Establishing A Connection Between Knowledge Transfer And Innovation Diffusion

Champika Liyanage[1], Taha Elhag[2], Tabarak Ballal[3]

[1] University of Central Lancashire, [2] University College London, [3] University of Reading

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ABSTRACT:

Successful innovation diffusion process may well take the form of knowledge transfer process. Therefore, the primary objectives of this paper include: first, to evaluate the interrelations between transfer of knowledge and diffusion of innovation; and second to develop a model to establish a connection between the two. This has been achieved using a four-step approach. The first step of the approach is to assess and discuss the theories relating to knowledge transfer (KT) and innovation diffusion (ID). The second step focuses on developing basic models for KT and ID, based on the key theories surrounding these areas. A considerable amount of literature has been written on the association between knowledge management and innovation, the respective fields of KT and ID. The next step, therefore, explores the relationship between innovation and knowledge management in order to identify the connections between the latter, i.e. KT and ID. Finally, step four proposes and develops an integrated model for KT and ID. As the developed model suggests the sub-processes of knowledge transfer can be connected to the innovation diffusion process in several instances as discussed and illustrated in the paper.

Keywords: *Innovation, Innovation diffusion, Knowledge management, Knowledge transfer, Integrated model*

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1. Introduction

There is a widespread agreement in the academic literature that innovation, knowledge and learning have become the main sources of wealth, employment and economic development in advanced regions and nations. According to Todtling et al (2006), in recent years a considerable body of work has been developed to understand and explain this shift towards a knowledge-based economy or a learning economy. This paper is based on a research project that focuses on two of the main strands that can help organisations to gear towards the knowledge-based economy. They are namely, knowledge transfer and innovation diffusion. The research project attempts to bring these two together in an Integrated Procurement System environment (particularly in Private Finance Initiatives – PFI). The main aim of this project is to develop an effective framework for the adoption and diffusion of innovations by enabling knowledge sharing between different projects and innovation diffusion within projects through the use of integrated procurement systems.

In the field of 'Innovation', diffusion of innovation has emerged as one of the most multidisciplinary research topics in the social sciences today (Rogers, 2003). This has led to the emergence of a common diffusion paradigm. The main elements of the process of diffusion of innovations have been described by Rogers as; an innovation, which is communicated through certain channels, over time, among the members of a social system. The adoption process of a decision-making unit and the way it is influenced are utmost important in the diffusion paradigm introduced by Rogers (2003). As he defines, adoption of an innovation is 'a decision to make full use of an innovation as the best course of action available'.

Knowledge transfer, on the other hand, also appears to be one of most discussed topics in the area of knowledge management. Unlike for innovation diffusion, a universal definition or framework for knowledge transfer is yet to emerge. However, irrespective of the situational contexts where it occurs and the types and forms of knowledge, there is a definite rule of thumb to understand the process of knowledge transfer; that it is a people-to-people process. Thus, communication lies at the heart of a knowledge transfer process. This leads to the notion that both innovation diffusion and knowledge transfer can be related in some ways. Nevertheless, hitherto, only a few have examined the relationship between the two constructs. The handful of evidence-based literature has therefore led to difficulties in determining how and in what ways they relate to each other; i.e. whether knowledge transfer is part of an innovation diffusion process or vice versa or whether one triggers the other. The paper is based on an extensive analysis of the literature in the fields of KM and innovation. The aim of the paper, therefore, is to present an analysis of existing studies from which a theory is developed linking KT and ID. This was achieved by using a four-step approach (refer to Figure 1). The steps are discussed in-detail in the following sections.

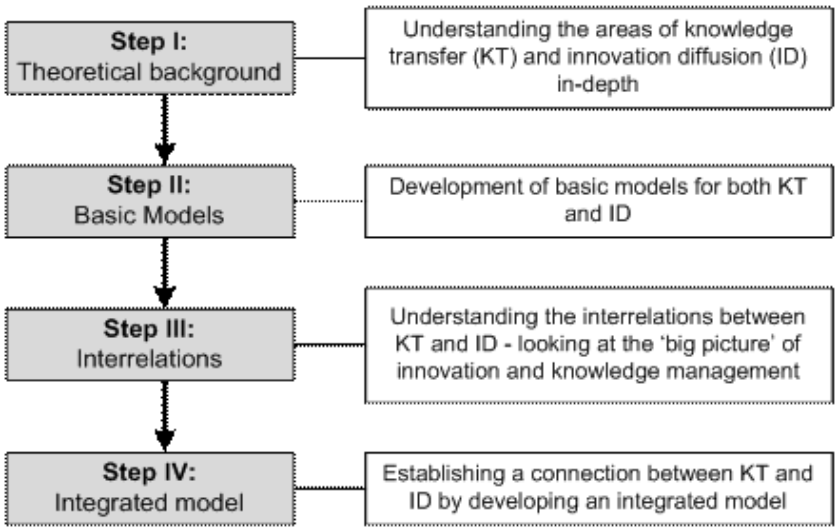

Figure 1: A Four-Step Approach To Develop An Integrated Model For KT And ID

2. Step 1 - Theoretical Background

A review of established theories relating to the areas of knowledge transfer (KT) and innovation diffusion (ID) was the first step of the aforementioned approach. The theories are discussed in the following sub-sections.

