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**‘Learning the Ropes’ of the  
Commercialisation of Academic Research:  
A Practice-based Approach to Learning in  
Knowledge Transfer Offices**

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A thesis submitted in September 2012 in partial fulfilment of the  
requirements for the degree of

*Doctor of Philosophy*

**SPRU - Science and Technology Policy Research  
University of Sussex**

*I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.*

*Signature:.....*

**UNIVERSITY OF SUSSEX**

Dagmara Maria Węckowska

Doctor of Philosophy in Technology and Innovation Management

***Learning the Ropes of the Commercialisation of Academic Research:  
a Practice-based Approach to Learning in Knowledge Transfer Offices*****SUMMARY**

Exploitation of the knowledge generated by university research can bring social and economic benefits; thus, knowledge transfer between universities and industry is an important aspect of public policy. In many countries, including the United Kingdom (UK), universities have been developing the capacity to support the commercialisation of publicly funded research, typically by setting up centralised Knowledge Transfer Offices (KTOs). Previous studies have revealed that KTOs need a wide range of abilities to support the commercialisation of academic research, but our understanding of how these abilities are developed and have evolved over time remains limited. In order to address this identified gap in the literature, this thesis examines the questions: What do KTOs learn? How do KTOs learn? and Why do KTOs learn?

To address these questions, the thesis adopts a practice-based view of organisational knowledge and learning. The conceptual framework developed to investigate learning by KTOs assumes that their commercialisation practice is learnt through the interactions of their staff within communities of practice, within networks of practice and across communities of practice, and that this learning can be initiated by KTO staff or by targeted strategies devised by the KTO and the university's management. This conceptual framework guides the case studies of six purposefully selected KTOs in the UK. The selection of KTOs is aimed at identifying cases with different learning patterns in order to maximise insights gained from cross-case comparisons as well as at literal replication of the findings. The analysis is based on data collected from semi-structured interviews with key staff in selected KTOs and on information from relevant documents, and follows the 'explanation building' technique (Yin, 2009). The findings reveal that KTOs tend to develop one of two types of commercialisation practice – each of which is based on different implicit assumptions about generating science-based innovation, and associated with a different set of abilities. Moreover, the findings demonstrate the processes by which changes in practice come about, highlighting the interplay between situated learning and strategic practices of management. The results presented address the aforementioned gap in the literature on university-industry knowledge transfer and contribute to the developing situated learning theory by shedding light on how incremental and more radical changes in practice emerge. The findings should be useful to policy-makers who seek to support universities to build capability for knowledge transfer.

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### ***List of Abbreviations***

ARMA - Association for Research Managers and Administrators

ASTP - Association of European Science and Technology Transfer Professionals

AURIL - Association for University Research and Industry Links

AUTM - Association of University Technology Managers

BD – Business Development

BIS – Department for Business Innovation and Skills

BTG – British Technology Group

COP – Community of Practice

CPD – Continuous Professional Development

DIUS – Department for Innovation, Universities and Skills

DTI – Department for Trade and Industry

ERDF – European Regional Development Fund

FTE – Full Time Equivalent

GINNN – the Global Innovation Network

GP – general practitioner in National Health System

HEBCI – Higher Education – Business Community Interaction Survey

HEFCE – Higher Education Funding Council for England

HEFCW – Higher Education Funding Council for Wales

HEFCS – Higher Education Funding Council for Scotland

HEIF – Higher Education Innovation Fund

HEROBC – Higher Education Reach-out to Business and Community fund

HESA – Higher Education Statistics Agency

IKT - Institute of Knowledge Transfer

IP – Intellectual Property

IPR – Intellectual Property Right

KTO – Knowledge Transfer Office

KTP – Knowledge Transfer Partnerships

LEP – Local Enterprise Partnership

LES – Licensing Executives Society

NCD – Non-Confidential Disclosure (e.g. marketing material)

NOP – Network of Practice

NRDC – National Research and Development Corporation

OECD – Organisation for Economic Co-operation and Development

OST – Office of Science and Technology

PCT – Patent Cooperation Treaty

RAE – Research Assessment Exercise

RDA – Regional Development Agency

TSB – Technology Strategy Board

UK – United Kingdom

UK IPO – Intellectual Property Office of the United Kingdom

UNICO – University-Companies Association

US – United States of America

VC – venture capitalist

## *Acknowledgements*

Writing up this thesis has proved to be one of the biggest challenges I have faced so far. Its completion would not have been possible without the support and help of many people, only some of whom it is possible to mention here.

