Where is the competitive edge in Knowledge Transfer?: the impact of KTPs

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Abstract

The need for technology transfer from universities to industry is a theme that resonates throughout many advanced countries of the world. This paper explores the effectiveness and efficiency of Business and Management schools in transferring technology through formal Knowledge Transfer schemes; it examines the value and impact of these activities by reporting on the outputs from thirteen major case studies across two sectors, manufacturing and healthcare. The paper assesses the impact of knowledge transfer, in relation to the development of a competitive edge and proposes some initial frameworks for potential application and use.

Keywords: knowledge transfer, universities, impact

Introduction

Universities have long been seen as a source of new ideas, technologies and ways of doing things, as indicated historically by Henderson, Jaffe and Trajtenberg (1988). The concept of the competitive edge, of having an advantage over competitors, generating greater sales/margins than competition, can be achieved through cost structure, product offerings, distribution network or customer support (Bhattacharjee and Chakrabarti, 2015; Su et al 2014; Ram et al, 2014; Soloducho-Pelc, 2014). Universities can tangibly support this through generating innovative products and processes through their engineering research, providing cures and therapies in medical research, and offering fresh insights and perspectives in social and economic research, including schools of

business and management (Arthur, 2010). Of course, there is much value to be had not only in the commercialisation of this knowledge but for improving efficiencies and practices in public and private businesses.

From the research above it is clear that technology transfer and university engagement with practitioners is a very broad field – across disciplines and from policy to operational levels. This paper therefore explores business school engagement - the role of Business Schools and the effectiveness of their technology transfer work by reference to the Knowledge Transfer Partnership (KTP) scheme (which previously ran under the banner of the Teaching Company Scheme).

Literature Review

Transfer of know-how and the competitive edge

Technology transfer is a frequently cited objective and aspiration for governments, businesses and universities alike – a holy grail which, if executed positively, will have profound benefits for all three groups, and for society as a whole. Given its importance, however, the literature is still relatively sparse in terms of providing usable models for transfer, whether for practical purposes or for structuring research enquiry. A major issue here is that projects entitled "technology" transfer are often seen predominantly from a technical perspective by those involved, whereas most projects are clearly more a transfer of know-how and human capital between parties (Bamford, Forrester and Ismail, 2011). A major reason for the lack of common framework appears to be because technology transfer can be so widely defined and interpreted. This leads us to believe the best way forward is to contextualise research enquiry and empirical analysis, thus the focus in this paper is on the impact of the UK KTP programme on partnering businesses. To help define this in an objective manner we have adopted and applied an early innovation assessment model, the Ansoff framework (Ansoff, 1957). This is a classic product–market strategy matrix which implies that products and markets are interdependent and inter-determining (Finch and Geiger, 2011). Within this paper technology is more narrowly defined as the transfer of management know-how and processes to address real business needs at the partnering companies.

University to Business Technology Transfer

There have been some notable contributions to the field of technology and knowledge transfer which have relevance to the current study. Tidd and Bessant's (2009) Managing Innovation text provides an engaging account on innovation management and knowledge transfer with examples to illustrate practitioners and researchers alike. It tackles the challenge of how organization's might adapt and regenerate their products, processes and business models, though not focused specifically on university to business transfer. Anderson, Daim and Lavoie's (2007) paper is particularly relevant to the current research. They consider the transfer of technology from universities to other sectors as the core of their research and provided a very sound and wide reaching literature review where they grouped papers under the following themes: "organizational structures, regional or international comparisons/case studies, impacts of university research, tangible outputs of university research (patents, licenses, spin-offs); and the efficiency of university research transfer" (2007:307). Their research entailed project by project analysis using a data envelopment approach (DEA). They concluded with a set of prepositions to help guide future research enquiry. In the case of the current research, in addition to questions of competitive edge and effectiveness through KTPs, we have focused on Preposition 6 from Anderson et al (2007), namely

whether there is a difference between the types of competitive edge generated by KTPs in the UK within public and private organisations.

