SPV ☐ Contractor ☐ Architect ☐ External consultant ☐ FM contractor ☐ Manufacturers/ suppliers	☐ Other contractors
	Select modularisation process to produce over 3000 identical room-units			
	Discuss with the FM contractor and the SPV about the pros and cons of the modularisation process	▪ Long -term relationship with the company ▪ Knowledge on the modularisation process		
Knowledge awareness	Hire an external consultant		☐ Contractor ☐ Architect ☐ External consultant ☐ Manufacturers/ suppliers	☐ Client and its representatives ☐ SPV ☐ FM and other contractors
	Select a manufacturer who has past experiences on producing modularised units	▪ Long -term relationship with the company ▪ Past experiences and performance in modularisation ▪ Financial stability ▪ Cost of the product ▪ Location of the manufacturing site		
	Form a joint venture between the contractor and manufacturer to finance the required amount of modularised units (N.B. the same manufacturer produces half of the required amount of modularised units)			
	Tender proposal and tender evaluation	▪ Long -term relationship with the company ▪ Past experiences and performance in modularisation ▪ Cost of the product ▪ Location of the manufacturing site		
	Select another manufacturer to produce the other half of the required amount of modularised units			
Knowledge acquisition	Send two site operatives (knowledge champions) to the two manufacturing sites - to monitor and understand the product, the manufacturing process and the process of product installation	▪ Rate of production of modularised units vs. the work programme ▪ Quality of the product ▪ Cost of the product	☐ Contractor ☐ Manufacturers/ suppliers ☐ Sub-contractors	☐ Client and its representatives ☐ SPV ☐ FM and other contractors ☐ Architect
	Product delivery	▪ Work programme ▪ Product transportation ▪ Delivery time ▪ Installation time ▪ Installation procedures		
Knowledge translation	Conduct on-the-job training by the knowledge champions to train sub-contractors on product handling, installation and health and safety considerations	▪ Language barriers ▪ Skills and expertise ▪ Absorptive capacity	☐ Contractor ☐ Manufacturers/ suppliers ☐ Sub-contractors ☐ Knowledge champions	☐ Client and its representatives ☐ SPV ☐ FM and other contractors ☐ Architect
	Product handling and installation		☐ SPV ☐ Contractor ☐ Manufacturers/ suppliers ☐ Sub-contractors ☐ Knowledge champions ☐ Quality Assurance department ☐ Designated person for quality checks	☐ Client and its representatives ☐ FM and other contractors ☐ Architect
Knowledge application	Monitoring and Supervision – Random quality checks by the Quality Assurance department and frequent quality checks by a designated person at different stages of the product handling, installation and completion	▪ Weight of the cladding panels ▪ Manual handling ▪ Location of the site ▪ Work programme ▪ Skills and expertise ▪ Health and safety considerations		
	Weekly or fortnightly review meetings to analyse the performance			
	Performance reporting to the SPV mainly in terms of work programme, cost, quality and safety			
Knowledge externalisation	Review meetings, on-going communication between the source and the receiver	▪ JV partnership ▪ Long-term collaboration to secure new projects	☐ Contractor ☐ Manufacturers/ suppliers ☐ Knowledge champions	

Figure 3: KT process – Modularised units (CS2)

As illustrated in Figures 2 and 3, any knowledge transfer episode is triggered by a knowledge need (i.e. awareness of 'needed' knowledge) and culminates when the need is satisfied (i.e. successful application of the 'needed' knowledge)[2]. Throughout this, from start to finish, the knowledge transfer process is facilitated by constant interactions and communications. If not, the whole process collapses. This is why the knowledge transfer model (Liyanage et al, 2009) is being built upon the theory of communication (refer to Figure 1). Cranefield and Yoong (2005) states that the transparency of an organisation, i.e. the extent to which it is open to communication, is an important factor affecting the success of knowledge transfer. According to Nonaka (1994), transferring knowledge that has tacit components requires frequent and numerous interactions between the involved parties. Studies on communication and collaboration have suggested that the quality of the relationship is another important factor affecting knowledge transfer between a source and a receiver (Argote, 1999). Szulanski (1996) defined relationship quality as an emotionally non-laborious, close and good relationship between a source and a receiver. Thus, development of good relationships, communication and collaboration are likely to affect knowledge transfer (Baum and Ingram 1998). This is extremely true for the modularisation process and unitised cladding system in the chosen case studies.

