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MANAGING EFFECTIVE INDUSTRY KNOWLEDGE TRANSFER WITHIN A HIGHER EDUCATION CONTEXT

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ABSTRACT
Effective knowledge transfer is essential in ensuring the successful development of products, but is the role of the different actors in this process clear? During the past 20 years De Montfort University (DMU) has supported in excess of 100 companies in the design and development of new products. Case study material has been produced to support undergraduate and postgraduate teaching, placements for students have been established and a number of Knowledge Transfer Partnerships (KTP) have been initiated and completed. Activities with Small and Medium sized Enterprises (SMEs), Large Enterprises (LEs), design consultancies and KTPs, all in the Higher Education context, have provided DMU with considerable and multifaceted experiences relating to knowledge transfer in product design and new product development in both the public and private sectors. Based on these experiences this paper considers the nature of and the difficulties in ensuring effective knowledge transfer in the product design and new product development discipline, in a higher education context. This paper investigates knowledge transfer environments that support academics in gaining experience and providing design students and professionals with access to information from which to generate innovation. This paper explores the nature and importance of relationship building in the management of knowledge environments to enable effective knowledge transfer and uses a case study to illustrate this activity within the Higher Education Institution (HEI) context.

Keywords: Knowledge transfer, KTP, product design, knowledge creation, knowledge environment

1 INTRODUCTION

In 2004 DMU undertook its first regional (East Midlands) design support scheme entitled Improving Business by Design (IBD), a highly successful initiative to assist SME's in making better use of product design in new product development activity. IBD was followed by a further six, regionally funded SME design support initiatives. These activities have included new product development support, the provision of rapid prototyping and manufacturing facilities and support with resource efficiency and sustainability in both new product development and design for retail. With all of these schemes an overarching requirement has been to involve the region's product design and manufacturing community in the delivery of these interventions.

On a number of occasions relationships with companies formed under these schemes have led to Knowledge Transfer Partnerships (KTP), a partnership between a company interested in developing a new product or technology with a HEI capable of supporting the venture. In most of these cases the relationship building between the HEI, the partner company, their sub-contractors and design practitioners on design exercises prior to a KTP have been invaluable in ensuring the KTPs success. Interactions between academia, manufacturing, the design profession and product design students have all made for a dynamic knowledge environment.

This paper begins with a quick review of some of the current literature relating to knowledge transfer. Three knowledge environment models are then proposed, illustrating different interaction scenarios within New Product Development (NPD) based on the experiences of the authors. The merits of the HEI distributed model are subsequently discussed with the context of a specific case study.

2 KNOWLEDGE TRANSFER ISSUES IN LITERATURE

This section considers both theoretical and empirical literature and concludes by presenting questions for debate.

2.1 The explicit and the tacit

An underpinning tenet of Nonaka and Takeuchi's book, 'The Knowledge-Creating Company' [1], is that the tacit and the explicit on their own are both limited in their knowledge creation capacity, but that when they interact, 'innovation emerges'. They advocate a dynamic relationship or interaction between the tacit and the explicit, which they refer to as the knowledge spiral, the conversion of knowledge created at an individual level (tacit knowledge) to generate explicit knowledge which in turn brings about the development of tacit knowledge in others; ''the root of all knowledge creation is the mobilization of tacit knowledge'' [2]. Thompson et al. [3] develop this further in that they acknowledge a cyclical characteristic to knowledge transfer but couch it in terms of it needing to 'stimulate action' in the receiver for it to be truly classed as knowledge transfer.

Qui et al. [4] refer to knowledge management as being essential to product design, proposing a "know-what, know-who, know-why and know-how framework for designers to obtain essential knowledge or information relating to the design task in hand". It is interesting to note that Thompson et al. [3] identify this as information diffusion and not effective knowledge transfer in itself and that interaction has to take place between both the sender and the receiver for knowledge transfer to take place. Van den Bosch et al. [5] state that outside sources of knowledge are critical to the innovation process; in particular, they refer to a company's ability to make use of this knowledge or their absorptive capacity to assimilate it and make use of it.

