KNOWLEDGE NETWORKS: COLLABORATION BETWEEN INDUSTRY AND ACADEMIA IN DESIGN

J. Spruce and M.Evans

ABSTRACT

Design education and industry can benefit greatly from collaboration. This paper discusses mechanisms of knowledge transfer through collaborative research, between academia and industry. It focuses upon the area of product and industrial design, detailing approaches to open innovation where industry and academia collaborate and form successful partnerships. Through case studies, it identifies how academia can facilitate knowledge transfer between numerous industries and across disparate market sectors. It concludes with an overview of the potential benefits to collaborators.

Keywords: university/industry collaboration, design education, product design, knowledge transfer, Knowledge Transfer Partnerships, KTP, live project.

1 INTRODUCTION

This paper addresses industry and university collaboration within design. It considers the broad context and drivers behind this collaboration, and mechanisms by which it can be facilitated. The authors utilise case studies to illustrate how this relationship operates within industrial and product design, providing examples from both institutional and national perspectives. Collaboration models are presented demonstrating the central role of the university in the facilitation of knowledge transfer between stakeholders.

2 THE CONTEXT OF UNIVERSITY-INDUSTRY COLLABORATION

The relationship between academia and industry, and ways in which the two can work together effectively to boost competitiveness, has attracted much attention over the last 20 years. More recently in the UK, universities have moved to actively seek to play a broader role in the regional and national economy. More and more, academics are sharing ideas and best practices with their industrial counterparts. UK academic institutions are well placed to engage with industry as they operate in international networks and thus are aware of the innovative work that is going on globally in their field. As such they can provide industry with well-informed and meaningful insights into their specialist area [1].

2.1 University-Industry Knowledge Transfer

During the last two decades, many countries have implemented policies that facilitate the transfer of knowledge from universities to industry. Fontana identifies these mechanisms and initiatives including: the establishment of legal frameworks, creation of technology transfer offices within universities, increasing the mobility of researchers to industry, and large co-operative Research & Development (R&D) programmes [2]. These mechanisms have assisted the increase of knowledge transfer activity. This said,

over 80% of businesses have no relationship with universities [3]. This is obviously an area for further development, holding many potential benefits for both parties.

The link between R&D and innovation, productivity and competitiveness is well established [4], [5]. There is evidence that the relative weakness of the UK's R&D spending over the last twenty years has played a measurable part in the UK's disappointing productivity performance. The development of numerous UK regional and national government funded initiatives, aimed at promoting and increasing the level of innovation in industry, has sought to address this.

2.2 The National Perspective

Departments within the UK government have attempted to provide support to industry via the development of a number of organisations over recent years. These include: Business Link, a national provider of practical advice to business on a wide variety of subjects, and Technology Centres, that provide access to and advice upon various technologies. These activities have been complemented by The British Chambers of Commerce, a national network of quality-accredited Chambers of Commerce, each uniquely positioned at the heart of every business community in the UK and representing over 100,000 businesses of all sizes in all sectors of the economy - equivalent to four million jobs. Some of the aforementioned initiatives have also engaged with universities in various forms to foster and develop relations across academia and industry.

As part of the drive to promote innovation and entrepreneurship, often in Small and Medium Enterprises (SME), government funding streams have provided incentives for industry to develop new products and services. These initiatives often require a significant level of financial commitment from company's in order to access matched funding. However, in many cases SME's lack the human and physical resources to effectively research, develop and test potential innovations within their organisation. Financial restrictions can also be a potential hurdle to SME's in terms of employing external commercial consultancies to undertake such research.

Universities are increasingly seen as appropriate and willing partners in such ventures as they have resources that can be utilised by commercial organisations in a new form of open innovation. However, collaborative projects with universities are viewed as being more innovative and risky than those not involving universities. Even though they encounter more difficulties, they are more stable [6].

Lambert recognised that businesses are moving away from a system in which most of their research and development was done in their own organisations, to one in which they are actively seeking to collaborate with others to fully exploit and benefit from there innovations [7]. If design is the link activity between creativity and innovation, as suggested by Sir George Cox [8], such collaborations with design education providers should be embraced fully as integral to successful growth and development.

3 INDUSTRY COLLABORATION WITHIN DESIGN EDUCATION

The value of industrial collaboration in an applied subject such as design has long been noted by academia. This collaboration can take various forms, including: student placements (where one of more students are based at a host organisation working upon

specific project/s); staff placements (where a member of academic staff is based at a company working upon a specified project/s); collaborative projects (where students undertake a specified project under the supervision of university staff, with subject specific input from the collaborative company). In the design domain, collaborative projects are often referred to as live projects due to the real world or 'live' focus of the activities.

