Title: Operations management intervention?: evidence of impact in public and private sectors

Abstract

This paper assesses the value and impact of operations management knowledge transfer. It proposes an evidence-based framework to demonstrate the output and impact from industry partners that co-exist within complex relationships. It also suggests a usefulness regard influencing public policy regard funding university-industry projects. This is examined through a multiple case study methodology, assessing a total of 26 years (13 projects, each of 2 years duration) of formally funded knowledge transfer projects. This research demonstrates that effective knowledge transfer from universities to enterprises is not only hypothetically feasible, but also realistically tangible and measureable. It explores the effectiveness and efficiency of UK Business and Management Schools in transferring knowledge and technology through external interventions and formal partnership schemes in two diverse sectors: manufacturing and healthcare. The paper examines the value and impact of these activities by developing an assessment framework and analyzing the perceived improvement. It concludes that the knowledge transfer impact from universities to businesses can be defined.

Key Words: knowledge transfer; industry studies; impact

1. Introduction

Universities have long been viewed as a source of new ideas, technologies and innovation, as indicated historically by Henderson et al. (1988) and Anderson et al. (2007). These ideas and concepts can tangibly support firms as they strive for competitive advantage. For instance, by assisting firms in generating innovative products in collaboration with suppliers, via distributed product development (Anderson et al., 2017) or supporting them in designing and managing world-class processes and adopting best practices (Tucker and Singer, 2015), which can be source of an operational edge and differentiator (Radaelli et al., 2014). Universities do this through shared engineering research, providing cures and therapies in medical research, and offering fresh insights and perspectives via technical, operational, social and economic research (Arthur, 2010). Of course, there is much value to be had, not only in the commercialization and facilitation of this knowledge, but in improving the operations' effectiveness and efficiency of both public and private sector organizations, the latter being the focus point of this study. However, the notion of value and impact will vary

depending on the particular situation, sector (e.g.: private v public), industry (e.g.: manufacturing v healthcare) and the range of stakeholders involved (Maguire, 2012). For example, Lang et al., (2014) posit there exists an optimal extent of knowledge transfer and of its impact. Hence, this paper examines the contribution that the Operations Management knowledge, technologies and know-how hold and contained within universities can make by directly influencing industry and public policy, when transferred adequately to create value and generate impact.

These transfers of know-how between universities and businesses are under growing scrutiny (Audretsch, et al., 2014; Wright, 2014). Firstly, there are questions in terms of the best mechanisms for transfer and university-industry liaison in general (e.g. joint projects, research, teaching). Pawar and Rogers (2014) suggest that firms typically apply a range of knowledge transfer mechanisms and approaches, and Gaimon et al., (2017) explore how firms develop and leverage internal and external knowledge-based resource capabilities to respond to dynamic opportunities and threats. In examining reasons for this Siegel et al., (2004) explored mechanisms for effective transfer of knowledge from universities to practitioners and provided the example of the university Technology Transfer Office (TTO). Furthermore, Siegel (2011) later updated this work and provided a contextualized review of the growth of university technology transfer, with its associated management and policy implications. Our study is coherent with this body of work, as the paper examines aspect of public policy by analyzing how Operations Management technology, knowledge and know-how transfers impact firms and create value. Our findings demonstrate how and to what extent both healthcare and manufacturing firms have benefited from an OM perspective. Perhaps surprisingly, the study shows that public healthcare organizations could capitalize even more than their manufacturing counterparts in the private sector. Considering these characteristics of value and impact are particularly pertinent to this paper, as governments

increasingly require universities and other recipients of public funding for research to demonstrate their contribution, at the level of practice and policy, in both the public and private sectors. This is a direct application of what we, in academia, would regards as planning, governance and control – being able to more reliably evidence or even predict the degree of impact or the potential return on investment. For instance, Alexander and Childe (2013) highlighted that the UK government is keen to stimulate the transfer of knowledge between higher education institutions and industry, and it is believed that Operations Management knowledge and technologies are at the heart of generating the impact for firms. Thorpe and Rawlinson (2014) undertook a major review of how universities could impact upon innovation and growth in the UK economy. They proposed that business schools engaging with business and innovating in pedagogy will better attract students, and made six recommendations: 1) Design practice into courses; 2) Bring more practitioner experience into the faculty; 3) Develop and manage company relationships institutionally; 4) Improve measurement and assessment of research impact; 5) Promote research in larger teams, and centres with multi-dimensional roles; 6) Move to more distinctly defined roles for different institutions.

Concern with effective transfer is particularly emphasized in the UK where the periodical review and rating of research performance through the Research Excellence Framework (REF) has "Impact" as a major factor, alongside matters such as academic publications, in its scorecard-type assessment model (Upton et al., 2014; Hug et al., 2013; Parker and Teijlingen, 2012; Reed, 2016). The intention of this is to improve the relevance and efficiency of knowledge transfer and engagement with practitioners. Considering this scorecard-type assessment model, Tartari et al., (2014) justifiably pointed out that university academics, whilst encouraged to engage with practitioners in knowledge transfer, are subject to peer pressure from their own community of scholars. This is particularly the case for younger

academics seeking to develop their career trajectory. It appears the introspective performance criteria for academic promotion and recognition still remain at odds with the broader need to disseminate and share research and new knowledge.

Knowledge transfer and university engagement with practitioners is a very broad field – across disciplines and from policy to operational levels. Reid et al., (2019) argued that, without the ability to tap into external sources, businesses are unlikely to resolve these knowledge gaps quickly, and the results are unlikely to be as successful, in terms of triple bottom line benefits. They further stated that Small Medium Enterprises (SMEs) adopted a broader scope of external intervention relating to: (i) business process; (ii) production processes; (ii) product development and (iv) information technology, whereas large enterprises focused predominately towards business process improvement, and concluded that tensions and frustrations exist in achieving long-term impact. This paper therefore explores Business Schools' engagement with businesses and attempts to evidence the effectiveness of their knowledge transfer work. This paper, unlike many that produce a token paragraph at the end of the piece that addresses relevance to practice (Cuervo-Cazurra et al., 2013), attempts a contribution that is both rigorous and relevant (Hodgkinson and Rousseau, 2009) by considering both a theoretical and practical problem when formulating the research questions and positioning the contributions (Nicholson et al., 2018).

Two research questions were developed as part of the investigation: i) Do public and private sector organizations generate tangible impact through Knowledge Transfer and, secondly what are the operational differences and similarities between these two diverse industries?, ii) Is there a difference in the type of impact generated by Knowledge Transfer in the public and private sector?

The next section reviews the wider university technology transfer literature, but with a focus on the transfer and impact of management know-how and insight. Following sections

explain the methods used, report on the findings, position the discussion and then draw conclusions and make evidence-based recommendations regarding aspects of public funding policy.

2. Literature Review

2.1. Transfer of know-how and competitive advantage

Knowledge is perceived as a key driver of entrepreneurial alertness and creativity (Meredith and Pilkington, 2018; Gaimon and Bailey, 2013), with successful technology and knowledge transfer being frequently cited objectives and aspirations for governments, businesses and universities alike (Bamford et al., 2011). If executed positively, such transfer should have profound benefits for all three groups, and for society as a whole. Alexander and Childe (2013) and Anand et al., (2010) touched on this in their paper exploring aspects of 'tacit' and 'explicit' knowledge transfer. Interestingly, Letmathe et al. (2012) found that explicit knowledge transfer is superior to other forms of knowledge transfer on shop floor performance. Despite the importance of these aspects, standardized models for transfer are not particularly popular or indeed perhaps worthwhile endeavors as contexts vary so much. There are, therefore, limited usable frameworks for evidencing transfer, whether for practical purposes or for structuring research investigation (Levine, 2011). 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 et al., 2011). Technology transfer is often reviewed at a policy level (e.g. Spring et al., 2017), as indicated from the literature, but there are fewer studies exploring the phenomenon at a project level (Upton et al., 2014). More project-level analysis is, therefore, needed, so the research upon which this paper is based tackles technology transfer on a project-by-project basis, without considering the benefits of

co-production (see, Rahanmani, et al., 2017). This research investigates knowledge-intensive environments through a set of 13 completed projects in both the public and private sector.

A possible reason for the lack of common framework appears to be because technology transfer can be so widely defined and interpreted (Bamford et al., 2011). This leads us to believe the best way forward is to contextualize research enquiry and empirical analysis, thus the focus in this paper is on the impact of university projects with partnering businesses, an approach also used by Alexander and Childe (2013). To help define this in an objective manner we have adapted and applied an early innovation assessment tool, the Ansoff framework (Ansoff, 1957). This is a classic product–market strategy matrix, which implies that products and markets are inter-dependent 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, their competitive advantage, at the partnering companies. Tucker and Singer (2015) highlighted the importance of problem-solving capacity for adopting improvement initiatives successfully.

Porter (1980) explained that with regards to competitive advantage within a firm's capacity to differentiate itself from competition, it is accepted that there are two types: i) cost advantage; or ii) value advantage (Yoo et al., 2006). These advantages, when designed, developed and managed accordingly have the potential to provide an organization with a competitive edge (Grant, 1991; Yoo et al., 2006; Paiva et al., 2008; Anderson et al., 2013). As mentioned, Ansoff (1957) developed a useful tool, to show that products and markets are interdependent and inter-determining (Finch and Geiger, 2011). Sharifi et al., (2009) later evolved this idea, creating an extended Ansoff matrix as a reference point to demonstrate that there are a number of transitions a firm can experience from a prevailing market position. Their key contribution in this area was that whilst general assumptions can be derived regarding which of the differentiation criteria are more important in each of the Ansoff matrix

cells, it is not possible to universally fix them. Specifically, business settings change and the particulars of each industry will influence the type of the criteria that impact upon the key roles for development. The criticality of these elements is derived from an in-depth appreciation of the context. This concept will be extended within this paper.

2.2. 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 (e.g. Sengupta and Ray, 2017; Olmos-Penuela et al. 2014; Hewitt-Dundas, 2012; Bekkers and Bodas Freitas, 2008). Tidd and Bessant's (2009) Managing Innovation text tackles the challenge of how organizations adapt and regenerate their products, processes and business models, though not focused specifically on university to business transfer. Research conducted by Anderson et al. (2017) investigated the coordination challenges involved in product development projects, particularly those noticed in distributed settings. A seminal paper by Cohen and Levinthal (1990) presented the concept of absorptive capacity; the ability of an organization to assimilate and put in place external sources of knowledge (e.g. Roper et al. 2017; Patel et al. 2012; Lewin et al., 2011; Volberda et al., 2010). They argue "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities" (1990:128) and therefore by extension the efficiency of their technology transfer activities. A point echoed by Alexander and Childe (2013) in their paper on innovation and knowledge transfer and by Muthulingam and Agrawal (2016) and Liu et al., (2014) with a specific focus on critical knowledge across supply chains. It is intriguing to note that Cohen and Levinthal's research is considered important, not only because it reflects on technology transfer and absorption from outside projects, but it also raises questions for determining the optimum level of absorptive capacity. It suggests that organizations already well versed in

innovation and change are less likely to desire high levels of absorptive capacity, as technology tends to be developed from within. This was also represented by Lawson and Potter (2012) and Nagati and Rebolledo (2013) in their work on inter-firm new product development projects. Setia and Patel (2013) examined to what extent technical and strategic information system designs improve operational absorptive capacity. Their article highlights the importance of information system and operations management synergies to enhance organizational competitiveness. Furthermore, Argote and Hora (2017) adopted an organizational learning framework that considers knowledge to be embedded in three major components of organizations – members, tasks and tools. Both Aalbers et al., (2014) and Nagati and Rebolledo (2013) raised significant issues regarding the optimal level of ties and relationships, and aspects of trust, needed by innovative companies to engender innovation in the firm. In a similar vein, Mom et al., (2015) explored relational capital and what levels of this should be encouraged by firms and public sector organizations. For example, Radaelli et al., (2014) presents an illustrative case study of an intervention research project focusing on creativity, conducted in Italy in collaboration with a fashion company; they demonstrate how intervention research can be rigorous and relevant to practitioners and how it can advance theoretical knowledge in management science. As a collective, these papers raise an issue of the assumptions made by university partnerships. They suggest that the reality of application is different, that firms and organizations have divergent levels of experience and perception in innovation / absorptive capacity / the need for working relationships. Realistically, these will vary significantly between the public and private sectors.