Teaching Company Scheme to Knowledge Transfer Partnerships – the benefits
Literature indicates that interaction between academia and external organisations can not only facilitate the transfer of knowledge but also stimulate the production of new knowledge (Gertner, et al. 2011; Kitson et al., 2009). One mechanism available in the UK focusing on university-industry collaboration is the Knowledge Transfer Partnerships (KTP) programme, previously known as the Teaching Company Scheme (TCS). This is a UK government sponsored scheme which aim is to establish collaborative projects lasting 12-36 months. Researchers have focused on university-industry interactions in order to understand the degree of economic impact occurred by the university knowledge transfer (Mansfield, 1991).

Methodology

This paper aims to explore the effectiveness and efficiency of Business and Management schools in transferring technology through their KTP schemes. To achieve this the research examines the value and impact of Knowledge Transfer Partnerships (KTPs) by adopting a multiple case study research methodology. Voss et al. (2002) have recommended this approach for theory development as well as theory testing. Considering the dimensions of the proposed model a multiple case study method was chosen (Yin, 2008). In addition an assessment of the impact of knowledge transfer, in relation to the development of a competitive edge in both public and private organisations, is undertaken.

The Resource Based View (RBV) has been used as the core theoretical framework to address the two research questions; developed as: RQ1: How can public and private sector organisations generate competitive edge through Knowledge Transfer Programmes? → *Mainly by combining capabilities and human capital.* RQ2: Is there a difference in the type of impact and competitive edge generated by Knowledge Transfer Programmes in the public and private sector? → *cost advantage or value advantage.*

The primary source of data involved the collection and collation of 13 sets of KTP programme documentation (bid documents, in programme and final reports. These KTP programmes were drawn from seven private sector and six public sector. The focus of the study and the results presented are intended to investigate the impact of KTPs (Bamford, Forrester and Ismail, 2011), as well as to assess the participating organisations perception of the KTP ideology. The 13 sets of project documentation were gathered and analysed using a thematic analysis technique (Fereday & Muir-Cochrane, 2006). The themes analysed are i) the competitive position of the organisation at the end of the project and what are the variables enabling it to develop an edge; ii) the cost saving generated and the projected future cost savings; iii) the investment directly related to the KTP project; iv) the staff development in term of knowledge, skills and competencies; and also v) the impact for the academic institution and the dissemination results are captured. The analysis and exploration of the generated dataset led the authors to address the research questions.

Findings

Table 1 presents an overview of the 13 projects, where 7 are manufacturing and private sector based and 6 are healthcare and public sector based.

Table 1 - Company profiles and project focus

	Sector Category	KTP Grant	KTP Project	Duration	Focus Product (P1), Process (P2) People (P3) Operations (O1) Organisation (O2) Technology (T) Marketing (M) Strategy (S)
C1	Manufacturing (Pharma)	£66,917.00	Integrated Enterprise and web based SCM system	2yrs	P3, O1, O2, T
C2	Manufacturing (Food)	£73,573	Six Sigma methods to drive a cultural change	2yrs	P1, P2, T, M
C3	Manufacturing (Oil and Gas)	£65,453	IT strategy	2yrs	P3, O1, O2, T
C4	Manufacturing (ICT)	£41,037.13	Integrate business systems	2yrs	P1, T, S
C5	Manufacturing (Automotive)	£63,423	IT strategy	2yrs	P3, O1, O2, T, S
C6	Architectural/design	£64,333	Business intelligence System	2yrs	P3, O1, O2, T
C7	Manufacturing (Food)	£44,300.86	Process Improvement: introducing new machinery and processes	2yrs	P1, P2, T1
C8	Service Sector (Healthcare)	£75,692	Improve tPCT's logistical assets	2yrs	P2, P3, O1, O2, T
C9	Service Sector (NHS Trust)	£66,329	SCM healthcare services - patient-blamed non-attendance ("did not attend" or "DNA") at outpatient clinics	2yrs	P2, P3, T, S
C10	Service Sector (NHS Trust)	£129,761	• Medical bed utilisation & utilisation in accident and emergency (A&E) services	3yrs	P2, P3, T, S
C11	Service Sector (NHS Trust)	£65,092.00	Design and management of a patient transport service	2yrs	P2, P1, P3 T, S
C12	Service Sector (tPCT)	£61,486	Operations Management Planning Process	2yrs	P2, P3, T, S
C13	Service Sector (NHS B&A))	£62,475	Healthcare new premises development processes & service integration	2yrs	P1, P2, P3, T, S