3.1 The Live Project

In industrial/product design, live projects are usually evident within the curriculum and as such form an important aspect of the student experience. The nature of such projects being often highly intensive and short term. Due to the requirements for these projects to align to curriculum delivery, available time can be restricted and projects may focus on specified aspects of the design process. Live projects can be initiated by either party and provide an excellent opportunity for both to draw benefit.

The financial cost to industry of taking part in live projects with academia varies a great deal depending on the nature of the project. Although the cost would not be comparable with commercial organisations variables such as output, duration, resources or student numbers can have an effect. Typically a company can hope to gain a great deal of information pertinent to their business through live projects, within industrial design this may be in the form of: market research analysis, user profiling and trends forecasting; insight's into technological developments such as materials or components; or design concepts generated for new products or services. Companies may seek a project to simply generate broad information or specific design solutions.

The basis of many industry-linked projects is the simple transaction of ideas for student experience. From an academic perspective, live projects with industry offer the opportunity for an extremely valuable and often unique student learning experience. The reality of commercial constraints and 'opinions' an industrial partner brings to a project is difficult to replicate in the everyday academic environment. In exposing design students at the appropriate times to real world commercial constraints upon their design process, industry led projects offer a more holistic view of how design functions and is deployed within organisations.

Creating strong links with industry is widely seen as being beneficial to universities. At course level this can greatly increase your profile, encouraging industry to actively seek relationships with specific courses as confidence in academia's ability to deliver relevant and useful output grows. Amongst students a strong real world focus and links with industry is viewed as being highly favourable. Many students (and parents) seeking reassurance of a future career view industrial links and a commercial input to their education as key to employment prospects.

3.2 Salford's Approach

Salford University's Product Design course has over recent years experienced a great deal of engagement with industry, and undertaken a number of 'live' projects that have provided excellent learning experiences for students and forged links with local industries. This has led to ongoing relationships in the form of graduate employment and Knowledge Transfer Partnership schemes (KTP) that have then provided further projects and collaborative opportunities to be developed within the course curriculum.

Listed below are a series of brief case studies detailing a selection of projects recently undertaken with industry partners.

3.2.1 Unilever, April – June 2002, 18 Level 2 Product Design students

This project focused on the generation of new product innovations under the theme of 'The Future of Personal Hygiene'. Market categories were defined and investigated as part of the project and a number of product concepts were presented. Much of the projects findings independently mirrored research findings conducted at the time within the organisation, but more significantly identified further potential for innovations that had not previously been identified in the organisations own study. This project was positively received within the company, its outcomes forming part of a major presentation by Unilever's research and development department at their Design Directions Seminar in Milan, July 2002.

3.2.2 Cannon Hygiene, April – June 2002, 8 Level 2 Product Design students

Cannon Hygiene Ltd, a manufacturer and service provider of washroom facilities based in the North West of England, engaged in a live industry project run with level 2 product design students. Cannon Hygiene were interested in the expansion of their existing product range that was felt to require replacement. At the time of this project there was no in-house design facility. All previous products being developed with the use of outside design consultants. The aim of the project was to research current trends within the market sector, generating ideas for new products from this. The project produced a series of thought provoking results that prompted the company to consider developing a more structured approach to integrating design within their company strategy. This ultimately led to the establishment of a much longer term and more structured relationship, including the employment of a Salford graduate.

3.2.3 Rectella, April – June 2007, 32 Level 2 Product Design students

Rectella Ltd, are the leading supplier of instant disposable barbecues in the UK. Their products have sold in great volumes for over two decades. However, the company identified changing habits in the UK market around social dinning and the evolving use of our garden spaces. Our student project with Rectella focused on these issues, generating ethnographic research data exploring lifestyle and social habits. The research studies enabled a wide variety of design concepts to be generated that placed the dining 'ritual' at the heart of the social experience across a spectrum of scenarios and market sectors. The project engaged students and company representatives in active dialogue around future strategies and the potential development of new product ranges. Following the project's conclusion three students were employed by Rectella over the summer vacation period to assist in developing their design proposals, thus providing further valuable experience for the students selected. In the longer term, this company is now in discussion with the University regarding potential KTP projects.