2.1. Theoretical Background On Knowledge Transfer

Knowledge transfer (KT) is an area of knowledge management concerned with the movement of knowledge across the boundaries created by specialised knowledge domains (Carlile & Rebentisch, 2003). It is the conveyance of knowledge from one place, person or ownership to another. Successful knowledge transfer means that transfer results in the receiving unit accumulating or assimilating new knowledge. According to van den Hooff and de Ridder (2004), KT involves either actively communicating to others what one knows, or actively consulting others in order to learn what they know. When organisations or employees within an organisation identify knowledge that is critical to them, they can use knowledge transfer mechanisms to acquire the knowledge. They can then constantly improve it and make it available in the most effective manner for others who need it. They also can exploit it creatively or innovatively to add value as a normal part of their work. Since knowledge transfer (KT) involves networking and encourages having close ties with people to share knowledge between and within organisations it can be identified as an 'act of communication'.

The process of KT has been described by many researchers using models. Major and Cordey-Hayes (2000) look at several frameworks and models of knowledge transfer presented by different authors and draw parallels between them. The models they have reviewed are by Cooley (1987), Cohen and Levinthal (1990), Trott et al (1995), Slaughter (1995) and by Horton (1997). Major and Cordey-Hayes (2000) distinguish two streams of models:

I. node models: these describe nodes and discrete steps that are each gone through in a knowledge transfer process

II. process models: these describe knowledge transfer by separate processes that are each undertaken.

Most of these models, although contextually different, have significant similarities. Apart from these models, some researchers attempt to relate the process of knowledge transfer using different theories. Some of these are; translation theory (Holden and von Kortzfleisch, 2004; Jacobson et al, 2003; Abjanbekov and Padilla, 2004), agency theory (Arrow 1985; as cited in Boyce, 2001), intermediate modes and voice-exit and game theory (Boyce, 2001). Fundamentally, issues concerning knowledge, collaboration and learning lie at the heart of most of these theoretical approaches.

The aforementioned theories and models have stemmed from the basic idea of collaboration and communication between the source (or sender) and receiver; an idea that has originally been introduced by Shannon and Weaver's mathematical approach to communication and information (1949; as cited in Carlile, 2004). This has then been further developed by Deutsch (1952) in his theory of communication. The practical strength of the original approach of communication and information is its mathematical capacity to adequately define the relations between source and receiver and their differences and dependencies. From the perspective of social sciences, two main points can be taken from this to simply explain the process of KT. First is that a KT process has two main components, i.e. the

source or sender that shares the knowledge, and the receiver who acquires the knowledge. Secondly, KT, although looks simple, is a complex process due to various prerequisites, factors and contextual issues surrounding the process.

2.2. Theoretical Background On Innovation Diffusion

Innovation diffusion (ID) refers to the communication, spread and adoption of new ideas among social communities (Rogers, 2003). Rogers' definition highlights the significance of understanding not just the new ideas, indeed, the social networks through which ideas are communicated, in order to understand ID and its development across organisations. Newell et al. (2000) believe that supplier-focused models of diffusion have made an important contribution to highlighting the importance of social networks that allow communication of new ideas across organisations, in particular the links between technology suppliers and users. They also suggest that both strong and weak relationships (i.e. ties) are important for the diffusion of new ideas. Strong ties are close associations among firms, whilst weak ties link individuals from organisations across different sectors or communities that would not normally make contact during their day-to-day business. These can be equally important in the diffusion process because, through weak ties, organisations can encounter ideas that go beyond their usual ways of operating.

The Community Innovation Survey (Department Trade and Industry - DTI, 2004) distinguishes between two types of innovations, i.e. product and process. The survey's definition of each is as follows:

> "A product innovation is the market introduction of a new good or service or significantly improved goods or service with respect to its capabilities, such as quality, user friendliness, software or subsystems. The innovation must be new to… [the] enterprise, but it does not need to be new to… [the] market. It does not matter if the innovation was originally developed by… [the] enterprise or by other enterprises."
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> "Process innovation is the use of new or significantly improved methods for the production or supply of goods and services. The innovation must be new to [the]… enterprise, but it does not need to be new to… [the] industry. It does not matter if the innovation was originally developed by… [the] enterprise or by other enterprises. Purely organisational or managerial changes should not be included…"