The success of the KTP from the university and the enterprise was captured through both financial and non-financial measures of the KTP, often recorded via an intangible benefits log. Tables 4 to 8 below presents a summary of the 'impact' of the KTP partnerships. Section 4.2 provides a summary of KTPs within the manufacturing sector, section 4.3 highlights the summary of KTPs within the services sector, predominantly Healthcare.

Manufacturing Cases C1-C7

Various aspects of the companies' products and strategies, future growth objectives and span of activities in developing new products, processes and services were examined, as shown in Table 2 Manufacturing KTP Example Summary. Furthermore, most of the KTP invested heavily in term of the organisations infrastructure, such as IT, layout, training and future growth, in order maximise the potential return of investment. Each KTP company presented the aims and objectives of the project, and also where the new knowledge capability originated from, including savings for the company's operations the investments derived funds onto the KTP. These investments were then grouped under staff development, infrastructure and capital equipment as well as against institutional benefits such as teaching, publications, collaborations.

Table 2 - Manufacturing KTP – Example Summary

	C1	C2	C3	C4	C5	C6	C7
Impact	**1B→4E**	**2B→4E**	**2A→5F**	**1A→5G**	**2A→4E**	**3A→5E**	**2A→5B**
Competitive position	Reduced Processing times: Purchase Orders Increased Capacity Order, Processing Order Tracking CRM Management	Reduced Staffing Levels Stock Control Lean Thinking Tools Six Sigma Techniques	Strategic Overview project man capability IT awareness	25% UK Market Integrated business system Lower cost of sales Reduced inventory, Improved Quality Control, Reduction in purchase order costs	Reduced Processing times: Stock Controlling Increased Capacity Order Communicatio n- systems	Integrated Marketing MIS System Open Collaboration Confidence in MIS analytics Target Markets	Reduction in Raw Material Reduced operating costs factory waste
Cost Savings	£10K IT Errors £2.5 Transactions £4.5K from Online £7.5 Tracking £3K -Telecom	Y1 £300K Y2 £330K Y3 380K	Increased turnover 50% £50K operating costs £75K predicted on future projects	£430K move from US market	Market share £250K New Market £250K E-shop- £80K Maintaining Profit £200K, with 9 less staff	£120K new orders £10K billing teim £20K Admin Support £30K CRM Conversation rate tenders 1 in 8- Target 1 in 25) Order winning 1in 4, previously 1 in 10	£80K factory Waste
Impact of cost savings	70% Growth Annual increase £989K	5% in crease profit on £20M turnover	£500 Turnover Pre-tax profit £1.4M	£450K of new orders 11% of orders taken £16K on staff	70% Growth Annual increase £989K	Y1 £170K Y2 £200k Y3 £230K	0.3% i.e 0.1% a year (£48k), improved efficiency on line 1, i.e increase throughput by 2% (£140K)

Service Sector: Healthcare Cases C8-C13

Transfer of Know-how and Practice- Impact Assessment

In a similar fashion to the Manufacturing Cases, a review of the competitive position is carried out and then the Trust's capabilities are assessed to ascertain the viability of the strategy from a practical point of view. Table 3 depicts the issues, priorities and approach of the Trusts. The data shows a particular focus on process redesign, the use of operations management techniques adopted from manufacturing, and a clear step change into service operations. It is worth noting that as each of the Case Organisations is an NHS Trust success should be measured not in terms of profitability or entry into new markets, but for example in terms of cost savings, increasing / freeing up capacity in key high demand services, and increasing access to or uptake of services.