3.2.4 BASF, Feb – May 2008, 6 Level 3 Product Design students

BASF is a well known chemical company with bases and subsidiary companies located across Europe. This project involved a small group of level 3 students exploring the potential for new applications of an adhesive product developed by BASF. The product used as ceramic tile cement has a series of characteristics/properties that the company wished to be exploited beyond its current use. This was an unusual project which the students tackled outside of their taught curriculum, requiring them to create their own

brief and define the project's parameters. Working largely independently the students identified key areas for investigation, carrying out testing and experimentation. Collectively they delivered a series of proposals that not only offered new applications for the product but also explored ways in which the product's characteristics could be marketed via innovative and novel methods, demonstrating to potential buyers the products full range of benefits. This project firmly placed students in the role of independent enterprising designers, requiring them to employ skills and knowledge broader than traditional design boundaries in answering the needs of an unfamiliar client.

3.2.5 Grafton, Sept – Nov 2008, 36 Level 2 Product Design students

Grafton are a large UK and Ireland based organisation, manufacturing a broad range of products in facilities across both Europe and China. A large part of their business is involved in the design and manufacture of bathroom products, from taps to basins and bathtubs. Grafton approached the Product Design course with the aim of engaging students in a series of 'live' projects, in the first instance to explore the bathroom market. This would be supported by the opportunity for field trips to manufacturing sites across the UK. The first project, exploring future and emerging trends in the use of the bath/washroom environments has been successfully delivered. It is anticipated that a smaller number of students continue the relationship with the company into their final year of study and take on another collaborative project with the aim of developing opportunities for graduate employment within Grafton. This type of relationship with collaborative partners offers a great advantage for students and assists the course in facilitating highly valuable field trips that enrich the students learning experience.

3.3 Potential Benefits

There are obviously other structured mechanisms in use to promote and provide collaborative partnerships, including sponsorship schemes or in some cases scholarships which can be available to a small number of students. The examples demonstrate the potential short and long term benefits of undertaking industry collaboration projects. In the immediate short term, they enrich the academic curriculum and student learning experience. In the longer term, their cumulative effect is to benefit the building of relevant and dynamic course content, provide employment opportunities for graduates through association and allow academic staff the opportunity to develop professional practice skills and research material.

In this climate of open collaboration, industry can access university resources and utilise them as an external source of information. This can make valuable information available to industry that, without engaging academia, would not be possible. It has also been recognised that the best forms of knowledge transfer involve human interaction, be it through structured network events or chance conversations. Academics and industrialists often have more in common than either realise, this meeting of minds can produce rich pools of knowledge transfer opportunities that both can benefit from [9].

A number of structured initiatives have been established with the aim of promoting and increasing the level of innovation in UK industry through collaboration with industry. Knowledge Transfer Partnerships (KTP) are one such mechanism that have become prevalent in design.

4 KNOWLEDGE TRANSFER PARTNERSHIP

Knowledge Transfer Partnerships (KTP) are a government funded initiative that enables UK businesses to access and benefit from the wide range of expertise available in the UK's 'Knowledge Base' - higher education institutions, further education colleges, and private and public sector research organisations and institutes. University expertise is applied to a project that is central to the development of the Company Partner. In the process, academic staff are able to enhance the business relevance of their teaching and research. The aim of KTP is:

- to strengthen the competitiveness and wealth creation of the UK by the stimulation of innovation in business through collaborative partnerships with the UK knowledge base

Their objectives are:

- to facilitate the transfer of knowledge and the spread of technical and management skills and encourage investment in training, research and development
- to provide business based training, supervised jointly by personnel in the knowledge base and in business, for high calibre graduates intending to pursue a career in industry
- to enhance the levels of research and training in the knowledge base that is relevant to business by stimulating collaborative research and development projects and forging lasting partnerships

At the heart of each KTP are one or more associates. An associate is a high-calibre graduate (that is to say a student who has achieved an award of upper second class or first class degree) who is recruited to work in industry on a project that is central to its strategic development. The associate is supported by members of academic staff and carries out a programme of work designed to facilitate the transfer of knowledge, skills and technology central to the company's business. For the company, this has the benefits of improved performance, as measured by profitability and competitiveness.

The participation in government funded R&D projects (such as KTP) is an appropriate mechanism to meet new partners, learn more about them, their competences and access their networks, as well as opening up new technological options [10].

4.1 Design Led Knowledge Transfer Partnerships

Within The University of Salford, KTP’s have provided a suitable framework for the School of Art & Design to support organisations in new product development: from user, market and sector research, through concept, design and manufacturing development, to product launch.