Innovation, as a key dynamic driver for our society's development, has attracted the interests of researchers from various disciplines, such as engineering, anthropology, sociology, psychology, organisation theory, economics and political science (Jones and Saad, 2003). Such diversity clearly segments the innovation diffusion literatures. Firstly, among the existing innovation studies, most attention has been paid to product innovation, such as the process of product innovation adoption (Rogers, 2003), the organisational context for product innovation (Burns and Stalker, 1961, Van de Ven, 1986), the relations between product innovation process and marketing strategy (Robertson, 1967), the relations between the product innovator and the financial performance (Capon, et. al., 1992) and the cost of product innovations (Mansfield and Rapoport, 1975). Studies in product innovation are so numerous in most fields of research to the extent that the phrase 'innovation' has in many cases become synonymous to 'product innovation'. However, much less attention has been given to innovations in management processes or organisational practices. Secondly, most of the studies have been set to answer the "what" question while, comparatively,

studies for solving the 'how' and 'why' enquires have lagged behind (Rogers, 2003). Finally, the units of analysis have been dominated by, and mostly concentrated on studies of, individuals and organisations in isolation of external influences, and the level of the analysis has normally been confined to the micro-level which is the individuals' behaviour. For example, Rogers' (2003) model for the diffusion of innovations has been based solely on the individuals' behaviour throughout the process of product innovation adoption whereas Taylor (1977) has investigated the characteristics of individual innovators.

3. Step II – Basic Models

The second step of the four-step approach for the development of an integrated model for KT and ID focuses on developing basic models for the processes of KT and ID based on the key theories discussed in the previous section.

3.1. A Process Model For Knowledge Transfer

Based on the communication theory discussed in section 2.1, an apposite process model for knowledge transfer (KT) has been developed to understand the knowledge transfer process in-detail (Liyanage et al, 2009). The model is mainly built upon two elements, i.e. source and receiver (refer to Figure 2).

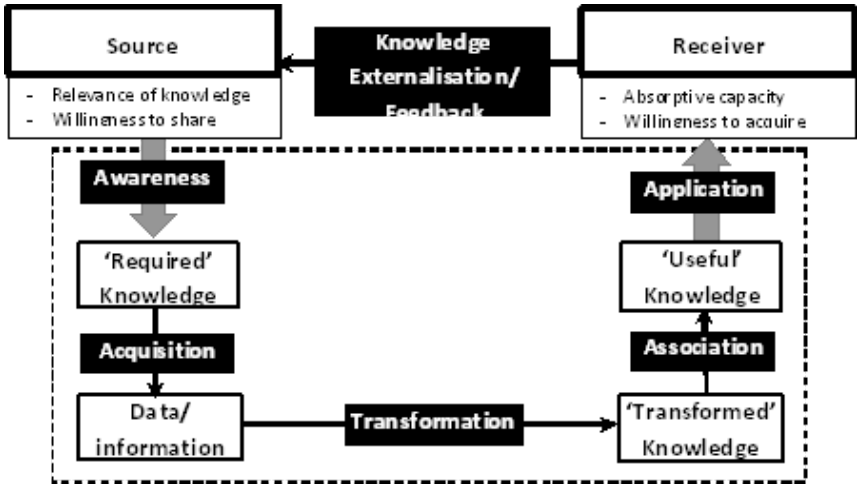


Figure 2: A Model For Knowledge Transfer (Adapted From Liyanage et al, 2009)

Apart from the communication theory, another theory has been also taken into account when developing the aforementioned model. It is the theory of translation. During a KT 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 (Liyanage et al, 2009):

i. Awareness: identifying where the right knowledge is

ii. Acquisition: acquiring the knowledge, provided that both receiver and source have the willingness and the ability and resources to do it.

iii. 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.

iv. Association: recognising the potential benefit(s) of the knowledge by associating it with internal organisational needs and capabilities

v. Application: utilising the knowledge to improve organisations capabilities

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

3.2. A Process Model For Innovation Diffusion

Rogers' (2003) model on innovation–decision process systematically framed the innovation diffusion. According to Rogers (2003), an innovation is communicated through certain channels over time among the members of a social system. Innovation is regarded as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. Rogers (2003) identified five characteristics of innovation that would determine an innovation's rate of adoption. Four of the characteristics – "relative advantage", "compatibility", "trialability" and "observability" are believed to have positive correlations with the rate of adoption, while "complexity" is the only characteristic that has a negative correlation with the rate.

Rogers (2003) divided the innovation-decision process into five stages; i.e. knowledge stage, persuasion stage, decision stage, implementation stage, and finally confirmation stage. Although the five characteristics of innovation are believed to have influences on the whole decision process, they are especially influential on the persuasion stage.

Based on Rogers' five stages of innovation-decision process, a conceptual model for innovation diffusion has been developed for the purpose of this study to understand innovation diffusion as an organisation management process. This is shown in Figure 3.

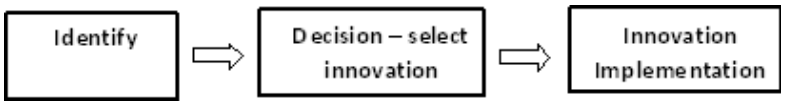


Figure 3: Innovation Diffusion Process

4. Step III – Interrelations

Even though there is only handful of literature on the interrelations of KT and ID, a considerable amount of literature has been written on the association between their

respective fields, i.e. knowledge management and innovation. Therefore, exploring the relationship between innovation and knowledge management was the third step of the approach in facilitating the development of a possible connection between KT and ID.