A previous study explored university to business technology transfer and, in particular, compared approaches in the UK versus the US (Decter et al., (2007). It concluded that the US has more experience in such interaction and transfer, with the UK government being much later with its programmes to promote university to business transfer. Like Tartari

et al., (2014) they found the key motivation for UK universities was to "publish rather than patent" (2007:153) and revealed considerable inconsistencies in approaches to technology transfer in the UK, compared with US universities and businesses. Banal-Estañol et al., (2018) found that synergies between universities and firms are more likely to be proposed by academics having higher academic status. Similarly, Olmos-Penuela et al. (2014) stated that more multidisciplinary academic groups show higher engagement in knowledge transfer activities. Landry et al., (2010) explored different knowledge transfer approaches undertaken by academics (e.g. Iorio et al. 2017 and Sengupta and Ray, 2017), including the dissemination of knowledge through publications, transmission of knowledge through teaching and consulting activities.

Anderson et al.,'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 provide a comprehensive literature review. 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 used a project-by-project analysis employing a data envelopment approach (DEA) and concluded with eleven propositions to help guide future research. This paper explores the question of impact through KTPs, and is informed by Anderson et al.,'s (2007) Preposition 6 = There are no differences in university technology transfer efficiency between private and public institutes. To address this gap in the current academic research (Alvesson and Sandberg, 2011), in this paper we have adapted Proposition 6 to help examining if there are differences in the impact generated by Knowledge Transfer between the public and private sector.

2.3 UK Government Knowledge Transfer Partnerships

The literature indicates that interaction between academia and external organizations can not only facilitate the transfer of knowledge, but also stimulate the production of new knowledge (Banal-Estañol et al., 2018; Malik, 2013; Gertner et al., 2011; Kitson et al., 2009). One mechanism available in the UK for developing and facilitating university-industry collaboration is the Knowledge Transfer Partnerships (KTP) programme. This is a UK government sponsored scheme, which establishes collaborative projects lasting between 6 to 36 months (see http://ktp.innovateuk.org). The scheme is viewed as a bridge for exchanging important ideas and experiences from universities to industry and vice versa (Ternouth et al., 2012), which also aligns with Gaimon and Bailey (2013). Interestingly, some early researchers did focus on university-industry interactions in order to understand the degree of economic impact occurring through university knowledge transfer (Azagra-Caro et al., 2017; Hewitt-Dundas, 2012; Bekkers and Bodas Freitas, 2008; Mansfield, 1991).

A KTP consists of a three way collaborative partnership: an academic partner (representing the university), an associate partner (a recent graduate employed as the project leader/manager), and a company partner (the business). These three partners work together to try and achieve the set objectives for a specific business project. All parties can benefit from different perspectives: for example, teaching cases and academic papers for the university; high profile project experience and possibly a postgraduate degree for the associate; increased efficiencies / effectiveness / profitability for the business (Giudice et al., 2008). The scheme has been successfully applied in a range of private and public sector organizations, with a wider assortment of university departments being involved in it over the years (Bamford et al., 2015; Dehe and Bamford, 2015; KTP, 2009; Lodge and Bamford, 2008; Robson, 1996; Zhang et al., 2012). Universities' engaging with firms have played a crucial role in assisting non-innovative firms to gain access to existing knowledge. It

increases the practical values of research by putting the studies' outputs directly into the real business world (Gertner et al., 2011). Alexander and Childe (2013) also highlighted this aspect regards knowledge transfer. Universities not highly ranked in terms of traditional academic research outputs can and have been actively involved in KTPs (Wilson, 2012), giving them the opportunity to increase their reputation and ensure their teaching is up to date (Ternouth et al., 2012). Coombs et al., (2012) reported that KTPs have the potential to make a defined contribution to developing a learning experience that benefits both the associate and the academic. The outcomes of projects are not only related to the generation of the weighted number of solution concepts (Ternouth et al., 2012), the design of new or improved products or projects, and up to date collaborative research (Gertner et al., 2011), but also have a defined impact upon the associate. This consists of benefits such as building wider networks within the academic and industrial communities and training/adoption of new techniques, methods and approaches (Perkmann et al., 2011). Aboelmaged (2014) perceives a direct linkage between knowledge management capabilities positively affecting innovation performance, which in turn, have a positive effect on operational and financial performance.

3. Methodology

This paper explores the effectiveness of Business and Management Schools in transferring knowledge to their industry projects, and the resulting impact. To achieve this the value and influence of Knowledge Transfer Partnerships (KTPs) is examined using a multiple case study research methodology to explore the concepts proposed (c.f. Yin, 2013). We are particularly interested in the task dependency, that is, the extent to which an individual's successful completion of a task is dependent on the efforts of others. Task interdependence has generally been associated with beneficial outcome effects in group settings (Gaimon, et al., 2017). The practical importance is to investigate the knowledge transfer members, with

this focus, we aim to make explore management know-how and insight and the similarities between these two diverse industries from both the private and public sector? Through the adoption of a systematic inductive research established by Gioia et al. (2013) analyzing this knowledge-transfer assessing 13 KTPs projects, each of 2 years duration = in a total of 26 years of university – practitioner collaborations.

3.1. Case study method

In developing our arguments of the assessment of the value and impact of knowledge transfer we examined the knowledge transfer mechanisms and implications (Lang et al., 2014) we explore the emerging research questions through a case study research methodology. This design fits well within knowledge-intensive environments (Froehle and White, 2014), the case study research category is recognized as being particularly valuable for examining a phenomenon and providing clarifications; it also provides a variety of rich, empirical evidence (Yin, 2013). To add, Voss (2005) recommends this approach for theory development as well as for theory testing. Furthermore, Eisenhard and Graebner (2007) demonstrated that articles that build theory by using a multiple-case study approach are highly cited and characterized as the 'most interesting' research (Bartunek et al., 2006). In addition to this, they explained that by adopting this approach, a more robust theory is developed, which is 'surprisingly objective because its close adherence to the data keeps researchers honest' (Eisenhard and Graebner, 2007, p.25). For instance, Joglekar, Davies and Anderson (2016) found that increasing attention has been given to context-specific research, such as case studies, which consider evidence from multiple industries and provide unique opportunities for methodological innovation. Considering the dimensions of the proposed framework a multiple case study method was chosen (Yin, 2013). All the selected cases offer strong theoretical insight that enabled the authors to explore the phenomenon under

investigation. There are a number of avenues to support the existing research within the context of cross functional knowledge exchange (Li etal, 2014; Guo et al 2017). Furthermore, Joglekar, Davies and Anderson (2016) stated that parallel studies in the service sector industry and the opportunities, to consider different types of operational choices have not been fully exposed. This three-way collaborative knowledge transfer partnership (graduate, company, and partner university), connects with the task interdependency and their inspirational and transformational leadership (Gaimon, et al., 2017), as well as extend of the impact generated as a result of the project.

3.2. Data collection and analysis

The primary source of data involved the collection and collation of 13 sets of knowledge transfer project documentation, for a total of 26 years of formal project funding. These projects were drawn from seven private sector in manufacturing organizations and six public sector projects within healthcare. Before project commencement an extensive formal funding bid had to be jointly created for each project (by the company and the university). The notion of co-creation between university and university presents both a challenge and an opportunity. Additionally, contracts can influence expectations that may either stimulate or constrain attempts to be creative (Shalley and Gibson, 2107). We analyzed these key artefacts (formative formal documents) and transcripts using the procedures described in Miles and Huberman (1994, pp. 58–62) and Tucker and Singer (2015:261). This activity was expected to outline the focus, scope, scale and ambition of the project – with a detailed work plan and projected key performance indicators and targets. During the project the tangible benefits were reported throughout the regular documented meetings, where the associate and the project team (the academic and the industry partners) report on the project progress and set the future short-term direction, as well as highlight any potential risks and required changes,

of which could be considered as such network assets, (see Lui et al., 2017). These artefacts form the foundation for the project final report. At the end of a project, a UK Government requirement was to capture and measure the outcomes of the undertaking and to compile a comprehensive report following a structured and standard framework. This document, written jointly by the project team, is the main dissemination mechanism for the stakeholders (the funding body, the organization, the university) and seeks to assess, measure and report the project contributions in terms of, for example, new business practices and partnerships, processes and products, as well as estimating the return investment, strategic misalignment, organizational performance and the development of a potential competitive advantage (Bhattacharjee and Chakrabarti, 2015; Su et al., 2014; Ram et al., 2014; Soloducho-Pelc, 2014; Hardcopft, et al 2017).

The artefacts collated for this paper comes from the whole spectrum of the knowledge transfer projects, from the initial funding bid application documents, through the in-programme regular formal reports, to the project final report. For example see Table 1. This collective represented a substantive volume of data, both quantitative and qualitative.

Table 1 - Data coding framework: knowledge transfer partnerships

Theme	Example Variables	Example Measures	Key Sources of Information
Competitive position at end of project / enabling variables	Degree of improvement in efficiency or productivity	Improvements in business processes and customer service - 18.75% less cycle time; Increased number of customers - 77% patents would use the service again; Evidence of applying innovation - Lean Six Sigma	Bid document / in progress reports / final reports
Cost saving generated / projected future cost savings	The degree of applying the KTP suggestion	Cost savings - 25% reduction in costs of ad-hoc journeys/ 20% increase in export sales; Future cost savings: 3 times the annual savings over the next 3 years (on average)	In progress reports / final KTP reports
Investment directly related to the KTP project	The aim of the project and the defined areas for improvements	Investments derived from the results of the KTP: in plant, machinery and buildings; in employing new staff; in training staff	In progress reports / final KTP reports
Staff development in term of knowledge / skills / competencies	The aim of the project and the need of new knowledge and capabilities	Performance measurement systems; Evidence-based decision-making; Lean/ 6 sigma methodologies; Redesign and knowledge management tools and techniques;	Bid document / in progress reports / final reports

		Benchmarking; Team working skills	
Impact for the academic institution / dissemination results	The degree of KTP outputs have been analysed be the academic institution	Journal/Conference Publication; Case study/Teaching material; Student projects	In progress reports / final KTP reports

Note: Project bid document avg.10,000 words; Project in-progress reports (6 per project) avg. total 6,000 words, Project joint final report avg. 8,000 words; Project Associate final report avg. 4,000.