2.2 Academia and practice

Boland et al. [6] state "it is a widespread perception that knowledge created by scholars is not used in practice". Rynes et al. [3] concur and build on this in their paper that focuses specifically on the knowledge transfer relationship between practitioners and academics; suggesting that academics and practitioners have fundamentally different frames of reference with respect to the many aspects of obtaining, using and interpreting knowledge. They make significant reference to Nonaka and Takeuchi [1] in support of this, stating that "the failure to truly integrate practitioner and academic perspectives is what causes this form of knowledge transfer (the academic or explicit with the practitioner or tacit) to be generally ineffective" [2].

Rynes et al. [2] make the point that this lack of interaction between academic and practice suggests that current academic knowledge generation processes are therefore likely to be inferior, even from an academic perspective. They urge researchers to seek and not avoid the tension inherent in interactions between the explicit approach of the academic in contrast to the tacit approach of the practitioner.

A particularly interesting point made by Thompson et al. [3] is their reference to the cycle of knowledge producing action which in turn produces greater knowledge, being referred to as experience. Crabbe [7] discusses the conundrum of design academics having opportunity to practice design, debating as to whether worthwhile knowledge of design is in itself good enough without acquiring practical skills, that without this experience, academics may not be 'best equipped' to pass on design knowledge to students.

2.3 Knowledge Transfer Partnerships

Several papers discuss the benefits of product design related Knowledge Transfer Partnership (KTP) schemes. Crabbe [7] and Wormald and Evans [8] describe three successful KTP's between them; whereas Schaber and Thomas [9] describe two that had limitations in their varying degrees of success. Millward et al. [10] [11] describe a number of KTPs but in both papers they define the main obstacle to achieving successful product development is the lack of understanding of the discipline on the part of the dominant owner manager, or the impact of the owner manager operating within a resource constrained environment.

Rynes et al. [2] stress "that good social relations, mutual empathy, and some sort of common ground are prerequisites for achieving optimal outcomes in cross-boundary knowledge creation" they state that knowledge transfer is fundamentally a social process. A theme expanded by Thompson et al. [3] who state that the management of knowledge is a human phenomenon and that therefore knowledge transfer rests on behaviour and relationships.

2.4 Summary

As has been described, there are many facets to the issue of knowledge transfer, from the management of knowledge to the knowledge environment, to the diffusion and assimilation of information. The review highlights current thinking on the need to have interaction between the tacit and the explicit in order to enable innovation and how that the academia and practice relationship does not always make this possible.

In the majority of the examples of KTPs referred to above, emphasis is placed largely on the financial success of the activity; while important it is interesting that the nature of the actual knowledge transfer is not always clearly defined. Establishing an in-house NPD capability and the embedding of CAD and CAD related processes are consistent outputs in many KTPs. Crabbe [7] describes the benefits to the academics involved in terms of the opportunity to gain experience in practice.

While the current literature emphasises the importance of interaction between academics and practitioners, and the benefits of KTPs in the context of product design, the best knowledge environments for this to be achieved are not explored. How can HEIs manage the knowledge environment to benefit all the actors in the process?

3 KNOWLEDGE ENVIRONMENT MODELS

It is the opinion of this paper that the nature of any knowledge environment has a critical impact on the creation of new knowledge. The formulation of a knowledge environment not only establishes the sources of information and the mechanisms for obtaining appropriate information, but it is where the relationships for a particular new product development exercise are established. Thompson et al. [3], explains that understanding who the senders and who the receivers are, and where the new knowledge may reside in a knowledge environment is needed to stimulate true knowledge transfer.

The figures below present three simplistic knowledge environment scenarios; Figure 1 presents a knowledge environment centred on design practitioners that have been contracted to develop a product for a client company, a traditional design consultancy process without an HEI involvement. The primary information flow is from the client and potential sub contractors to the design group. During the NPD process, the new knowledge will reside largely within the design group with some new information possibly flowing back to the client company.