From the case study findings, it is apparent that the project team always demonstrate a clear commitment to make the knowledge transfer process more efficient and effective. Along this process, some project teams/companies have core roles; thus, have a direct involvement throughout, whilst others support the process of knowledge transfer in-directly. The parties who are directly and in-directly involved in the process are listed in Figures 2 and 3.

Even though the chosen knowledge transfer processes look very much alike in many instances as mentioned in previous sections, the stage of knowledge externalisation clearly shows a difference between the two (refer to Figures 2 and 3). Many can regard 'knowledge transfer' as a one-way-process where the receiver usually takes the bulk or all of the benefits. However, a success of knowledge transfer process should always take into account benefits gained at both ends (i.e. source and receiver). Thus, externalising knowledge is significant, herein, to transfer the experiences or new knowledge created by the receiver to the source (and other organisations involved). This can occur in the way of a feedback loop. The case study findings reveal that, in CS2, the source (manufacturer) and the receiver (main contractor) have carried out several on-going review meetings and knowledge exchange activities throughout the process of modularisation. It is also evident that the source of CS2 has been intensively involved in throughout the knowledge transfer process. This may be mainly due to the joint venture partnership the source and the receiver have in producing modularised units. As the case study participants affirmed, the close association between the two companies has resulted in benefiting both the receiver and supplier in improving their operational performance. It has also resulted in creating long-term relationships between the two. Due to this, they are now in the process of extending their joint venture partnership in order to secure future projects for producing modularised units.

As Figures 2 and 3 above reveal, both cases have hired an external consultant who had experience and knowledge in the required areas, i.e. unitised cladding/modularisation. The external consultants were mainly chosen to find a suitable manufacturer for the project. For the knowledge transfer process in the unitised cladding system (CS1), however, the external façade consultant was required to guide the main contractor throughout the rest of process. They also had to carry out a world-wide market survey to find the best manufacturer in unitised cladding. The manufacturer was eventually chosen from an Italian based company.

In CS1, a clear feedback process is not present to pass on the final outcomes and experiences of the process to the manufacturer (source). Besides, in comparison to CS2, the extent of the relationship between the source and the receiver are seemingly low. The physical distance between the two companies (Italy and UK) may be one of the main reasons for this. Physical distance herein refers to the difficulty, time requirement, and expense of communicating and getting together face-to-face (Cummings and Teng, 2003). According to Cummings and Teng, face-to-face meetings remain superior to other methods of

[2] As Holsapple and Joshi (2000) aver, the knowledge transfer episode can even end when the effort for finding the 'needed' knowledge is abandoned.

technology-related communication. They further claim that tight interactions demand a close proximity. Therefore, studies investigating the impact of physical distance have found that the larger the distances between the parties, the slower and less the transfer of knowledge (Lester and McCabe, 1993). This is not totally true for CS1 as they have successfully completed the knowledge transfer process (on-time with high-quality project outputs).

The findings also show that the two cases also have knowledge champions during the knowledge transfer process. In CS1, two site engineers were assigned the task to acquire knowledge from the Italian company and to subsequently transfer it to the main contractor and sub-contractors. They, therefore, had to make frequent visits to Italy to monitor the manufacturing process, to study the product and learn its handling and installation. Similarly, in CS2, two site operatives were chosen to monitor the manufacturing process of modular units (in the two manufacturing sites) and understand the handling and installation of the finished product.