The key points listed in the tables presented were extracted from the (extensive) available data via collation and coding, performed by the remaining members of the multiple project teams, facilitated by the papers authors. This process involved meetings with project partners to review and agree upon the partnership impact and outputs. The meetings followed a standard agenda (re-introductions, outline of purpose, review of key documents and data, record of agreed project effect, etc) and details were precisely logged.

For this paper the 13 sets of project documentation were gathered and analyzed using a thematic analysis technique (Fereday and Muir-Cochrane, 2006) and co-production (Rahmani, et al., 2017). The themes analyzed were: i) the competitive position of the organization at the end of the project and what were the variables within this; ii) the cost saving generated and any projected future savings; iii) the investment directly related to the 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. This process involved: i) thematic analysis; ii) focus groups with multiple stakeholders from each project; iii) re-review and analysis by the author team. Eisenhard and Graebner (2007) clearly position that the adoption of multiple-cases approach offers a robust and generalizable analysis, which is based upon the patterns emerged from relationships among variables within and across the set of cases. See Table 1 for a summary of the data coding framework. The analysis and exploration of the generated dataset allowed the authors to address the research questions, by examining specific aspects of the findings in relation to the available academic literature. Eisenhard and Graebner (2007) highlighted that the themes emerged from the analysis of the

rich empirical case data enable a further exploration of research questions and significant contribution to theory, and that developing well-crafted tables provides an effective way to present the case evidence and underline the richness of case data. To summarize the above, Anderson et al (2018) propose a useful framework that is adapted and represented in Figure 1 to showcase an overview of the contributions from this research study.

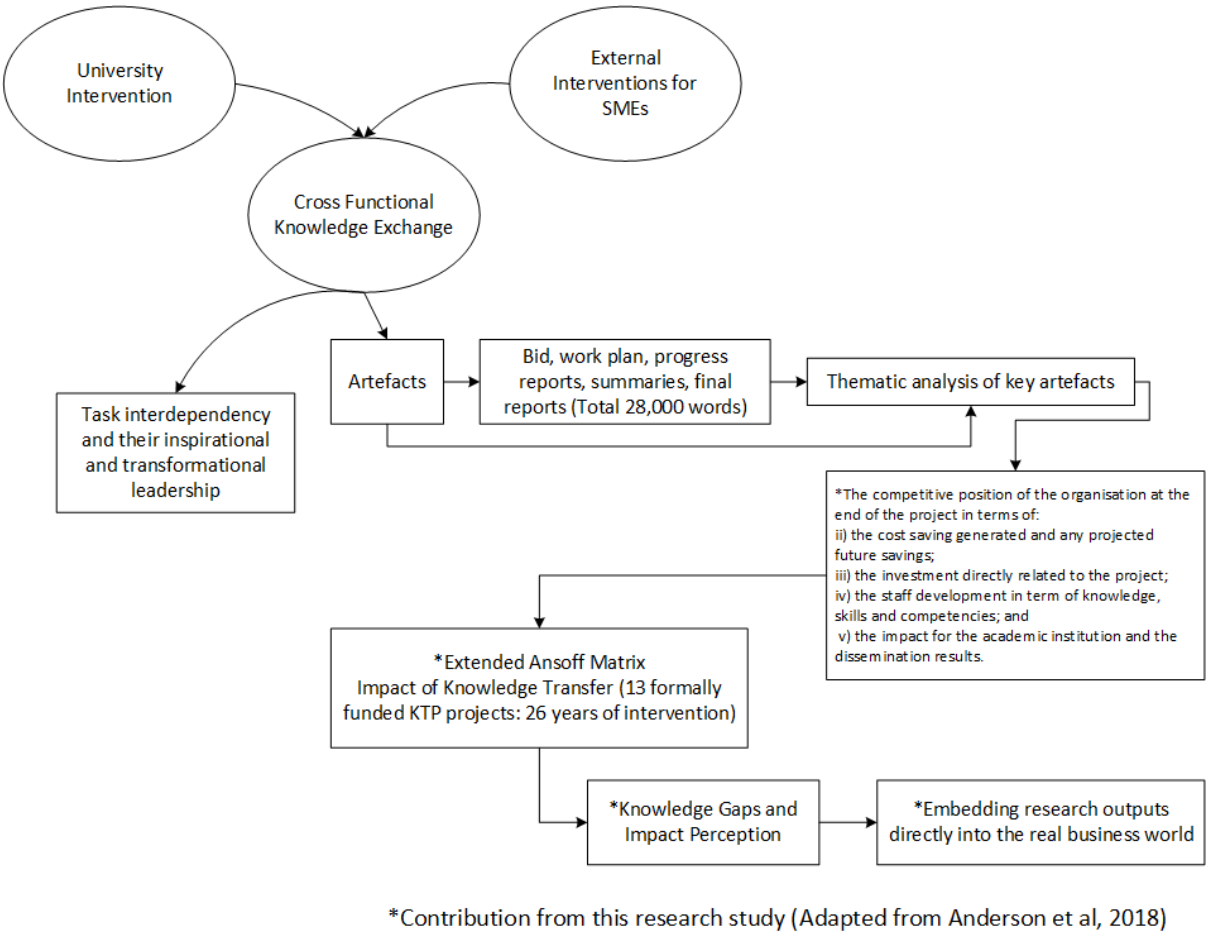

Figure 1 – Knowledge transfer interventions

3.3 Creation of the extended Ansoff matrix for Knowledge Transfer

To explore these important characteristics the authors have, as a development from the literature, created an 'extended' Ansoff matrix (adapted from Sharifi et al., 2009, based on Ansoff, 1957). According to Ansoff (1965), the four major types of growth opportunities are

market penetration, market expansion, product expansion and diversification growth as represented in Figure 2.

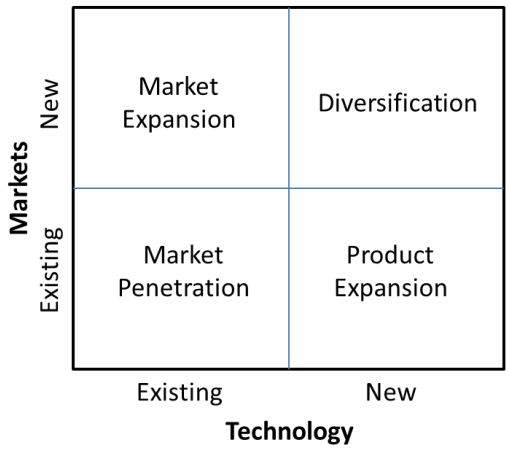

Figure 2 - Ansoff matrix for growth strategy (adapted from Ansoff, 1965)

Our interpretation is that: Market Penetration (Han et al., 2013) involves an organization seeking increased sales for current services/products in its existing markets as well as the supply chain challenges.; Market Expansion is where sales are increased by taking services/products into new (perhaps international) markets; Product Expansion is seeking increased sales by developing new or improved services/products for its current markets; Diversification growth increases sales by developing new services/products and taking these into fresh (perhaps international) markets. The Ansoff Matrix was first extended by Sharifi et al., (2009) who proposed that companies traditionally extended the sales of their existing products by moving from sector 1 to sectors 2 and 3 through cost and operational efficiencies and, where possible, by aligning their existing supply chain to meet this new shift in emphasis (see Figure 3).

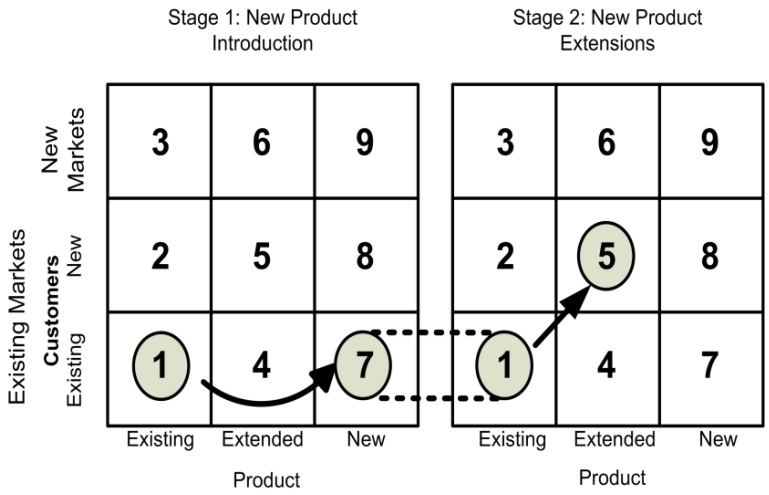

Figure 3 - Extended Ansoff matrix for growth strategy (Sharifi et al., 2009)

Extending the product range through a shift from sector 1 to sectors 4, 5 and 6 involves a redesign or modularization of the product to capitalize on new opportunities in customization and product platforms. Typically a redesign of the supply chain is often required with a shift in emphasis from cost to flexibility (Sharifi et al., 2009). From this concept we adapted the idea to allow comparison and evaluation regards the perceived change/knowledge transfer within organizations, initially from both the university and the company partner. Please see Figure 4. This adapted Sharifi et al., (2009) model enabled coding and assessing the know-how of the university and the company partner, plus aspects of know-how and sustainability of the organization. Both Ansoff (1965) and Sharifi et al., (2009) represented aspects of the market within their models. This aspect has been included on the horizontal axis here as per Figure 4.

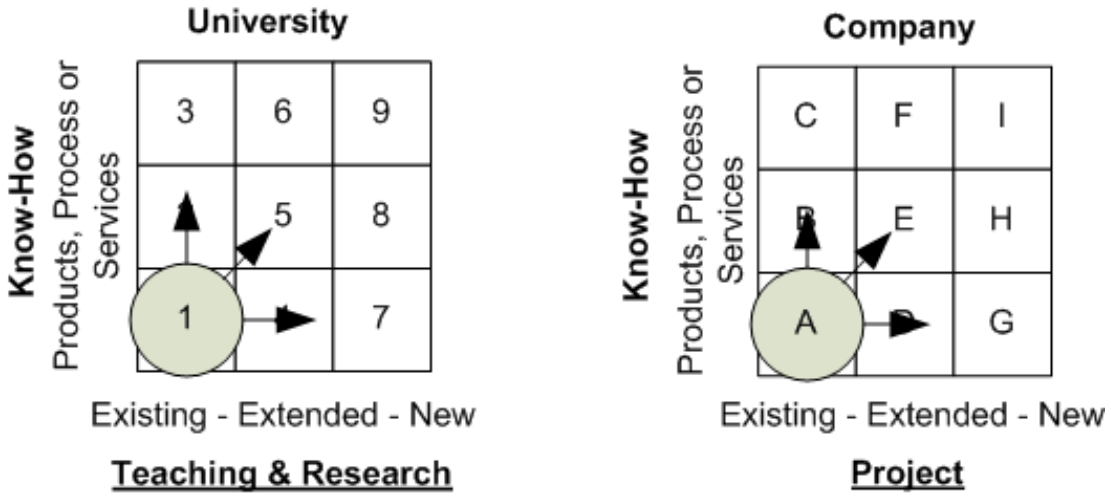

Figure 4 - Extended Ansoff matrix for Knowledge Transfer (A) (adapted from Sharifi et al., 2009)

Applying this matrix to the data shows that a number of transitions can be observed through a project for both the university and the company base partners – using the longitudinal data available – which according to Nagati and Rebolledo (2013) can provide a better understanding of the relationships between variables.