4.1. Knowledge Management vs. Innovation – The 'Big Picture'

There is a widespread agreement in the academic literature that respective fields of innovation diffusion (i.e. innovation) and knowledge transfer (i.e. knowledge management - KM) have become the main sources of wealth, employment and economic development in advanced regions and nations. Therefore, an increasing number of researchers have recently been turning their attention to the relation between the two.

The connection between management of knowledge and innovation is inseparable (Alam, 2005). From an extensive literature review on innovation, there appears to be convincing empirical evidence that acquisition of knowledge can 'positively' affect innovation (Tang, 1999). Responding to knowledge, one of another component of knowledge management, was also found to positively affect innovation in one study (Kitchell, 1995; as cited in Darroch and McNaughton, 2002). There is also some evidence of a link between knowledge dissemination to knowledge and innovation. However, as Darroch and McNaughton (2002) claim, studies linking aspects of knowledge dissemination and innovation have provided mixed results. For example, inter-functional coordination and human resource practices were found to positively affect innovation; encouraging work group behaviour that supports innovation and allowing people the time for innovation yielded mixed results; and lastly, codifying or making knowledge explicit in databases or organisational memories was generally found to not affect innovation (Darroch and McNaughton, 2002).

The process of implementation of a KM strategy involves the operations of creation, storage, distribution and application of knowledge; together, these make up a full cycle. This process is called the KM cycle, to emphasize the continuity which should characterize this type of strategy (Forcadell and Guadamillas, 2002). According to Forcadell and Guadamillas (2002) this cycle of KM, especially the creation of knowledge, is closely related to innovation. As they further explain, the creation of new knowledge and of innovations implies the application of intelligence, tacit knowledge and information: that is, an interaction between actions and behaviours. The action of creation does not consist of the processing of information or data, since the obtaining of tacit knowledge, which cannot be directly processed, is a fundamental part of this phase. It allows for the development of improvements and innovations on products and processes, capable of creating value, which then becomes part of the new knowledge in the system.

In her article, Horibe (2007) attempts to understand the relation between knowledge management (KM) and innovation. As Horibe explains, successful KM provides knowledge that might not otherwise be available through the usual channels of publication, study and personal contact. Innovation, on the other hand, is a ground-breaking, category-shattering, revolutionary change in how people see the world. According to Horibe, KM and innovation are closely tied. When organisations decide to undertake either KM or innovation, they typically approach it in a similar way. They develop an often elaborate process to "manage the project," with the hallmarks of a good project - careful encouragement of grassroots ideas, judicious seed funding, regular reviews, pilots, prototypes, the infusion of technology and in the end hopefully, the desired result. KM and

innovation come together in that they both require an organisational culture where people want to and are allowed to be innovative and share their knowledge (Horibe, 2007).

Holsapple and Joshi (2000) claim that knowledge management involves the execution (by humans and/or computers) of some configuration of knowledge activities operating on available knowledge resources to develop the needed knowledge. By satisfying knowledge needs, knowledge management environments result in learning and projection. According to Holsapple and Joshi, learning and projecting are the basis of an organisation's innovations. Similarly, Amidon (1997) has also claimed that management of knowledge is inseparable from “the innovation process - defined as bringing ideas to market”. Indeed, in a top-line finding of a recent survey of Ernst and Young (1997), executives also see innovation as the greatest payoff from knowledge management, even though KM efforts have so far concentrated on achieving productivity gains.

Thornhill (2006) too have also researched the connection between management of knowledge and innovation. As he claims, management of knowledge is critical to the process of innovation. Choo (1998) is also another researcher who believes that knowledge management and innovation are interrelated. As Choo claims, in organisations, there are three vital knowledge creation activities. First, the process called sense making. This is an activity that enables organisations to use information to make sense of changes and developments in the external environments. This is a vital activity wherein managers discern the most significant changes, interpret their meaning, and develop appropriate responses. Second, organisations create, organise, and process information to generate new knowledge through organisational learning. This knowledge creation activity enables the organisation to develop new capabilities, design new products and services, enhance existing offerings, and improve organisational processes. Third, organisations search for and evaluate available knowledge and information in order to make decisions. This activity is critical since all organisational actions are initiated by decisions and all decisions are commitments to actions, the consequences of which will, in turn, lead to innovation. Therefore, as Choo (1998) states, how well the organisation adapts to its environment and be ‘innovative’, depends on how well it succeeds in its knowledge creation activities.