One of the key findings of this study is that the external consultant and the knowledge champions have played a pivotal role in the knowledge transfer process, performing a variety of activities at different stages. In knowledge transfer terms, their role is almost similar to the role of translator or mediator. The importance of these roles was referred to frequently by the interview participants and was described by them as being essential to the success of knowledge transfer:

> *"You always have a tendered risk when you are going for a new product like this (modularised units). We had a quite a lot of problems with building regulations. It was very difficult, because people have never done it. Therefore, we had to employ an outside consultant."*
>
> *– Project Manager (CS2)*

> *"….. we opened up the competition and competitive tender; so, we looked for companies that are equally as competent as the one we knew in London. For that we felt that it was important to network with people who have experiences in this kind of business. This is why we engaged a façade consultant…. We used his networks and experiences to find out who else might be equally in the frame for us to consider."* *– Project Manager (CS1)*

> *"We had two people within our team, who are engineers by profession. They were working for the company since a long time, they have an awful lot of experience and also they were engaged in similar large projects in previous times. They actually go to Italy fairly regularly to monitor manufacture… they get familiarised with the product. Once they come here, they train the sub-contractors. This is important to us because we can't just spend a lot of money on labour to bring installers all the way from Italy. That would also present us a risk factor. The two engineers follow the company procedures to train the installers."*
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> *– Project Coordinator (CS1)*

According to Cranefield and Yoong (2005), the role of translator/mediator demands both sound, in-depth, organisational knowledge, and also a range of skills for which there had been no recruitment exercise: strong interpersonal abilities and specialised (verbal, written and pictorial) skills in the communication and adaptation of new knowledge. These skills enable the mediators to convert new abstract and inaccessible knowledge; first into accessible, concrete examples within an appropriate disciplinary and organisational context, and second, into more individualised interpretations of the new knowledge, focusing at the job-specific level.

Cohen and Levinthal (1990) contend that an organisation's capacity to exploit external information effectively once inside the organisation depends heavily on prior experience with that knowledge. Crosson et al (1999) further assert that once knowledge enters an organisation, it must be transformed and institutionalised, enabling interpretation and shared meaning by members of the organisation. From the two case studies it is apparent that the knowledge mediators (external consultants and the selected site operatives/engineers) have facilitated this process. More importantly, they have provided the link to bring

the knowledge source and the receiver together throughout the knowledge transfer process. They have not only helped the receiving organisation to acquire the knowledge but have also helped them in successfully transforming and applying the knowledge where required.

4. CONCLUSIONS

Due to the highly competitive nature in business environments, knowledge transfer between and within organisations has become increasingly popular in recent years. However, although organisations can realise remarkable benefits by transferring knowledge from one unit to another, successful knowledge transfer can be difficult to achieve. Since knowledge can only be valuable if it is appropriate, accurate and accessible to its users; its effective transfer requires a framework of systems, methods and procedures, and an appropriate organisational culture. With the many interpretations of the knowledge transfer process in effect, various knowledge transfer models have been introduced by many researchers. This paper presented the development and validation of a new model that portrays the key constituents of a knowledge transfer process. The proposed model is mainly built upon two main components that are based on: (a) the theory of communication, (i.e. the source and the receiver of knowledge); and (b) the theory of translation, (i.e. the action of interpreting the transformed knowledge.

One of the key findings of this study is that the external consultant and the knowledge champions (expert staff – i.e. site operatives/engineers) have played a pivotal role in the knowledge transfer process, performing a variety of activities at different stages. In knowledge transfer terms, their role is almost similar to the role of translator or mediator. The importance of these roles was referred to frequently by the interview participants. Their roles appear to highly specialised practices that are critical to knowledge transfer. This combined role of mediator/translator appear to be particularly significant in the context of inter-organisational knowledge transfer (e.g. for PFI projects) where it facilitates a close connection between the knowledge source and receiver.

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