Two research questions have therefore been developed as follows: RQ1: Do public and private sector organizations generate tangible impact through Knowledge Transfer?; RQ2: Is there a difference in the type of impact generated by Knowledge Transfer in the public and private sector?

4. Findings

The 13 cases were based on a convenient sample, from Knowledge Transfer Programmes (KTPs) with whom the authors had been directly involved. In convenience sampling, whatever population element that is handy or convenient for inclusion in the study is selected (Mallet, 2006). The sample is representative of the population under study but the extent of representativeness is always conditional upon the specification of well-defined characteristics

of the population (De Beuckelaer, and Wagner, 2012). The cases came from the healthcare and manufacturing industry sectors, as the purpose of this paper is to compare these two sectors. Table 2 presents an overview of the projects, where 7 are manufacturing and private sector based (C1 to C7) and 6 are healthcare and public sector based (C8 to C13). The last column of this table ("focus") indicates the focus of each KTP project in terms of the operations-based improvements each was officially categorized as addressing. in the project documentation.

Table 2 - Company profiles and their anticipated area for operations improvement

	Sector / Grant	**Operations Project Focus**	**Operations-based Improvement**
C1	Manufacturing (Pharma) £66,917.00	Integrated operations enterprise & web based Supply Chain Management	Operational efficiency Use of new operations planning/control technology Operations-marketing integration Effective use of people New IT equipment Operations strategy Product redesign Operations and process improvement New process technology
C2	Manufacturing (Food) £73,573	Operational Six Sigma methods to drive a cultural change	
C3	Manufacturing (Oil and Gas) £65,453	Operations linked IT strategy	
C4	Manufacturing (ICT) £41,037	Integrate operations business systems	
C5	Manufacturing (Automotive) £63,423	Operations IT strategy	
C6	Architectural/design (IT) £64,333	Business intelligence operations system	
C7	Manufacturing (Food) £44,300	Process Improvement: introducing new machinery & operations processes	
C8	Healthcare (Commissioning) £75,692	Improve operational logistical assets	Process improvements Operational efficiency Use of new logistics planning/control technology Process improvements New planning/control technology Operations strategy Service system redesign Effective human resource utilization
C9	Healthcare (Provider) £66,329	Supply Chain Management healthcare services - patient-blamed non-attendance at outpatient clinics	
C10	Healthcare (Emergency Department / Room) £129,761	Operational bed utilisation & utilisation in Emergency Department / Room services	
C11	Healthcare (Provider) £65,092	Operational improvement & management of the patient transport service	
C12	Healthcare (Commissioning) £61,486	Operations management planning process	
C13	Healthcare	Operational new premises development &	

	(Provider) £62,475	service integration	

The impact of the KTPs from the university and the enterprise was captured through both financial and non-financial measures, recorded via a regularly updated benefits log. Tables 3 to 7 below present a summary of the recorded tangible 'impact' of the KTP partnerships. Section 4.1 provides a summary of the projects within the manufacturing sector, whilst 4.2 highlights the summary of those within the healthcare sector.

4.1. Private sector: 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 3 Manufacturing KTP Summaries. Furthermore, most of the projects invested heavily in terms of the organizations infrastructure, such as IT, production layout, training and future growth, in order to maximize the project return of investment. Within the reports each company presented the aims and objectives of the project, and also indicated from where the new knowledge capability would originate; quantitative outputs included the savings for the company and the investments derived to facilitate the project. These investments were then grouped under staff development, infrastructure and capital equipment as well as against institutional benefits such as teaching, publications, and collaborations.

Table 3 - Manufacturing KTP Summaries

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
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 time £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)
Investments	Extranet Plant M/c £120K New Staff :3 Travel expenses £75K	Extranet Plant M/c £60K Shop Floor IT system £70K £2.5M Expansion	4 New staff £40K IT Equipment Service offerings- adoption of digital formats	IT Servers £15K Software £60K Staff Training £4.5K	IT £120K Office Change £20K New Warehouse £80K 15% Staff reduction £50K Telecoms	New staff Marketing and IT Company wide MIS training (110) Servers and Licences £5K	Recipe Weighing System (2008) Associated 30 Staff training All staff on NVQ Lean Manuf course
Staff Development	Marketing Strategy	Leadership Development. BPR and Change Management	IT training	KTP Champion Guest Lectures	Case study Material for the academic Institution Staff development and recruitment	B2B Marketing, Bid Preparation, Key account management training – and branding	Documented Change Management Paper Second KTP awarded
Impact of institutional Teaching	3 publications 1 UG projects	2 Int. publications Case study Material	2 publications Case study Material	1 conference publications Case study Material	1 conference publications Case study Material Enterprise Modelling E-shop	B2B Marketing Module Material for CRM 2 Case studies	3 publications 1 UG projects

Impact on University	Student Visits. Staff attending courses	Staff attending NLA course	2 Placement Students 5 Staff attending courses	Employment of 2 Graduates	Student Visits. Staff attending courses	Student Visits. Staff attending courses	Student Visits. Staff attending courses
Dissemination of Results	Marketing Material – Regional Impact Case	Marketing Material – Enterprise network	Marketing Material – Enterprise network	Marketing Material – Regional Impact Case	Marketing Material – Enterprise network	Marketing Material – Regional Impact Case	Web story on university portal

Table 4 (Manufacturing Capability Output) provides a summary and collation of the recorded output capability, according to the key sources of information from the final KTP reports.

Table 4 - Manufacturing Capability Output

Manufacturing	Capabilities	Measurement Criteria
New Knowledge	• Technical knowledge of business systems • Availability of skilled labour to service an order • Technical knowledge of product to prevent glitches • Streamlined purchasing • Streamlined manufacturing • Streamline tendering • Appropriate levels of stock • the impact of management information systems and web technologies • Ample logistics capabilities	• Intellectual capital • Social capital • Percentage on-time deliveries • Accuracy of inventory status • Accuracy stock control • accuracy on sales potential orders • Average delay • Accuracy and quality assurance and control • Delivery time • IT awareness
Cost Savings	• Sourcing raw materials through supplier networks • Appropriately skilled labour [not over-skilled or under-skilled] • Efficient purchasing • Lean manufacturing • Market reach [acquisition cost] • Ergonomic product design • Lean Thinking through Six sigma • Recyclable product components • Life Cycle Costs	• Product cost • Labour cost • Unit cost • Cycle Times and Setup Times • Overhead cost • Inventory turnover – W.I.P., raw material, finished goods • Capital productivity • Capacity/machine utilisation • Direct labour productivity
Investments	• System integration • Appropriate machinery • Correctly trained operators • Unambiguous definition of specifications • Staff training • Manufacturing input conformity [supplier quality] • Manufacturing output consistency & conformity • Ability to satisfy market qualifying criteria	• KPIs • Number of revisions • Return of Investment • Funding/Grants • Throughput time • Training budgets • Qualifications

Staff Development	• Culture of innovativeness in the firm • Knowledge of competing products • Intimate knowledge of own product • Intimate knowledge of market requirements	• Training budgets • Qualifications

4.2 Public Sector: Healthcare Cases C8-C13

In a similar fashion a review of the healthcare cases was carried out and then each organizations capability was also collated. Table 5 depicts the issues, priorities and approach of the organizations. The data shows a particular focus on process redesign, the use of management techniques adopted from manufacturing, and a clear step change into service operations. As each of the organizations were non-profit making, so called 'success' could not be measured in terms of profitability or entry into new markets. Impact was therefore recorded in other ways, e.g. in terms of cost savings, increasing / freeing up capacity in key high demand services, and increasing access to or uptake of services.

Table 5 - Healthcare KTP Summaries

	C8	**C9**	**C10**	**C11**	**C12**	**C13**
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: reorganization 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 organizational 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% Optimization 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 utilization -15% Maintenance cost -10%
Investments	£12,000 in the development and implementation of a new expense system Head of Logistics and Transport Contracts post created	There will be investments in information systems integrate the Balanced Scorecard into existing systems	New Medical Assessment Unit 2 Staff to run the new bed capacity management system 1 Speech Therapist post created	Transport coordinator post created	N/A	N/A
Staff Development	Training will be delivered to all staff on the new expenses systems	Staff have been trained in the use of data gathering and analysis tools and process mapping, the use of the Balanced Scorecard	Staff have been trained in the use of data gathering and analysis tools and process mapping	Staff training in order to support the roll out of the new service and improve standardization and clarity in the transport booking process	Staff have been trained in the use of data gathering and analysis tools and process mapping, the use of the Balanced Scorecard	Training in business improvement tools and techniques: MCDA, QFD, Benchmarking, Performance measurement, Lean techniques.
Impact of institutional Teaching	3 Academic Journal Publications 2 conference publications Case study Material	2 Academic Journal Publications 2 conference publications Case study Material	2 Academic Journal Publications Case study Material	2 conference publications Case study Material	1 Academic Journal Publication 2 conference publications Case study Material	2 Int. Publications 3 conference publications Case study Material
Impact on University	Guest Lectures	Guest Lectures Associate led weekly seminars	Associate led weekly seminars	Associate led weekly seminars	Guest Lectures	Guest Lectures Staff attending courses
Dissemination of Results	Teaching material Associate awarded "Business Leader of Tomorrow" by Technology Strategy Board	Teaching material Presentation to Local and National NHS	Teaching material Presentation to Local and National NHS	Teaching material	Teaching material	Teaching material

The capability assessment was conducted in a similar manner as for the Manufacturing Cases (Table 4), and is illustrated in Table 6. It provides a summary and collation of the recorded output capability, according to the key sources of information (e.g. KTP reports).

Table 6 - Healthcare Capability Output

Healthcare	Capabilities	Measurement Criteria
New Knowledge	• New service delivery processes • New management processes • New performance measurement system • Service improvement and Lean Methodology • New capacity management processes • Population demographics • New Public Consultation processes • Quality Function Deployment • Multiple Criteria Decision Analysis	• Waiting times • Do Not Attend (DNA) rates • Appointment cancellation rates • Increased capacity • Uptake of services • Hospital Acquired Infection rates • Average length of stay • Overall new premises development time
Cost Savings	• Appropriately skilled labor [not over-skilled or under-skilled] • Efficient new premises development • Lean service delivery • Efficient use of resources • Efficient use of transport services • Increased take up of preventative services	• Average length of stay • Overall new premises development cost • Overall new premises development time • Overall patient transport cost • DNA rates • Referral rates for preventative treatment
Investments	• Appropriate IT infrastructure • Correctly trained staff • Development of new services	• KPIs • Return on Investment • Funding/Grants • Training budgets • Qualifications
Staff Development	• Culture of continuous improvement in the Trust • Knowledge of best practice • Intimate knowledge of own services • Intimate knowledge of population demographics and health needs • Ability to convert population demographics and health needs into design specifications for services and new premises	• Training budgets • Qualifications

4.3 Knowledge Transfer: University – Company

Table 7, created from a review of the final reports, summarizes the effects of involvement in the projects upon the university. It summarizes the acquisition of new knowledge, the capabilities that the application of newly acquired knowledge brought plus the impact of that

capability. Finally, it captures what has been put in place to sustain the stated impact in the longer term.