Table 3 - Healthcare KTP – Example Summary

	C8	C9	C10	C11	C12	C13
Impact	**3B→8E**	**2B→7F**	**2A→6H**	**3A→5C**	**3B→6C**	**3A→8F**
Competitive position	Transport Legal issues Resourcing for Demographics Service Support Training Patient Knowledge Staff Knowledge	Resourcing for Demographics Service Support Training Patient Knowledge Staff Knowledge	Resourcing for Demographics Service Support Training Patient Knowledge Staff Knowledge	Resourcing for Demographics Service Support Training Patient Knowledge Staff Knowledge	Service Support Training Staff Knowledge	Resourcing for Demographics Service Support Training Patient Knowledge Staff Knowledge
Cost Savings	£84K plus £8K recurrent: reduction in appropriate transport use. £168K recurrent: set up of Pathology Transport Service.	£250K recurrent: DNA reduction £400K recurrent: reduced hospital caused cancellations. £273K Reduced waiting lists	£5.8M recurrent: bed day reduction, Expanded Medical Admissions Unit, surgical bed reduction, Delayed discharges decrease, Radiology £890K reduced Ultrasound wait	£123K recurrent: reduced cost of the contract £206K recurrent: reduction in ad hoc journeys, £124K recurrent: reorganisation patient dialysis sessions.	N/A	£357K recurrent: reduction in time to complete the development of new premises.
Impact of cost savings	96% patients would not have attended the appointment if transport had not been provided 36% increase in screening uptake 14% patients screened have been referred for further tests 29% have background retinopathy The partnership has strengthened the engagement of all the key stakeholders	Reduction in cancelled appointments. Reduction in the number of patients that get more than 1 follow-up appointment. Implementation of Balanced Scorecard performance measurement system for the Outpatient Department.	1,300 bed days p.a. saved in the Medical Assessment Unit. 43,476 bed days p.a. saved through reducing length of stay for emergency patients Increased elective surgery capacity by 1,021 admissions p.a. Increased organisational capability to hit key performance objectives.	Reduced risk to the patient from spending fewer nights in hospital Improved use of resources Reduced length of stay, therefore bed available for other patients	Strategic meeting relevance increased from 35% to 90%. Development of Balanced Scorecard for strategy deployment. Virtual library was created for Articles on developing strategy;	The following cost savings are being achieved: implementation of the design Lean Methodology: Consultation cost -10% Business case cost -5% Optimisation of Decisions -10% Opportunity cost -2% Full Business case cost -5% Design cost -10% Long lead time cost -3% Construction cost -5% Rework design cost -5% Energy cost -10% Resource utilisation -15% Maintenance cost -10%

The impact score shows the transitions achieved in each KTP based on the Extended Ansoff Matrix. It is interesting to note that each partner does not appear to have benefitted equally from the KTP. This is partially a reflection of the Company Partner's attitude to risk taking and willingness to contemplate radically altering its service offering. In each case the Knowledge Base partner extended its teaching and research to new levels, this was not always the case for the Company Partners service offering.

Discussion

In order to clearly add value and make a defined contribution within the confines of the necessary word limitation we have arranged the discussion around the research

questions. *Research question 1:* How can public and private sector organisations generate competitive edge through Knowledge Transfer Programmes? - Mainly by combining capabilities and human capital. Using an extended Ansoff matrix (adapted from Sharifi et al, 2009, based on Ansoff, 1957) as a point reference (Figure 1) there are a number of transitions that can be observed/achieved through a KTP for both the knowledge base and the company base partner. The results from the findings were examined under the condition of the integrated framework and the actual impact of the KTP assessed in terms of the perceived step change context with the extended Ansoff Matrix. The framework has been applied here using the specific criteria defined within the KTP final reports.