What is significant in knowledge management is that, irrespective of the point, place or situation where it occurs, it encourages acquiring and creating new knowledge. This is a continual process where people and organisations can (re)create new knowledge using the knowledge that is already created. It also promotes integration and empowers employees to constantly improve their work. Most of all, knowledge management improves decision-making, engenders learning, facilitates collaboration and networking and also encourages and promotes innovation. A basic premise has therefore been included in the creation of knowledge: that a firm needs to continuously renovate its knowledge base to ensure that this base does not become obsolete for the development of innovations. New knowledge, the basis for innovation, will constitute the future knowledge base for the organization and will contribute to the regeneration and widening of the existing base. As Forcadell and Guadamillas (2002) state, a critical aspect of business management is the successful creation of processes which drive the development of a continuous flow of innovation, to give a basis for competitive advantage. To reach this goal, the establishing of a knowledge management (KM) strategy may be considered the best way to channel the organization’s efforts to this end.

As Darroch and McNaughton (2002) aver, effective management of knowledge has been presented in the literature as one method for improving innovation and performance. More specifically, knowledge dissemination and responsiveness to knowledge have been mooted as the two components that would have the most impact on the creation of a sustainable competitive advantage, such as innovation, because of their ambiguity and uniqueness to the firm (Fahey and Prusak, 1998; Grant, 1996). Therefore, it is apparent that there is a definite connection between management of knowledge and innovation. The authors, thus, argue that one aspect of this connection is the interrelation between transfer of knowledge and diffusion of innovation.

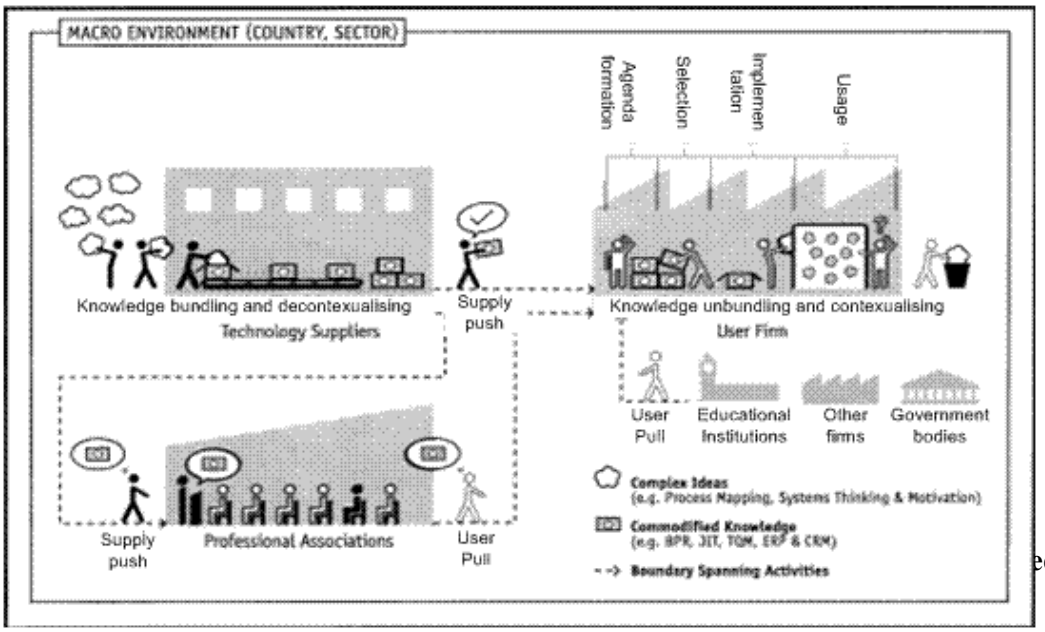
4.2. Knowledge Transfer And Innovation Diffusion – Making A Connection

When establishing a connection between KT and ID, it is difficult to determine whether KT is part of an ID process or vice versa or whether one triggers the other. KT and ID could also occur as totally separate processes with little overlaps. A closer scrutiny would suggest that it can take any of these forms.

A few researchers (Stewart Jr., 1987; Attewell, 1992; Baptista, 1999; Newell et al, 2000; Fichman, 1992) have affirmed that when diffusion of innovation occurs there is generally some sort of knowledge transfer associated with it. According to Attewell (1992), several studies have shown that, although one can readily accept an 'innovation', the knowledge needed to use that 'innovation' is acquired much more slowly and with considerably more difficulty. Therefore, as Attewell explicates some studies of innovation conceptualise the diffusion process in terms of knowledge transfer. However, as Stewart Jr. (1987) claims, innovation diffusion is restricted by demand, whereas knowledge transfer is constrained on the supply side - as the initiative remains in the hands of the innovator (i.e. the source in knowledge transfer terms). As Stewart Jr. further notes, the important difference between knowledge transfer and innovation diffusion is that the very firm that has every reason to extend its market, to accelerate diffusion of use of its new product, has no reason at all to transfer its knowledge on technological aspects. This is because too early a transfer destroys its reward for invention and innovation. However, this is arguable. As Gee (1974) and Cheung (1977) aver, knowledge transfer accelerates diffusion of innovation by multiplying the sources of the product, reducing its price, spreading knowledge and increasing availability. Also knowledge transfer stimulates further innovation by making exclusive know how and/or proprietary knowledge available to others as an input to further research and development.