Table 7 - University Impact / Output

Service	University
New Knowledge	• Application of process improvement and development, Lean, 6 Sigma, capacity management and other theories in specific contexts • Benchmarking, MCDA, Evidential Reasoning (ER), Analytical Hierarchy Process (AHP), and QFD • Performance measurement systems • Re-engineering methodologies • Strategy development and planning • Team working skills
New Capability	• Increased ability to engage with industry partners • Improved bid writing • Increased ability to identify the issues • Improved staff skills • Increased use of improvement methods/innovation
Impact	• Journal Publication • Conference publications and presentations • Case study material • Guest Lectures • Teaching material • Student projects • Placement students
Sustainability	• Further KTP / collaboration with Industry partner • Associate continuing study at University • Associate employed at University • Associate/staff developed their skills • Data/experience has transformed to teaching material

5. Discussion

Fundamentally this is primarily a practitioner focus paper, not a conceptual one. In order to clearly add value and make a defined contribution, the latter part of this paper has been arranged around the aim, objectives and research questions. In response to RQ1, the section first presents a proposal for an impact assessment framework, using an adapted Ansoff Matrix. Then, it goes on to address RQ2 by applying the framework to the case findings, leading to the presentation of the collated and perceived impacts; a representation of the difference that the projects have made.

5.1. Impact Assessment using an Extended Ansoff Matrix: Do public and private sector organizations generate tangible impact through Knowledge Transfer? (RQ1)

Lang et al., (2014) suggest that there is an optimal extent of knowledge transfer, so to examine aspects of tangible impact in an objective manner we have adapted and applied an early innovation assessment tool, the Ansoff framework (Ansoff, 1957). This product–market strategy matrix implies that they are interdependent and inter-determining (Finch and Geiger, 2011). Once the 'know-how' and practice are identified within a knowledge transfer project the next step was to carry out a review of the company's capabilities to determine the viability of the strategy from a practical perspective. This capability assessment was carried out across a number of factors. For example, product, process, people, operations and organization with respect to the above critical factors, and through the application of the Resource Based View (Barney, 1991; 2001). For each of the capability factors a set of measures were identified that addressed the requirements of the project. A sample of capability outputs for the projects is shown in Tables 6 and 7. Of course, by necessity, multiple assumptions are made by projects such as these. As identified within the literature (Cohen & Levinthal, 1990; Aalbers, Dolfsma & Koppius, 2014; Mom et al., 2015; Radaelli, Guerci, Cirella, & Shani, 2014) the reality is that diverse firms and organizations have different levels of experience in innovation and multiple levels of absorptive capacity (Argote and Hora, 2017; Lawson and Potter, 2012; Nagati and Rebolledo, 2013). They also have differing needs for relationship working, and these are likely to vary significantly between the public and private sectors (Gaimon et al., 2017; Liu et al., 2014; Al-Faraj et al., 1993).

Interestingly, Dooley et al., (2013) state specifically that knowledge transfer requires lengthy, direct and intense interactions. The results and the impact of the projects here were assessed on a project by project basis in terms of the perceived step change with reference to the adapted, extended, Ansoff Matrix. Using the extended Ansoff matrix as a point reference

(Figure 5 – Extended Ansoff matrix for Knowledge Transfer (B)) there are a number of transitions a company can undergo from an existing market position.

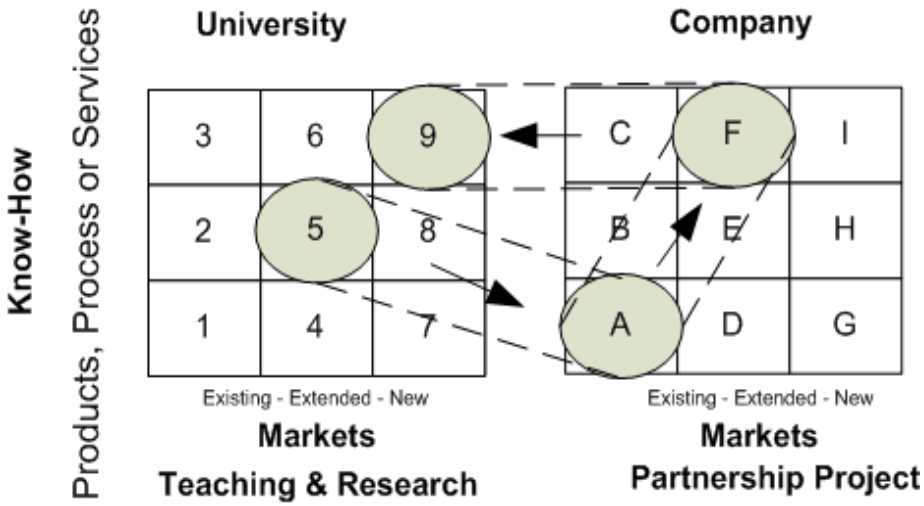

Figure 5 - Extended Ansoff matrix for Knowledge Transfer (B) (adapted from Sharifi et al., 2011)

We suggest that firms traditionally extended knowledge incrementally from their know-how, demonstrated by moving from sector A to B, D and E accordingly within the boundaries of the company. This step-wise approach examines cost and operational efficiencies and, where possible, firms align their existing supply chains to meet this new shift in emphasis. Extending the company from sector A to sectors F, H or I potentially involve a higher level of risk and investment in order capitalize on new opportunities. A knowledge transfer 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 knowledge transfer strategy, represented by a movement from 5 to A, from A to F, then from F to 9, is the most critical in terms of risk due to the embedding of new business offerings both internally and externally, but through the project interface it offers the company the

opportunity to fundamentally change their product and service offerings in a more controlled manner and subsequently plan for the 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 5A to E5 will involve partnering and extensive intervention. However, if the subsequent strategy is to move to sector F9, then it is important that external project partners are also responsive and flexible in order to gain the maximum level impact.

When this approach is applied to the data and findings presented in this paper the impact score shows the starting point and transitions achieved in each project based upon the application of the Extended Ansoff Matrix. Table 8 demonstrates the use of the above concept. In each project there has been a perceived impact and an identifiable tangible improvement.

Table 8 - Impact Perception of the Case Data

Manufacturing: initial position→end position						
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
1B→4E	**2B→4E**	**2A→5F**	**1A→5G**	**2A→4E**	**3A→5E**	**2A→5B**
Healthcare: initial position→end position						
C8	**C9**	**C10**	**C11**	**C12**	**C13**	
3B→8E	**2B→7F**	**2A→6H**	**3A→5C**	**3B→6C**	**3A→8F**	

This demonstrates what Lowe and Locke (2006) and Steuer et al., (2011) define as movement towards the "competitive edge" (c.f. Akinc and Meredith, 2015). Therefore, as evidenced by the collation and assessment of the 13 knowledge transfer projects presented within this paper, public and private sector organizations do generate impact and improvement through knowledge transfer projects. This also relates to the work of Bhattacharjee and Chakrabarti (2015), Ferdows (2006), Su et al., (2014), Ram et al., (2014), and Soloducho-Pelc (2014), who all mention aspects of impact regards new business

practices and partnerships, processes and products, as well as estimating the return on investment. In addition, as per Radaelli et al., (2014), under the right circumstances universities can substantially help firms as they endeavor to develop their competitive advantage by supporting them in applying novel systems, products and processes (c.f. Audretsch, et al., 2014; Wright, 2014). Arthur (2010) states this well by describing the opportunity as one of offering fresh insights and perspectives, a view reinforced by Alexander and Childe (2013), Gaimon et al., (2016), Gertner et al., (2011) and Perkmann et al., (2011). They highlighted the benefits as being building wider networks, the training/adoption of new techniques, methods and approaches and particularly the practical value of research by embedding research outputs directly into the real business world. This also fits with Pawar and Rogers (2014) observation that firms apply a range of knowledge transfer mechanisms and approaches, perhaps to aid the planning cycle and to try and enhance their degree of control, and Argote and Hora (2017) promoting three components (members, tasks, tools). Finally, the results discussed above support the Joglekar et al., (2016:2006) perspective that 'industry studies provide a uniquely valuable platform for studying the implications of and potentially prescriptions for public policy initiatives'. As such, a contribution of this paper is the proof of impact regards the UK Government Knowledge Transfer Partnerships. Table 8 does also show the potential for comparing one sector with another. In this case the projects within manufacturing can be compared those within healthcare. The next section develops this idea.

5.2 Is there a difference in the type of impact generated by Knowledge Transfer in the public and private sector? (RQ2)

This section will address the question from a number of perspectives, building on preposition 6 from Anderson et al., (2007) to examine impact in two different industries. The authors

have taken the data from the findings and plotted this on a representation of the Extended Ansoff Matrix for Knowledge Transfer (B) (Figure 5). Figure 7 shows a representation of the manufacturing and healthcare organizations position, as defined by the interpretation of the Key Sources of Information (in Table 1) before the two year knowledge transfer project has started. A line of best fit has been created and applied (the dotted line).

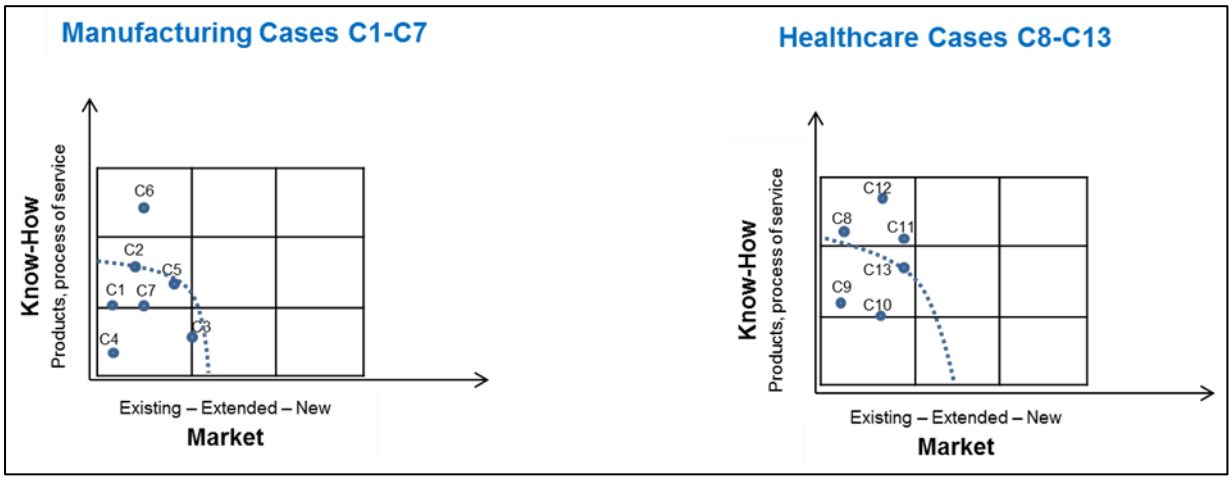

Figure 7 - The organizations' state before the KTP

This figure clearly shows the interpreted position, pre-intervention, of the multiple companies. The grouping makes for an interesting presentation, especially given sector specificity. This snapshot identifies the spread of know-how and development (c.f. Akinc and Meredith, 2015; Al-Faraj et al., 1993; Forker and Mendez, 2001), indicting by comparison the slightly greater know-how represented within the healthcare companies.

Figure 8 shows a representation of the manufacturing and healthcare organizations position, after the two-year knowledge transfer project, as defined by the project teams interpretation of the Key Sources of Information. Every organization has improved following the interpretation applied. The second dotted line (line of best fit) demonstrates this visually.