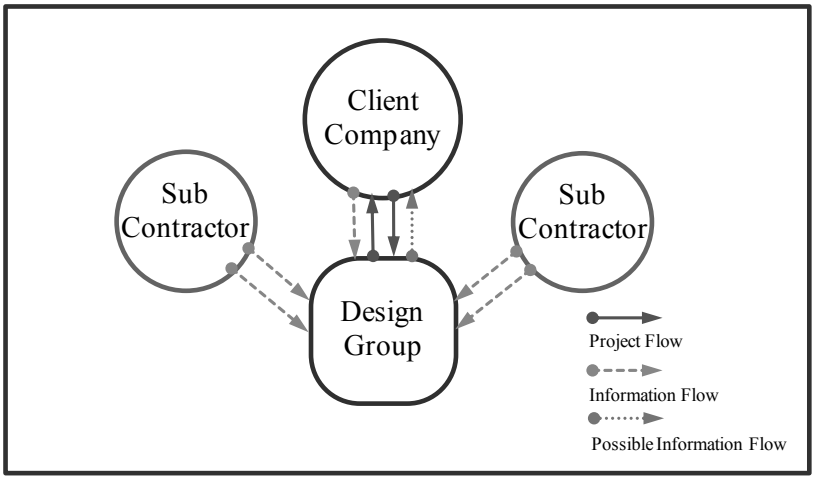

Figure 1. Consultancy model, design group centred

Figure 2 presents a typical KTP knowledge environment. With the KTP associate being placed within the partner company the information flow gravitates toward the partner company. With only weekly or fortnightly meetings, there is less opportunity for the HEI to play a fundamental role. Typically relationships with sub-contractors tend to be remote and less intimate, with new knowledge residing largely with the partner company.

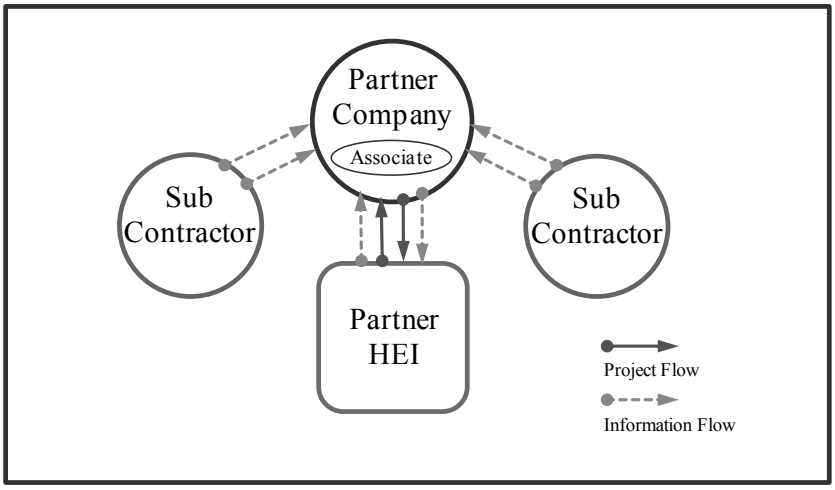

Figure 2. KTP model, partner company centred

Figure 3 presents a scenario where the partner HEI has a more fundamental and active relationship with all those involved with new product development including the identification, contracting and briefing of design practice and sub-contract support, enabling greater opportunity for explicit and tacit interaction to occur. In this model a more circular information flow provides greater opportunity for new knowledge to reside in all parties; in particular there is more potential for dissemination within the HEI environment.