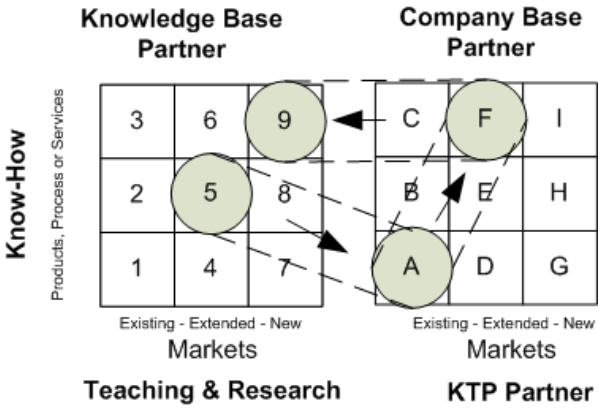

Figure 1 - Extended Ansoff matrix for Knowledge Transfer (adapted from Sharifi et al, 2011)

Company's traditionally extended the knowledge incrementally of their know-how by moving from sector A to B, D and E accordingly within the boundaries of the company's knowledge base. Through this step-wise approach cost and operational efficiencies and where possible align their existing supply chain to meet this new shift in emphasis. Extending the company's knowledge base through a shift from sector A to sectors F, H or I (see figure 1) involves a higher levels of risk and investment in order capitalise on new opportunities (Ismail et al., 2007). A KTP intervention is often more calculated with a shift in emphasis on control, monitoring and review in order to develop the company's knowledge frontier. A KTP strategy, represented by an initial shift from sector 1A to sector 9F, is the most risky in terms of embedding new business offerings both internally and externally, but through the KTP interface offers the company the opportunity to fundamentally change their product and service offerings in more controlled manner and subsequently sustainability of the knowledge transfer. In this case, it is critical to identify at an early stage the knowledge gaps. For example, a shift from sector 1A to 5E will involve partnering and extensive intervention. However, if the subsequent strategy is to move to sector 9I then it is important that KTP partners are also responsive and flexible in order to gain the maximum level impact.

Research question 2: Is there a difference in the type of impact and competitive edge generated by Knowledge Transfer Programmes in the public and private sector? - cost advantage or value advantage. These features can be compared from one sector to another. Using the integrated framework for KTPs as a reference model in figure 2, there are a number of key milestones the KTP partnership can undergo from a knowledge position, in terms of developing and embedding this new knowledge as a result of the KTP project/partnership:

1. KTP attractiveness, where knowledge transfer is identified and grouped based on engagement, collaboration, understanding, embedding and impact.

2. Expression of Interest institutional development of the KTP proposal based on the initial assessment of the KTP attractiveness phase