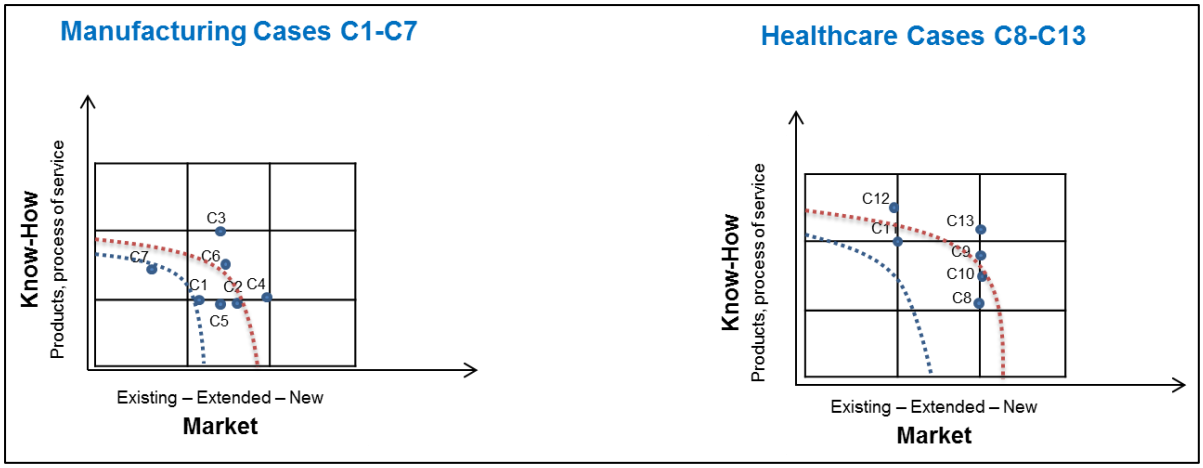

Figure 8 - The organizations' state after the KTP

In terms of possible differences between public and private sector, 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 (c.f. Boer et al., 2001; Fox et al., 2013; Li et al., 2012). Although Ferdows (2006) stated this much more directly, in that operations managers have a responsibility to improve their 'production' know-how as fast as possible. This would as a result also include elements of creativity and the management of technology (Shalley and Gilson, 2017), plus senior management engagement (Tucker and Singer, 2015). In each case the university partner extended its teaching and research to new levels; this was not always the case for the Company Partners service offering.

Comparing the Healthcare with Manufacturing organizations identifies that 'improvement' appears more pronounced with the former. From experience the authors believe that many manufacturing organizations are actually reasonably efficient at knowledge transfer and implementation; because they have tangibly developed these skills (c.f. Maldonado-Guzmán, et al., 2016). Those organizations that have survived over the past several years have had to rapidly adapt or they would have failed. This appears to fit with the

work of Bessant et al., (2003) which looked at the possibilities of transferring appropriate practice during uncertain and turbulent conditions. In Healthcare the use of some of the techniques and technologies that are considered standard in manufacturing (such as lean) are still quite innovative (Bamford and Griffen, 2008; Cheng et al., 2015; Papalexi et al., 2016) and therefore there exists the potential for even greater impact, or a critical contribution (Liu et al., 2014) - something tangibly demonstrated with the results of these knowledge transfer partnerships, where knowledge is perceived as a key driver of creativity and improvement (Gaimon and Bailey, 2013). A contribution of this paper is the evidence to potentially influence the UK Government Knowledge Transfer Partnerships funding regime, answering a call made by Joglekar et al., (2016) for industry studies and public policy research to examine operational decisions with policy considerations in, amongst others, healthcare and high-tech manufacturing industry.

Conclusions

This paper has analyzed 13 formally funded knowledge transfer projects. The key similarity across all the cases was that the main focuses of the project was to improve the operations management of the organization through a focus on the operations themselves, or the processes that combine to make up the operations (see Table 2). This reinforces our view that organizations focus on cost and operational efficiencies when attempting to extend the organizational knowledge base and has created an evidence based framework to try and demonstrate the output impact from multiple partners co-existing within complex relationships (Nagati and Rebolledo, 2013); but who are working towards a shared strategic intent. The contribution of this paper is palpable when one considers the defined output from the projects: as shown in the developed framework presented in Figure 8. 'What' organizations want to do is very clear; they want to survive / improve / thrive. They want to

obtain market dominance and improve competitive positioning, according to the Akinc and Meredith (2015), Lowe and Locke (2006) and Steuer et al., (2011) definitions of the term. However, the authors did observe some key differences in the case studies. The 13 knowledge transfer projects that have been analyzed in this paper are grouped into two groups: manufacturing cases (C1 to C7) and healthcare cases (C8 to C13). There observable differences between the two groups of cases, in terms of the focus of their knowledge transfer projects, the measurement of the success of the project, and the outcomes of these projects. Most (but not all) of manufacturing cases invested heavily in terms of the organizations infrastructure (production, layout, IT, training and future growth) to maximize the return of investment project of the project. In contrast the healthcare cases focused on process redesign, the use of management techniques adopted from manufacturing, and a clear step change into service operations.

The difference in the focus of the projects, alongside the difference in measuring the success of the projects: profitability and entry into new markets for the manufacturing cases; and cost savings, increasing / releasing capacity, and increasing access to or uptake of services for the none profit making healthcare cases, mark two of the key differences observed between the two groups of case studies. The third, and potentially most important for this study is the outcomes of the project, as measured by the difference in the starting positions before the knowledge transfer project (Figure 7) and the position after the project (Figure 8).

Both groups of cases as a whole showed identifiable movement towards the "competitive edge" (Lowe and Locke, 2006; Steuer et al., 2011, Akinc and Meredith, 2015), however this 'improvement' appears to be greater for the healthcare organizations. This is potentially explained by the difference between public and private sector organizations, in that private sector organizations would not have survived with the ability to rapidly adapt to

changes in the environment, and therefore can been seen as already being reasonably efficient at knowledge transfer and implementation (Bessant et al., 2003; Maldonado-Guzmán, et al., 2016). Healthcare (and other public sectors) appear to view as innovative techniques and technologies that are seen as standard in other sectors (Bamford and Griffen, 2008; Cheng et al., 2015; Papalexi et al., 2016) and therefore there was the potential for greater impact from the projects (Liu et al., 2014). From an operations management perspective this is seen more as having greater potential to increase the operations managers 'production' know-how as quickly as possible in order to provide the capability and capacity which will facilitate the required improvements (Ferdows, 2006)

The authors also observed that there each organization did not benefit equally for their knowledge transfer partnership. The two reasons identified to explain this were the organizations attitude to taking risk and willingness to potentially radically alter their service offering (Boer et al., 2001; Fox et al., 2013; Li et al., 2012), which due to their very nature was viewed as being universally low for the healthcare cases and much more varied for the manufacturing organizations.

What we have attempted to do within this paper is to examine the 'how' question. 'How' is where universities can help project manage knowledge transfer by defining the evidence based approaches to achieving these objectives - not just achieving success, but a higher achievement of objectives from a controlled and planned perspective. Where this can be demonstrated it makes a tangible contribution to an organization.

This paper demonstrates that effective technology transfer from universities to enterprises is not only hypothetically feasible, but also realistically tangible; reinforcing the view of Aboelmaged (2014) that knowledge management capability influences innovation performance, which directly impacts performance. Of course, the longitudinal nature of the research period is also an important factor, supporting Dooley et al., (2013) with their

observation that knowledge transfer requires lengthy, direct and intense interactions. The paper has explored the involvement of Business and Management Schools in transferring knowledge through formal schemes and examined the value and impact of these activities by developing a bespoke framework and by analyzing the perceived 'improvement' through its application. As a contribution the framework is transferrable and should be of interest to both academic and professional researchers in the field. The authors acknowledge Maguire's (2012) perception that the notion of value and its achievement will vary depending on the particular situation and the stakeholders involved.

The paper develops the work of Alexander and Childe (2013) and Siegel (2011) who both discussed the need for a growth in university technology transfer and the associated management and policy implications. However, there do exist a number of unanswered / unexplored areas that, given word limitations and the need for a defined focus to this paper, are perhaps more appropriate for future papers and research focus: i) The impact (Upton et al., 2014; Hug et al., 2013; Parker and Teijlingen, 2012; Reed, 2016) that universities are actually capable of regards transfer needs to be more fully explored, especially with regards Business School and none science based projects; ii) the concept of 'additionality', taken from the worlds of economics / financial accounting (Marino et al., 2016) and meaning what has actually been achieved 'in addition' to what would have been done anyway. This is a different usage than that suggested by Brotherton (2004) who examined critical success factors in UK budget hotels, defining additionality as the provision of services, etc., to differentiate one offer from another. Investigating aspects of additionality, the level of analysis would require far more rigorous monitoring pre / during / post project and was outside the scope of this paper; and finally iii) there appears to be a lack of formal research available on these areas within the top ranked academic journals – surely a tempting proposition for future researchers.

It should also be stressed that the universities benefited from the project relationship as well. They grew their management and service-related research base, often as part of strategic plans both nationally and internationally, and transferred the application of approaches to the design of strategic management support systems, development and improvement. For the universities the knowledge transfer projects also generated MPhil, MSc and PhD dissertations, plus multiple papers in refereed journals and conference proceedings. They also benefited from the ongoing relationships set-up by the projects in terms of inputs to other research activities and teaching, e.g.: development of case studies for use in teaching; student placements; guest lectures from company staff; employment of graduates; company staff attending courses; follow-on funding. There is definitely an aspect of win-win to the whole concept of the knowledge transfer projects, not least for the associate employed who benefits from the high-profile nature of the role and all that brings, often including the award of a higher degree and employment.

As a final word, in terms of increasing the levels of confidence and predictability, and of reducing the risk that businesses expose themselves to, the analysis and resulting evidence base presented by this empirical research proves that knowledge transfer from universities to businesses is tangible. That being the case, this paper directly answers the call by Joglekar et al., (2016) for further investigations and public policy research into operational within the healthcare and high-tech manufacturing industries, and shows the potential for comparing one sector with another (Table 8). It also provides tangible proof of the effectiveness of Knowledge Transfer Partnerships for the UK Government, and makes a strong case for the continuation of funding in this area.

References – need to update these regard the additions by the team

Aalbers, R., Dolfsma, W. and Koppius, O., 2014. Rich ties and innovative knowledge transfer within a firm. *British Journal of Management*, 25(4), pp.833-848.