5. Step IV – Integrated Model

Traditionally, the innovation diffusion process has been explained from the perspective of the supplier (Newell et al, 2000). Based on the supplier perspective and different other perspectives (e.g. user perspective, fashion perspective, etc.), Newell et al (2000) have developed a knowledge-focused model for exploring the process of innovation diffusion. The model is illustrated using a business process re-engineering (BPR) example (refer to Figure 4).



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Starting from the left-hand side, the above model depicts complex ideas relating to organization and technical processes that exist in a public domain. These ideas are bundled together and packaged in particular ways to create solutions that can be applied to organizational problems in a variety of contexts. The model shows how these solutions, as suggested by the supplier-focused perspective, are communicated directly to potential users via various communication channels linking technology suppliers and users – a process of 'supply push'. However, the model also draws on the user-focused perspective and depicts the fact that users do not wait passively for new ideas to be broadcast by the supply side, but actively search these out through networking (both formal and informal). According to Newell et al (2000), this is the process of ‘user pull’. These solutions, which are 'packaged' or commodified, then enter the user firm through both a supply push and a user pull. However, to be fully appropriated or utilized, this knowledge has to be unpacked or unbundled within the user firm because, as complex technologies such as BPR originate as a set of complex ideas, both technical and organizational. A key to this ability to unbundle or unpack the knowledge underpinning complex technologies relates to how the implementation project within the user firm is managed and, in particular, who is involved (Newell et al, 2000).

As Newell et al suggest, the firm may have to find an ‘expert’ within the firm or may have to rely on an external party (i.e. a consultant) to provide the aforementioned knowledge. Nevertheless, if they fail or do not have the right knowledge to do so, it will undoubtedly lead to a failure of innovation adoption; so that the 'solution' is discarded (refer to Figure 4 - as depicted by the ideas being thrown into a bin). This is where the need for a connection between innovation diffusion and knowledge transfer occurs. A knowledge transfer process between the supplier (i.e. source in KT terms) and the user (i.e. receiver in KT terms) from the beginning to the end of the innovation diffusion process could avoid failure of innovation adoption. Nevertheless, some may argue that revealing the ‘complex knowledge’ underpinning the innovation might lead to lose of supplier’s competitive advantage. Even though this may seem as an obvious disadvantage in supplier’s point of view, this can be avoided by introducing some boundaries in terms of the level and extent of transfer of knowledge between the source and the receiver.

It is obvious from above discussions that the supplier-focused approach takes the broadcaster-receiver approach when explaining the diffusion of innovation process. These models have made an important contribution to highlighting the importance of social networks that allow communication of new ideas across organizations, in particular the links between 'innovation' suppliers and users. Interestingly, the broadcaster-receiver approach is the very notion that originates from the theory of communication, which was used to describe the process of knowledge transfer in section 2.1. Based on this and the basic models introduced in section 2 (refer to Figures 2 and 3), a conceptual model has been developed to portray the connections between KT and ID (refer to Figure 5).