The KTP framework requires a member of university staff to undertake the role of Lead Academic with responsibility for overall coordination of the work programme. In addition, the KTP programme has one, or more, Academic Supervisor/s who are closely involved with the supervision of the work programme. The work programme often requires input from a number of academics and disciplines allowing specialist knowledge to be accessed from across the university. This can benefit the programme as a broad knowledge base can be drawn upon by the associate.

The acquisition of knowledge by academic institutions is clearly important. Knowledge feeds all elements of the institution: academics, practitioners, researchers and students. Commercial organisations involved in KTP schemes have access to academic knowledge, support and supervision that reaches further than their immediate academic supervisor. Collaboration between university departments and cross discipline areas creates a flow of knowledge transfer that commercial organisations then have the opportunity to access.

5 KNOWLEDGE NETWORKS

In this section the authors discuss (i) models of knowledge networks within academia, and (ii) how these internal models interface in a broader context with external organisations. It highlights the different approaches to the availability of knowledge between academia and industry.

5.1 Access to Knowledge in Academia and Industry

There is a difference in the way that access to knowledge is dealt with in academia and industry. Academic institutions allow free access to knowledge that in turn can be used in the development of further knowledge creation. Within commercial organisations, knowledge is traditionally retained internally, even departmentally due to commercial sensitivity. This can present a barrier to understanding innovative approaches and elements of best practice being employed within specific organisations.

Academia works towards placing knowledge into the public domain, making it accessible and digestible in many ways. Academic output can take the form of research documents, exhibitions and participation at conferences, as well as the delivery of knowledge via teaching activities. The recording of knowledge by academia - its transfer and filtration throughout its community - continues to be relevant and useful to industry. It provides industry with access to leading research intelligence and experimental approaches within specific areas.

5.2 Collaboration Frameworks

Knowledge moves through a number of key stages during its journey through academic institutions. In the context of this paper, these have been identified as:

- *identification:* knowledge is acquired from a context (a)
- *decoding:* knowledge from context (a) is deconstructed and generalised
- *adaptation:* deconstructed knowledge from context (a) is transformed and applied to context (b)
- *application:* the application of knowledge from context (a) to context (b)

This model describes the micro-cycle of knowledge management within specific subject domains in academia, eg design, engineering, chemistry, etc. This process usually occurs independently at subject level. The following model summarises this process:

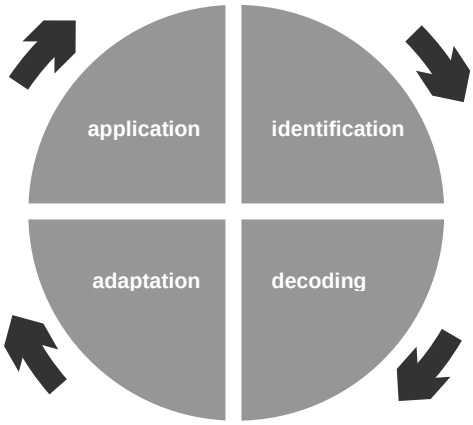

Fig. 1 Micro-cycle of knowledge management

5.3 Collaboration Modes

The channels used to access knowledge from universities by industry are diverse and vary greatly across industry sectors. As already identified, there are numerous forms of academic/industry collaboration. These approaches support engagement with stakeholders in an extended network. This includes members of academic staff and also members of other commercial organisations often from other market sectors. These models support a multiplicity of collaborative arrangements ranging from start up companies to national and multi-national organisations.

5.4 Interaction with Knowledge Networks

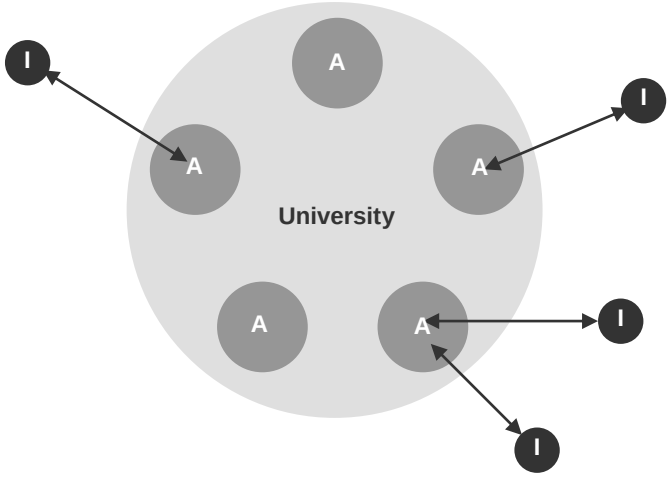

Fig. 2 Industry (I) interacting with Academic (A) domains

The diagram above visualises the academic institution as part of a knowledge transfer network, however in this model industrial partners interact independently with different academic departments, thus not fully exploiting the potential for knowledge transfer. This model can be further developed to generate greater knowledge transfer when a number of organisations feed into the academic institution at the same time.