Aboelmaged, M.G., 2014. Linking operations performance to knowledge management

capability: the mediating role of innovation performance. *Production Planning & Control*, 25(1), pp.44-58.
Akinc, U and Meredith, J.R., 2015, Make-to-forecast: customization with fast delivery", *International Journal of Operations & Production Management,* 35(5), pp.728 – 750.
Alexander, A.T. and Childe, S.J., 2013. Innovation: a knowledge transfer perspective. *Production Planning & Control*, 24(2-3), pp.208-225.
Al-Faraj, T.N., Alidi, A.S. and Bu-Bubshait, K.A., 1993. Evaluation of bank branches by means of data envelopment analysis. *International Journal of Operations & Production Management,* 13(9), pp.45-52.
Alvesson, M. and Sandberg, J., 2011. Generating research questions through problematization. *Academy of Management Review*, 36(2), pp.247-271.
Anand, G., Ward, P. and Tatikonda, M. 2010. Role of explicit and tacit knowledge in Six Sigma projects: An empirical examination of differential project success. *Journal of Operations Management,* 28(4), pp.303-315.
Anderson, E.G.J., Chandrasekaran, A., Davis-Blake, A. and Parker, G.G. 2018. Managing distributed product development projects: Integration strategies for time-zone and language barriers. *Information Systems Research,* 29(1), pp. 42-69.
Anderson, M. A., E. G. Anderson, G. G. Parker. 2013. Operations Management for Dummies. John Wiley and Sons Inc, Hoboken, NJ.
Anderson, T.R, Daim, T.U. and Lavoie. F.F., 2007. Measuring the efficiency of university technology transfer. *Technovation* 27 (5), pp.306-318.
Ansoff, H. I. 1965, *Corporate strategy*. New York: McGraw-Hill.
Ansoff, H.I., 1957. Strategies for diversification. *Harvard Business Review*, 35(5), pp.113-124.
Argote, L., & Hora, M. 2017. Organizational learning and management of technology. *Production and Operations Management*, 26(4), 579-590.
Audretsch, D.B., Lehmann, E.E. and Wright, M., 2014. Technology transfer in a global economy. *The Journal of Technology Transfer,* 39(3), pp.301-312.
Arthur, W.B., 2010. *The Nature of Technology: What It Is and How It Evolves*, New York: Free Press.
Azagra-Caro, J. M., Barberá-Tomás, D., Edwards-Schachter, M. and Tur, E. M. 2017. Dynamic interactions between university-industry knowledge transfer channels: A case study of the most highly cited academic patent. *Research Policy*, 46, pp.463-474.
Bamford. D.R, Forrester P.l. & Ismail.M, 2011, Analysing approaches to technology transfer in the UK National Health Sector, *OR Insight,* 24 (2), pp 90-109.
Bamford.D & Griffen.M 2008, A case study into operational team-working in healthcare, *International Journal of Operations and Production Management*, 28 (3), pp.215-237.
Banal-Estañol, A., Macho-Stadler, I. and Pérez-Castrillo, D. 2018. Endogenous Matching in University-Industry Collaboration: Theory and Empirical Evidence from the United Kingdom. *Management Science*, 64(4), pp.1591-1608.
Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management,* 17(1), pp.99–120.
Barney, J.B. 2001. Resource-Based Theories of Competitive Advantage: A Ten-Year Retrospective on the Resource-Based View. *Journal of Management*, 27(6), pp.643–50.
Bartunek, J.M., Rynes, S.L. and Ireland, R.D., 2006. What makes management research interesting, and why does it matter? *Academy of Management Journal*, 49(1), pp.9-15.
Bekkers, R. and Bodas Freitas, I. 2008. Analysing knowledge transfer channels between universities and industry: To what degree do sectors also matter?. *Research Policy*, 37(10), pp.1837-1853.
Bessant, J., Kaplinsky, R. and Lamming, R., 2003. Putting supply chain learning into

practice. *International Journal of Operations & Production Management*, 23(2), pp.167-184.
Bhattacharjee, S. and Chakrabarti, D., 2015. Investigating India's competitive edge in the IT-ITeS sector. *IIMB Management Review*, 27(1), pp.19-34.
Boer, H., Caffyn, S., Corso, M., Coughlan, P., Gieskes, J., Magnusson, M., Pavesi, S. and Ronchi, S., 2001. Knowledge and continuous innovation: the CIMA methodology. *International Journal of Operations & Production Management*, 21(4), pp.490-504.
Brotherton, B., 2004. Critical success factors in UK budget hotel operations. *International Journal of Operations & Production Management*, 24(9), pp.944-969.
Cheng, J. L. C. 1983. Interdependence and coordination in organizations: A role-system analysis. Acad. Managment Journal.26(1): 156–162.
Cheng, S., Bamford, D., Papalexi, M., Dehe, B. 2015. Improving access to health services – Challenges in Lean application, *International Journal of Public Sector Management*, 28(2), pp. 121-135.
Cohen, W.M. and Levinthal, D.A., 1990. 'Absorptive Capacity: A New Perspective on Learning and Innovation'. *Administrative Science Quarterly*, 35 (1), pp.128-152.
Coombs, H., Porch, M. and Telford, B. 2012. 'A critical and analytical study of the benefits of Knowledge Transfer Partnerships (KTPs) to the teaching of business and management students'. University of Glamorgan.
Cousins P.D., Lawson B, Squire B., 2006. Supply chain management: theory and practice ? the emergence of an academic discipline? International Journal of Operations and Production Management. 26 (7):697-702.
Cuervo-Cazurra, A., Caligiuri, P., Andersson, U., & Brannen, M. Y. 2013. From the Editors: How to write articles that are relevant to practice. *Journal of International Business Studies*, 44 (4), pp 285–289.
De Beuckelaer, A. and Wagner, S.M., 2012. Small sample surveys: increasing rigor in supply chain management research. *International Journal of Physical Distribution & Logistics Management*, 42(7), pp.615-639.
Decter, M., Bennett, D. and Leseure, M., 2007. University to business technology transfer—UK and USA comparisons. *Technovation*, 27(3), pp.145-155.
Dehe, B. and Bamford, D. 2015. 'Development, test and comparison of two Multiple Criteria Decision Analysis (MCDA) models: A case of healthcare infrastructure location' *Expert Systems With Applications*, 42(19), pp. 6717-6727.
Dehe, B. and Bamford, D. 2017. Quality Function Deployment and operational design decisions–a healthcare infrastructure development case study. Production Planning & Control, 28(14), 1177-1192.
Dooley, L., Kirk, D. and Philpott, K., 2013. Nurturing life-science knowledge discovery: managing multi-organization networks. *Production Planning & Control*, 24(2-3), pp.195-207.
Eisenhardt, K. and Graebner, M. 2007. Theory Building From Cases: Opportunities And Challenges. *Academy of Management Journal*, 50(1), pp.25-32.
Ferdows, K. 2006. POM forum: transfer of changing production know-how. *Production and Operations Management*, 15(1), 1-9.
Fereday, J., and Muir-Cochrane, E. 2006. 'Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods*, 5(1), pp.80–92
Finch, J and Geiger, S 2011 'Constructing and contesting markets through the market object', *Industrial Marketing Management*, 40(6) pp.899–906.
Forker, L. and Mendez, D., 2001. An analytical method for benchmarking best peer suppliers. *International Journal of Operations & Production Management*, 21(1/2), pp.195-209.
Fox, G.L., Smith, J.S., Cronin, J.J., Brusco, M., 2013, Weaving webs of innovation,

International Journal of Operations & Production Management, Vol. 33 (1) pp. 5 – 24.
Froehle, C. M. and White, D. L., 2014. 'Interruption and Forgetting in Knowledge-Intensive Service Environments', Production & Operations Management, 23(4), pp. 704–722
Gaimon, C., & Bailey, J. 2013. Knowledge management for the entrepreneurial venture. *Production and Operations Management*, 22(6), 1429-1438.
Gaimon, C., Hora, M., & Ramachandran, K. 2017. Towards building multidisciplinary knowledge on management of technology: an introduction to the special issue. *Production and Operations Management*, 26(4), 567-578.
Gaimon, C., Schoenherr, T., Bendoly, E., Bachrach, D. G., & Hood, A. C., 2017. 'Task Interdependence Impacts on Reciprocity in IT Implementation Teams: Bringing Out the Worst in Us, or Driving Responsibility?', Production and Operations Management, p. 667-685
Gertner, D., Roberts, J. and Charles, D. 2011. University-industry collaboration: a CoPs approach to KTPs, *Journal of Knowledge Management,* 15(.4), pp. 625-647.
Giddens, A. and Sutton, P.W., 2013. Sociology, Polity Press; 7th Edition, London
Gioia, D. A., K. G. Corley, A. L. Hamilton. 2013. Seeking qualitative rigor in inductive research notes on the Gioia methodology. Organiz. Res. Methods 16(1): 15–31
Giudice, D.M., Formica, P. and Carayannis, E. 2008. 'Special issue industry and research: cross-cultural perspectives on knowledge transfer and entrepreneurial interaction', *Industry and Higher Education*, 22(6), pp. 337-42.
Grant, R.M. 1991. 'The Resource-based Theory of Competitive Advantage: Implications for Strategy Formulation', *California Management Review*, 33, (3), pp.114-135.
Guo, L. Tobias, J., Bendoly, E., Hu, Y. (2017) "Different departments, different drivers: Asymmetry in antecedents and outcomes of voluntary knowledge exchange between sales and production functions", International Journal of Operations & Production Management, Vol. 37 Issue: 8, pp.1031-1053,
Han, C., Dong, Y. and Dresner, M. (2013) 'Emerging Market Penetration, Inventory Supply, and Financial Performance', Production and Operations Management, 22(2), pp. 335–347.
Hardcopf, R, Goncalves, P, Linderman, K & Bendoly, E., 2017, 'Short-term bias and strategic misalignment in operational solutions: Perceptions, tendencies, and traps', European Journal of Operational Research, no. 3, p. 1004,
Henderson, R., Jaffe, A.B. and Trajtenberg, M., 1988. Universities as a source of commercial technology: analysis of university planning'. *Review of Economics and Statistics*, 80(1), pp.119-127.
Hewitt-Dundas, N. 2012. Research intensity and knowledge transfer activity in UK universities. . *Research Policy*, 41, pp.262-275.
Hodgkinson, G. P., & Rousseau, D. M. 2009. Bridging the rigour–relevance gap in management research: It's already happening! *Journal of Management Studies*, 46(3), 534-546.
Hug, S. E., Ochsner, M., & Daniel, H. D. 2013. Criteria for assessing research quality in the humanities: a Delphi study among scholars of English literature, German literature and art history. *Research Evaluation*, 22(5), 369-383.
Iorio, R., Labory, S. and Rentocchini, F. 2017. The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: An analysis of Italian academic scientists. *Research Policy*, 46, pp.497-509.
Joglekar, N., Davies, J. and Anderson, E. 2016. The Role of Industry Studies and Public Policies in Production and Operations Management. *Production and Operations Management Society*, 25(12), pp.1977-2001.
Kitson, M., Howells, J., Braham, R. and Westlake, S. 2009, *The Connected University: Driving Recovery and Growth in the UK Economy*, NESTA, London.