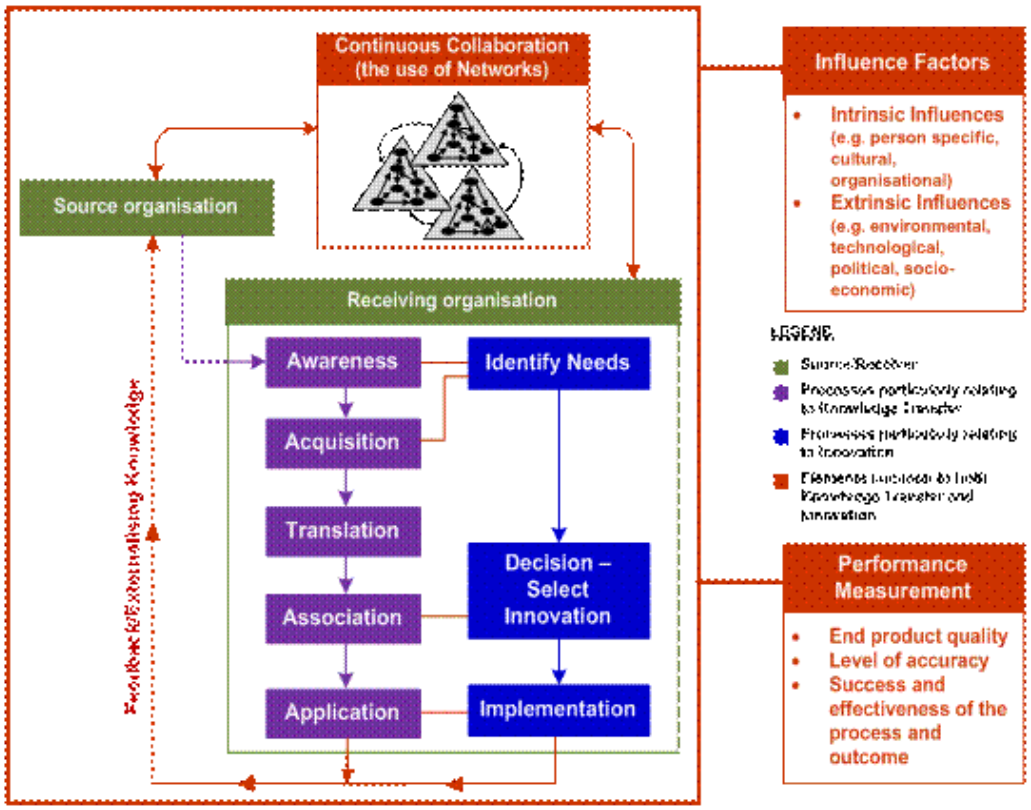

Figure 5: Knowledge Transfer And Innovation Diffusion – An Integrated Model

The authors argue that there are several instances where sub-processes of KT can be interrelated with the ID process (refer to Figure 5). First of all, it is at the stage of knowledge awareness. 'Knowledge awareness' will be helpful to identify whether and where an innovation exists. A knowledge transfer process can often go wrong if the parties involved are unwilling to share knowledge due to issues of confidentiality, cultural difficulties and also due to fear of losing the competitive edge. This is also true for innovation diffusion. Therefore, the 'knowledge awareness' stage presupposes a great level of participation from the source and the receiver and also requires a strong relationship between the two.

The knowledge acquisition stage of the knowledge transfer process can also be related to an ID process. This can be helpful for an organisation to identify and acquire externally generated 'innovation' (or knowledge) that is critical to them. Zahra and George (2002) introduce three main attributes that can influence the process of knowledge acquisition, i.e. intensity, speed, and direction. The intensity and speed of an organisation's effort to identify and gather knowledge can determine the quality of a knowledge acquisition process. The greater the effort, the more quickly the organisation will build its knowledge-base. However, sometimes, there are limits to an organisation's ability to achieve this speed. The direction of accumulating knowledge can also influence the paths that the organisation follows in obtaining external knowledge. These activities vary in their richness and complexity.

During innovation diffusion, the receiving organisation (or the users) needs to take decisions on 'innovation selection'. This is where establishing a connection with the 'knowledge association' stage of the knowledge transfer process becomes crucial. Knowledge association recognises the potential benefit of the innovation by associating it with internal organisational needs and capabilities. Only then it becomes an innovation that is usable for the receiver. This can then be implemented or adopted by the receiver using the knowledge application stage. According to many researchers (Alalvi and Lediner, 2001; Cohen and Levinthal, 1990; Trott et al, 1995; Ortiz-Laverde et al, 2003), 'knowledge application' is the most significant stage during a knowledge transfer process. Every other step in the knowledge transfer process does not lead to improved performance, nor does create value. Value is created only when knowledge (or innovation) that is transferred from its previous site is successfully applied where it is needed (Alavi and Leidner, 2001). Therefore, an important aspect of knowledge transfer is enhancing the knowledge application process. This can be achieved through rich communication and collaboration.

According to Baptista (1999), successful dissemination of embodied knowledge may be limited to those innovators possessing certain communication and services facilities, and to adopters with adequate absorptive capacity. Moreover, it depends on the extent to which experience can be transmitted from one firm to another. It has been suggested that the capacity to absorb spillovers of new technological knowledge is mediated by geographical proximity. As Baptista (1999) suggests, this capacity should influence both the creation and diffusion of innovations.

Many can regard 'knowledge transfer' as a one-way-process where the receiver usually takes the bulk or all of the benefits. However, a successful 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 process of externalising knowledge adds value to both parties and can lead to continuous improvement through new innovations.

As repeatedly mentioned, both innovation diffusion (ID) and knowledge transfer (KT) appear to be closely associated with 'communication', 'networks/networking' and 'relationship (ties)'. The use of networks has therefore been highlighted in the aforementioned model. For both KT and ID mechanisms to be effective, close, tight interactions between individuals, teams and organisations are critical in organisations. 'Networks' facilitate this tight collaboration between and across entities, i.e. between individuals, individuals to teams, between teams, across teams, teams to organisation, between organisations, etc. Such tight collaborations subsequently allow organisations to generate and coordinate acquired knowledge more efficiently. Therefore, innovation diffusion and knowledge transfer presupposes some kind of personal or virtual network, since the process involves both a sender and receiver of knowledge. Thus, without networks, there is no opportunity for accessing such valuable knowledge (or information).