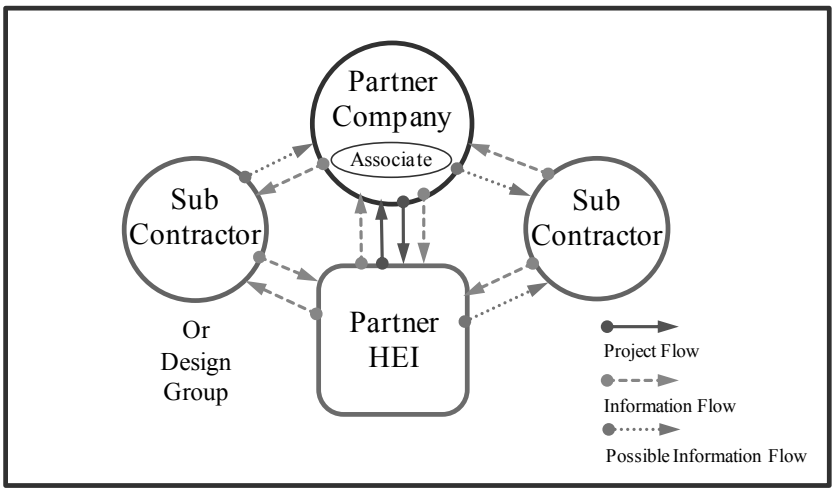

Figure 3. HEI distributed model

4 CASE STUDY

This case study provides an example of the HEI distributed model, defined in figure 3. As part of the 2004 IBD support scheme, DMU established a relationship with a manufacturer and distributor of dust and fume extraction products (who will be referred to as EC). A thorough review of EC's new product development capabilities, their products, their markets and their competitors was undertaken with a view to identifying opportunities for new product development. This resulted in a project to rationalise the number of components needed to construct their range of devices and at the same time 'design out' any features that would present a restriction to airflow. Overall this would have a positive impact on cost and performance, and therefore ultimately competitiveness.

This exercise required a fundamentally innovative approach to design and construction; a design practitioner was sourced and contracted to assist in the project, both DMU and the practitioner being involved in proposing concepts to EC. The results were so successful that the potential for EC was far more than they had been envisaged; as such they were sufficiently encouraged to embark on a KTP with DMU to take full advantage of this potential. A significant advantage in the set up of this KTP was that the partner company EC, was already known as was their commitment and ability to invest in the project. Again the project continued to progress well with both the design academics from DMU and the design practitioner, supporting the KTP associate in building upon the original concept.

Early in the KTP there was a change in health and safety regulations requiring dust and fume extraction equipment to monitor itself continually in terms of flow rate. This required a review of the design requirements and the contracting of an electronics consultancy (who became a sub-contractor) into the development team. DMU by this time was running another regional SME design support scheme which was able to support the enlistment of this additional contractor to develop the flow monitoring and feedback technology that would be compatible with the new design and manufacturing approaches.

Driven by the NPD experience of DMU, this knowledge environment was established over a period of time and was based on skills, experience and knowledge from an HEI (academics and KTP associate), the client company, a design consultant and an electronics consultant. However to make this possible funding was required beyond that which the KTP on its own could afford, a significant consideration for an exercise of this type.

The result has been a genuinely successful exercise with all parties benefitting from the opportunity to develop new knowledge. This success can be attributed largely to the establishment of long term relationships. As both consultancies could not provide input to the project over its duration (due to other consultancy commitments) they were brought into the project as and when needed, the common denominator being DMU acting as the manager of this knowledge environment and communication hub for all the parties concerned. This in itself proved useful experientially to the design academics involved and has indeed, in part, provided inspiration for this paper. Both consultants involved have expanded their knowledge base on design issues relating to extraction devices but more importantly with the new associated technologies.

The partner company has of course developed new, market leading products, but has in addition, been able to embed new product development frameworks within the company that extend beyond the KTP associate. There is a genuine knowledge transfer legacy within EC; as such they are not reliant on the associate having to stay with them. EC is also seeking to develop its own Masters programme in extraction and venting related issues, potentially involving DMU.

With regard to knowledge dissemination on the design courses within DMU, this has provided valuable study material, with case studies being constructed in a manner where the tacit is carefully being made explicit through anecdotal and related methods, including KTP associates presenting their experiences in lectures and contributing to tutorials on student projects.

5 CONCLUSIONS

Knowledge transfer has generated much discussion; but clearly the process is inextricably linked to human activity; the interplay between all the participants and their roles within the environment. This paper has highlighted, that effective knowledge transfer has to be more than just placing a KTP student within a company. The case study demonstrates the benefits of the HEI distributed model, derived from a circular information flow between the different partners. If HEIs take the opportunity to manage the knowledge environment, engaging academics, students, design practitioners, manufacturers and sub-contractors it can bring about knowledge benefits for all. Especially new tacit and explicit knowledge relating to NPD located within the HEI, which can be disseminated to students.

This paper has been largely based on experiences of one HEI engaging in NPD, in collaboration with companies, design consultants and subcontractors; further work needs to be conducted to explore the generalisation of the finding to alternative contexts such as in-house design teams.

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