The model now moves the academic institution into the role of a central 'hub' linking organisations through it (fig 3). This concurrent interaction of industry from a broad base of market sectors provides the potential for knowledge transfer to flow not only from commerce to academia, but also from commerce to commerce on multiple levels. Transfer can be gained at a strategic level, where best practice can be identified and translated meaningfully. Practical and executive decisions can be greatly informed through the convergence of tacit knowledge. The convergence also provides the opportunity for individual staff to communicate with each other in open dialogue.

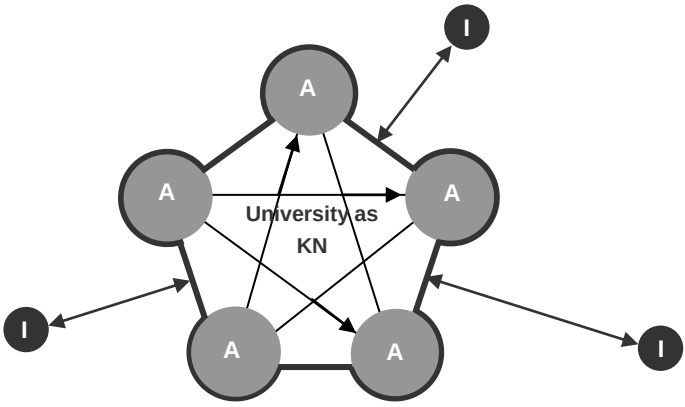

Fig. 3 Industry (I) interacting with The Knowledge Network (KN)

Examples of strategic knowledge transfer from organisation to organisation can be evidenced where KTP have been used as a vehicle to audit and evaluate organisational strategy as part of its measurable outcomes. For example, at the University of Salford best practice in design management theory has been identified, adapted and implemented across market sectors.

The convergence of different organisations tacit knowledge can prove of great benefit as a shared resource. In design led KTP where experience of commercial design organisations or the suppliers of new technologies are often limited, utilizing pooled resources of others practical experience can be greatly beneficial.

The exposure of disparate industries to each other's practice enables relationships and non-structured dialogue to be generated between staff and associates from different organisations. Within the academic hub these relationships are open and non-competitive. Discussion of common professional practice issues and problem solving

debate can be facilitated. The models and structure of academic institutions makes such unlikely relationships possible.

6 CONCLUDING REMARKS

It is clear that collaboration between industry and academia plays a vital role in supporting R&D activities within the UK economy. Design, if employed effectively can add value not only in terms of intellectual capital, but to the bottom line of organisations (11). If we are to rival our global counterpart's, collaboration of this nature must be fully supported, Thus providing a stable platform for these relationships to mature and yield greater benefits.

Universities themselves increasingly employ a 'real world' focus to their activities – as industry continues to call for more commercial awareness within education and demand students who are able to apply their technical skills in a day-to-day commercial environment [12]. All this strives to make universities more approachable and send a relevant message to industry.

Benefits to universities who engage in collaboration include:

- real world inputs from the commercial world
- confirms relevance of curriculum content
- enhanced students learning experience
- professional practice opportunities for university staff
- financial remuneration
- career opportunities for graduates
- research outputs
- status benchmarking for course, department, university

Benefits to industry who engage in collaboration include:

- access to breath of facilities
- access to existing knowledge across institution
- opportunities to direct research activities
- alternative perspectives not limited by organisation cultures
- access to graduates
- access to academic concepts and approaches
- staff development opportunities

As collaboration continues to increase, it is important for industry to engage more visibly with academia and vice versa. Commercial organisations taking an active role in academic research undertakings may be aspirational, but it would clearly provide an indication of the benefits of collaboration to a wider audience. Universities must continue to provide and develop accessible channels for industry to not only tap into the wealth of knowledge evident within academia, but also to promote opportunities for industry input into relevant curriculum development.

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Contact Information

Jon SPRUCE
University of Salford
School of Art & Design
Centenary Building
Peru Street
Salford
M3 6EQ
United Kingdom
E: j.spruce@salford.ac.uk
T: +44 (0)161 295 6086

Martyn EVANS
Lancaster University
Lancaster Institute for the Contemporary Arts
The Roundhouse
Bailrigg
Lancaster
LA1 4YW
United Kingdom
E: m.evans@lancaster.ac.uk
T: +44 (0)1524 593435