When innovation diffusion or knowledge transfer takes place, the factors that inhibit or enable the processes can be enormous. This is mainly because of the organisational factors and cultural influences that can impact on the processes. For example, problems such as the stickiness of knowledge (Szulanski, 1999), knowledge of where to find knowledge, the tacit dimension of knowledge (Nonaka and Takeuchi, 1995), the relationship between the sender and receiver of knowledge (Hansen, 1999), the motivational factors for engaging in transferring knowledge, the identification of knowledge worth sharing or transferring (Gupta and Govindarajan, 2000) can all be barriers for KT process. Therefore, it is important to identify these barriers for ID and KT, and understand how organisations deal with these barriers in order to enable the said processes. A key to understanding the success and failure of a KT and ID process depends on the identification of the factors that could make an impact on the processes and their level of influence on it (refer to Figure 5).

To achieve sustainable competitive advantage and superior performance in a knowledge-based economy, organisations must have the capacity to learn and innovate continually (Spender and Grant, 1996; as cited in Grevesen and Damanpour, 2007). This demands a high level of accuracy and quality of the results throughout the processes of ID and KT. Organisations will not be in a position to identify the success and effectiveness of the processes of ID and KT unless they attempt to assess those. This will not only result in failing to recognise the impact the knowledge transfer process made on their organisations and its practices, but will also result in repeating similar mistakes (if any) in future ID and

KT processes. Therefore, monitoring and measurement of performance should always be part of the KT and ID processes (refer to Figure 5).

6. Conclusions

The purpose of this paper was to introduce an integrated model to establish a connection between knowledge transfer and innovation diffusion. In the developed model, the sub-processes of knowledge transfer have been interrelated to innovation diffusion process in several stages. As the model suggests, a successful innovation diffusion process may well take form of a knowledge transfer process. Knowledge transfer and innovation diffusion exercise can often go wrong if the parties involved are unwilling to share knowledge due to issues of confidentiality, cultural difficulties and also due to fear of losing the competitive edge. Therefore, a great level of participation from the source and the receiver and a strong relationship between the two parties are needed throughout the aforementioned processes. However, what is not forgotten here is that when the knowledge is complex and diffusion of innovation takes the form of knowledge transfer, errors and misunderstandings are likely to occur. Even though this may seem as an obvious disadvantage, this can be avoided by introducing some boundaries in terms of the level and extent of transfer of knowledge between organisations, i.e. especially between the source and the receiver.

7. References

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About the Authors:

Dr. Champika Liyanage is currently working as a Senior lecturer in the School of Built and Natural Environment, University of Central Lancashire. She is also the Research Degree Tutor for the Built Environment part of the school and the MSc Dissertation Coordinator. Champika has a PhD in facilities management from Glasgow Caledonian University, UK. She has published over 40 journal and conferences papers to-date. She has also won several awards for her research and publications. She received the best student award from the National Health Service, Scotland in October 2004 for her research in Facilities Management. She also won the best paper award at the Second Scottish Conference for Post graduate Researchers of the Built Environment in November 2005. She is also the co-author of the best student paper won at the American Society of Civil Engineers' (ASCE) 6th International Engineering and Construction Conference, Cairo, Egypt in June 2010. Champika is engaged in carrying out research activities in the areas of Public Private Partnerships, Sustainable Procurement and Facilities Management. Champika is actively engaged in some of the working groups of the International Council for Research and Innovation in Building and Construction (CIB). For example, She is a member of some of its working groups such as W070 in Facilities Management, W092 (Procurement) and TG72 (Public Private Partnerships).

Dr. Taha Elhag is a senior lecturer in Project Management at UCL. Previously, he was a lecturer at UMIST and Manchester University. His teaching duties comprise undergraduate and postgraduate programmes; and course directorship. Dr. Elhag academic experience also includes the supervision of MSc dissertations and PhD research; and acting as internal and external examiner for various universities. He is also an expert reviewer for many international journals and EPSRC research projects. His research experience incorporates his role as principal investigator in EPSRC research grants. He was a visiting lecturer at the Universities of Reading, Manchester and the British University in Dubai (BUiD). His experience also involves working as site engineer and project manager with contracting organisations. Dr. Elhag has actively published in international refereed conferences and refereed journals. He is a member of the Association for Project Management (MAPM).

Dr. Tabarak Ballal worked as a site engineer for two years before joining the academic elite in 1995. Her research experience includes investigating methods of employing the notion of 'Design for Manufacturability' in construction. This has resulted in the use of state of the art Artificial Intelligent techniques for promoting the concept of 'Design for Constructibility'. Her current research activities include design process improvement in international multidisciplinary organisations through the use of 'Process Mapping and Process Modelling'. Tabarak's teaching focuses on construction technology and the integration of construction knowledge experience and design. She has developed innovative methods of material delivery through the use of computers and the Internet.

Dr. Champika Liyanage, Senior Lecturer, School of Built and Natural Enviornment, University of Central Lancashire, PR1 2HE

Dr. Taha Elhag, Senior Lecturer, School of Construction and Project Management, University College London, WC1E 7HB

Dr. Tabarak Ballal, School of Construction Management and Engineering, University of Reading,Reading RG6 6AW, UK