Knowledge Transfer Partnerships (KTP). 2009, *Knowledge Transfer Partnerships: Annual Report 2008/09*, Technology Strategy Board, London.
Landry, R., Saïhi, M., Amara, N. and Ouimet, M. 2010. Evidence on how academics manage their portfolio of knowledge transfer activities. *Research Policy*, 39(10), pp.1387-1403.
Lang, M., Deflorin, P., Dietl, H., & Lucas, E. 2014. The impact of complexity on knowledge transfer in manufacturing networks. *Production and Operations Management*, 23(11), 1886-1898.
Lawson, B. and Potter, A., 2012. Determinants of knowledge transfer in inter-firm new product development projects. *International Journal of Operations & Production Management*, 32(10), pp.1228-1247.
Letmathe, P., Schweitzer, M. and Zielinski, M. 2012. How to learn new tasks: shop floor performance effects of knowledge transfer and performance feedback. *Development and Learning in Organizations: An International Journal*, 26(5).
Levine, S.S, 2011, 'How Knowledge Transfer Impacts Performance: A Multilevel Model of Benefits and Liabilities', *Organization Science*, 23(6), pp 1748 – 1766.
Lewin, A., Massini, S. and Peeters, C. 2011. Microfoundations of Internal and External Absorptive Capacity Routines. *Organization Science*, 22(1), pp.81-98.
Li, Y., Tarafdar, M. and Subba Rao, S., 2012. Collaborative knowledge management practices: theoretical development and empirical analysis. *International Journal of Operations & Production Management*, 32(4), pp.398-422.
Liu, S., Moizer, J., Megicks, P., Kasturiratne, D. and Jayawickrama, U., 2014. A knowledge chain management framework to support integrated decisions in global supply chains. *Production Planning & Control*, 25(8), pp.639-649.
Liu, Y., Guo, H. and Nault, B. R. (2017) 'Organization of Public Safety Networks: Spillovers, Interoperability, and Participation', Production and Operations Management, 26(4), pp. 704–723.
Lodge. A and Bamford. D. 2008. 'Using Lean Techniques in Radiology Waiting Time Improvement: a case study', *Public Money and Management*, 28, (1), pp.49-52.
Lowe, A, and Locke, J., 2006. 'Constructing an 'efficient frontier' of accounting journal quality', *British Accounting Review*, 38, pp.321–341.
Maguire, S., 2012. Special Issue Editorial–Production Planning & Control: Service Science. *Production Planning & Control*, 23(7), pp.477-479
Maldonado-Guzmán, G., Lopez-Torres, G.C., Garza-Reyes, J.A., Kumar, V. and Martinez-Covarrubias, J.L., 2016. Knowledge management as intellectual property: evidence from Mexican manufacturing SMEs. *Management Research Review*, *39*(7).
Malik, T.H. 2013. National institutional differences and cross-border university–industry knowledge transfer. *Research Policy*, 42, pp.776-787.
Mallet, D. 2006, Sampling and weighting, in Grover, R. and Vriens, M. (Eds), *The Handbook of*
Marketing Research: Uses, Misuses, and Future Advances, Sage, Thousand Oaks, CA,
pp. 159-77.
Mansfield, E, 1991, Academic research and industrial innovation, *Research Policy*, 20 (1), pp. 1–12.
Marino, M., Lhuillery, S., Parrotta, P. and Sala, D., 2016. Additionality or crowding-out? An overall evaluation of public R&D subsidy on private R&D expenditure. *Research Policy*, 45(9), pp.1715-1730
Markowitz, H.M., 1952. Portfolio selection, *Journal of Finance*, 7, (1), pp.77–91.
McAdam, R, Leonard, D, Henderson, J & Hazlett, S-A,, 2008, 'A grounded theory research approach to building and testing TQM theory in operations management', Omega, vol. 36, no. 5, pp. 825–837,

Meredith, J. and Pilkington, A. 2018. Assessing the exchange of knowledge between operations management and other fields: Some challenges and opportunities. *Journal of Operations Management*, 60(1), pp.47-53.
Mom, T.J.M, van Neerijnen, P, Reinmoeller, P and Verwaal, E, 2015, Relational Capital and Individual Exploration: Unravelling the Influence of Goal Alignment and Knowledge Acquisition, *Organization Studies*, 36 (6), pp.809-829.
Muthulingam, S. and Agrawal, A. 2016. Does Quality Knowledge Spillover at Shared Suppliers? An Empirical Investigation. *Manufacturing & Service Operations Management*, 18(4), pp.525-544.
Nagati, H. and Rebolledo, C., 2012. The role of relative absorptive capacity in improving suppliers' operational performance. *International Journal of Operations & Production Management*, 32(5), pp.611-630.
Nagati, H. and Rebolledo, C., 2013. Improving operational performance through knowledge exchange with customers. *Production Planning & Control*, 24(8-9), pp.658-670.
Nicholson, J. D., LaPlaca, P., Al-Abdin, A., Breese, R., & Khan, Z. 2018. What do introduction sections tell us about the intent of scholarly work: A contribution on contributions. *Industrial Marketing Management*, 73, 206-219.
Olmos-Penuela, J., Castro-Martínez, E. and D'Este, P. 2014. Knowledge transfer activities in social sciences and humanities: Explaining the interactions of research groups with non-academic agents. Research Policy, 43, pp.696-706.
Paiva, E., Roth, A. and Fensterseifer, J. 2008. Organizational knowledge and the manufacturing strategy process: A resource-based view analysis. *Journal of Operations Management*, 26(1), pp.115-132.
Papalexi, M., Bamford, D. and Dehe, B., 2016. A case study of kanban implementation within the pharmaceutical supply chain. *International Journal of Logistics Research and Applications*, 19(4), pp.239-255.
Parker, J. and Van Teijlingen, E., 2012. The Research Excellence Framework (REF): Assessing the impact of social work research on society. *Practice*, 24(1), pp.41-52.
Patel, P., Terjesen, S. and Li, D. 2012. Enhancing effects of manufacturing flexibility through operational absorptive capacity and operational ambidexterity. *Journal of Operations Management*, 30(3), pp.201-220.
Pawar, K.S. and Rogers, H., 2014. Mobilising knowledge across organizational boundaries: addressing human issues in the telecommunications industry. *Production Planning & Control*, 25(5), pp.355-371
Perkmann, M., Neely, A. and Walsh, K. 2011, How should firms evaluate success in university–industry alliances? A performance measurement system, *R&D Management*, 41(2), pp. 202-216.
Porter, M.E. 1980. *Competitive Strategy*, Free Press, New York.
Rahmani, M., Roels, G. and Karmarkar, U. S. (2017) 'Collaborative Work Dynamics in Projects with Co-Production', Production and Operations Management, 26(4), pp. 686–703
Ram, J, Wu, M-L, and Tagg, R. 2014. 'Competitive advantage from ERP projects: Examining the role of key implementation drivers', *International Journal of Project Management*, 32(4) pp.663–675.
Reed, M.S., 2016. *The Research Impact Handbook*. Fast Track Impact, Huntly Aberdeenshire, U.K.
Radaelli, G., Guerci, M., Cirella, S. and Shani, A.B. 2014. Intervention Research as Management Research in Practice: Learning from a Case in the Fashion Design Industry, *British Journal of Management, 25(2), pp.335–351*.
Reid, I, Matthias, O, Bamford, D. 2019. Management Consultancy's role in delivering lasting [Triple Bottom Line] benefits, Production Planning & Control, Vol 30. Iss5-6. pp 479-492

Robson, E.H. 1996, Linking small firms with higher education, *Industry and Higher Education*, 10(2), pp.103-108.
Roper, S., Love, J. H. and Bonner , K. 2017. Firms' knowledge search and local knowledge externalities in innovation performance. *Research Policy*, 46, pp.43-56.
Sengupta, A. and Ray, A. S. 2017. University research and knowledge transfer: A dynamic view of ambidexterity in british universities. *Research Policy*, 46, pp.881-897.
Setia, P. and Patel, P. 2013. How information systems help create OM capabilities: Consequents and antecedents of operational absorptive capacity. *Journal of Operations Management*, 31(6), pp.409-431.
Shalley, C. E. and Gilson, L. L. (2017) 'Creativity and the Management of Technology: Balancing Creativity and Standardization', Production and Operations Management, 26(4), pp. 605–616.
Sharifi, H. and Ismail, H.S. and Reid, I. 2009. Framework for Developing an Agile Future-proof Supply Chain. In: Dekkers, R, ed. *Dispersed Manufacturing Networks; Challenges for Research and Practice*. Springer, Heidelberg, pp. 147-172.
Siegel, D.S., 2011. The rise of university technology transfer and academic entrepreneurship: managerial and policy implications. In Audretsch, D.B., Falck, O. and Heblich, S., ed. *Handbook of Research on Innovation and Entrepreneurship*, Cheltenham, UK: Edward Elgar.
Siegel, D.S., Waldman, D.A., Atwater, L.E. and Link, A.N, 2004. Assessing the Impact of Organizational Practices on the Productivity of University Technology Transfer Offices. *Research Policy*, 32 (1), pp.27-48.
Sołoducho-Pelc, L 2014. Competitive advantage: the courage in formulating objectives and expansiveness of a strategy', Procedia - *Social and Behavioral Sciences*, Vol.150, pp.271–280.
Spring, M., Hughes, A., Mason, K. and McCaffrey, P. 2017. Creating the competitive edge: A new relationship between operations management and industrial policy. *Journal of Operations Management*, 49-51(1), pp.6-19.
Steuer, R.E., Qi, Y, and Hirschberger, M., 2011. Comparative issues in large-scale mean–variance efficient frontier computation, *Decision Support Systems*, 51, pp.250–255.
Su, H-C, Lindermanb, K, Schroederb, R.G, and Van de Venca, A.H. 2014. A comparative case study of sustaining quality as a competitive advantage', *Journal of Operations Management*, 32(7-8), pp.429–445.
Tartari, V., Perkmann, M. and Salter, A., 2014. In good company: The influence of peers on industry engagement by academic scientists. *Research Policy*, 43 (7), pp.1189-1203.
Ternouth, P., Garnier, C., Wood, L. and Forbes, P. 2012. *Key Attributes for Successful Knowledge Transfer Partnerships*. Report to the Technology Strategy Board and Research Councils, London: Council for Industry and Higher Education (CIHE)
Thorpe, R. and Rawlinson, R., 2014. Engaging with engagement: how UK business schools could meet the innovation challenge. *Journal of Management Development*, 33 (5), pp.470-486.
Tidd, J. and Bessant, J., 2009. *Managing Innovation: Integrating Technological, Market and Organizational Change*. Chichester, UK: John Wiley and Sons.
Tucker, A. L. and Singer, S. J. 2015. The effectiveness of management-by-walking-around: A randomized field study. *Production and Operations Management*, 24(2), 253-271.
Upton, S, Vallance, P, and Goddard, J. 2014. From outcomes to process: evidence for a new approach to research impact assessment, *Research Evaluation*, 23, (4), pp. 352-365.
Volberda, H., Foss, N. and Lyles, M. 2010. PERSPECTIVE—Absorbing the Concept of Absorptive Capacity: How to Realize Its Potential in the Organization Field. *Organization Science*, 21(4), pp.931-951.

Voss, C.A., 2005. Paradigms of manufacturing strategy re-visited. *International Journal of Operations & production management*, 25(12), pp.1223-1227.
Wilson, T. 2012. *A Review of Business-University Collaboration*. London: Department for Business, Innovation and Skills
Wright, M., 2014. Academic entrepreneurship, technology transfer and society: where next?. *The Journal of Technology Transfer*, 39(3), pp.322-334.
Yin, R. 2013, *Case Study Research: Design and Methods*, 5th edition, Sage, London.
Yoo, J.W., Lemak, D.J., and Choi, Y. 2006. Principles of management and competitive strategies: using Fayol to implement Porter, *Journal of Management History*, 12(4), pp.352 – 368.
Zhang, S., Bamford, D., Moxham, C., and Dehe, B. 2012. Strategy Deployment Systems within the UK Healthcare Sector: A Case Study', *International Journal of Productivity and Performance Management*, 61, (8), pp 863-880.