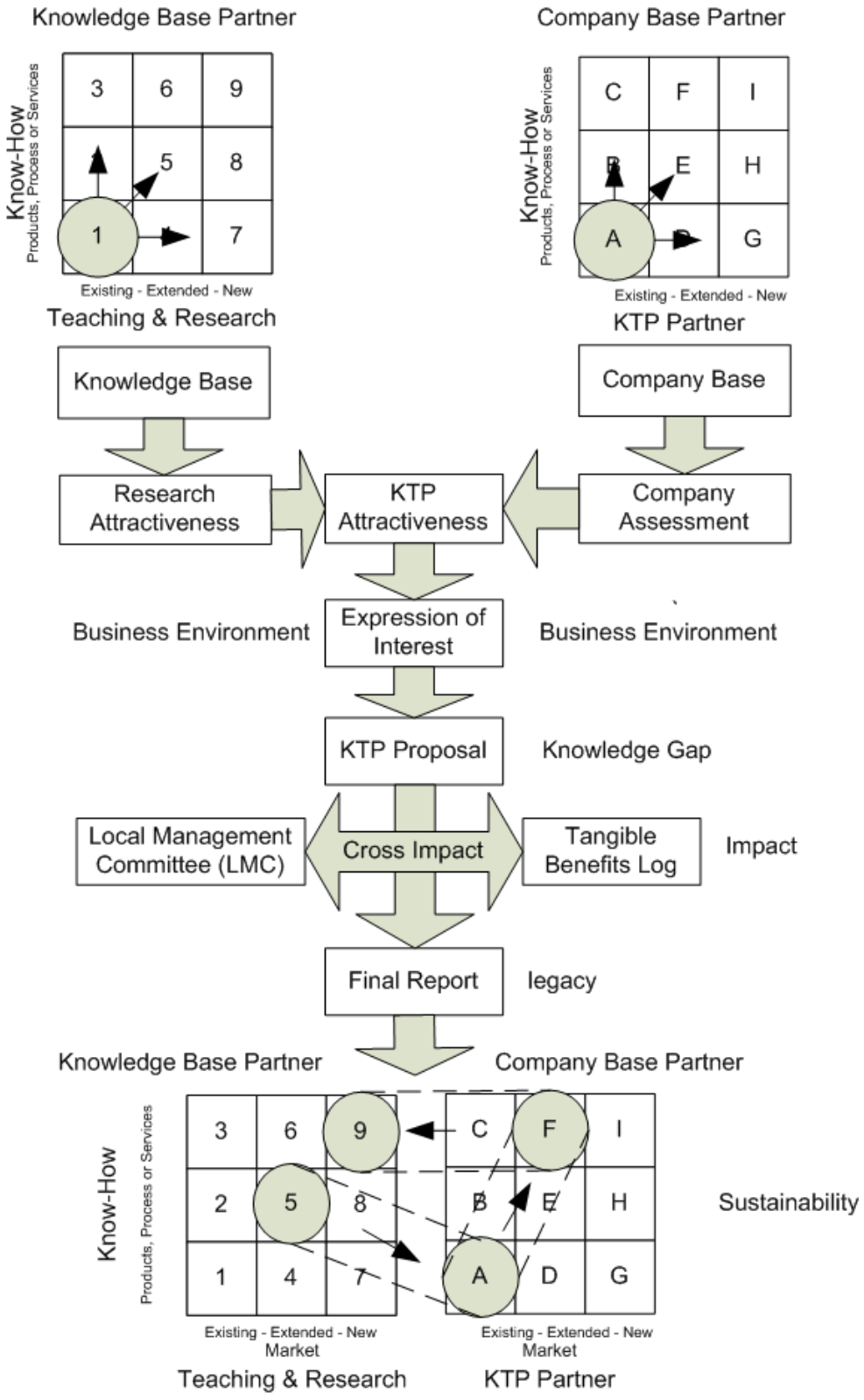

Figure 2: An integrated framework for KTPs

3. KTP Proposal: Knowledge Base Research, address the research contribution in terms of publications, but also opportunities for research led teaching, student placements, and teaching material, and testimonials for funding opportunities.
4. KTP progression is captured through a 'cross impact' assessment is carried to further prioritise the KTP sustainability, facilitated through the LMC, supported but the KTP Associate's tangible benefits log in terms of impact of the knowledge transfer through the following sub criteria:
    - Tangible Benefits: Operations & Competitive Position, where impact measures are identified and grouped based on their criticality into order of company based, associate based and knowledge based tangible benefits. These differentiators will contribute to key performance indicators and expectations presented in the KTP project plan.
    - Partnership development, involves embedding of the company and knowledge base capabilities with the aim of creating a level of sustainabiity. At this stage, features are also assessed along the line of "knowing-doing" gap (Tidd and Bessant, 2009.)
    - Cost Savings, which addresses all projects attributes that could impact on the current and future potential impact of the product. These differentiators cover cost, quality and delivery and the extended properties of flexibility, robustness, innovativeness, product, process and service. These properties are derived from Miltenburg's (1995) approach to defining manufacturing strategy and operational requirements.
    - Investments, which addresses the investments required or order to fulfil the project requirements.
    - Knowledge Dissemination, involves the distribution of the findings through publications, as well as providing case study material which is sector specific.
    - Final Report: Knowledge Base Research, address the research contribution in terms of publications, but also opportunities for research led teaching, student placements, and teaching material, and testimonials for funding opportunities.

Conclusions

This paper has enriched the technology transfer literature with an analysis of the role of universities. The research highlights the 'how' question regarding the potential of knowledge transfer as a source of a sustained competitive advantage and also touched upon the impact / sustainability question.

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