First and foremost I am sincerely grateful to my supervisors – Puay Tang, Matias Ramirez and Ben Martin – who offered invaluable assistance and advice throughout my doctoral study. Each brought a unique perspective to my research, enriching it greatly, and each in their own way, shaped my understanding of academic work helping me to become a scholar. I also thank Michael Hopkins, who was my first year supervisor; I am grateful for his golden advice that continued to shape my work in the succeeding years.

I am very thankful to Puay Tang for introducing me to the problems of university-industry knowledge transfer, encouraging me to apply to the SPRU PhD Programme, supporting my application and being not only a supervisor but also a mentor and a good friend. I am endlessly grateful for her compassion, patience, encouragement and guidance.

I thank all my interviewees for their time and valuable input. This thesis research would not have been possible without their help.

It has been a great privilege to do a doctoral degree in SPRU, which provides a friendly and intellectually stimulating home for its PhD students. I would like to thank all the faculty members with whom I have worked over the years including Puay Tang, Matias Ramirez, Nick Von Tunzelmann, Martin Meyer, Joe Tidd, David Twigg, among others, from all of whom I learnt a great deal about teaching and research. I have been blessed by a friendly and cheerful group of fellow PhD students in SPRU, who made my time at Sussex a very enjoyable experience. Many have become good friends and have been there to provide support and see me through ups and downs along the process.

I owe special thanks to Cynthia Little for editing my final draft, and to Janet French for her administrative support and other invaluable help, including fighting the spider which inhabited the space above my desk.

I also want to thank my husband, Florian, who has been the biggest source of joy in my life at every stage in my doctoral study. His love, unwavering support and encouragement made this challenging four-year journey easier, and our many discussions helped me to clarify my ideas. I am also deeply grateful to my parents who

have always believed in me and selflessly encouraged me to follow my dreams of studying abroad.

Finally, I am thankful for the funding that made my PhD study possible. I received funding from the UK Economic and Social Research Council for the first three years. In the fourth year I worked part-time for the Business and Management Department at the University of Sussex and would like to express sincere appreciation for my colleagues' understanding and accommodation of my multiple commitments.

*How do you know what to do?*

*Others have told me. People I worked with in the past and deals that I have seen over the years.*

*Can one learn it from a handbook?*

*No, not really because it is inherent knowledge. It is inherent expertise within the sector. (Quote from an interview with a KTO Director)*

## **1 Introduction**

This thesis analyses how universities develop and refine their abilities to transfer knowledge to industry and other users, through six case studies of university Knowledge Transfer Offices (KTOs) in the United Kingdom (UK). There are various modes of knowledge transfer including: (1) transfer of know-how through informal interactions, collaborative research, contract research, consultancy or continuous professional development courses; and (2) transfer of Intellectual Property Rights (IPR) via licensing, assignments or sales to existing commercial entities or newly-formed ones (spin-offs or spin-outs). In this thesis, the focus is on the second mode of knowledge transfer, referred to as the *commercialisation* of academic research, to examine the development and refinement of the abilities to manage commercialisation activities, such as identification, protection and assessment of Intellectual Property (IP), licensing, and the formation of spin-out/spin-off companies. The development of these abilities is argued to be a particularly challenging endeavour for universities (Lambert, 2003).

This thesis draws upon aspects of organisational science in order to bring new insights to science, technology and innovation policy studies concerned with knowledge transfer from universities to industry. Thus, the science, technology and innovation policy community is the primary intended audience for this thesis. In studying how university KTOs ‘learn the ropes’ related to the commercialisation of academic research, this thesis makes a contribution to situated learning theory, which has been developed in organisational studies since the early 1990s. Therefore, the secondary audience for this thesis is scholars interested in situated learning, and organisational learning in general. Finally, the findings in this thesis should be of interest to policy makers and other stakeholders concerned about the effectiveness of university-industry knowledge transfer.

This chapter provides an overview of the research. Section 1.1 discusses the benefits of commercialising academic research, the drivers of research commercialisation, and the challenges that universities are facing as a result of their changing role. As explained above, the purpose of this research is to investigate development of the ability to commercialise academic research. Section 1.2 presents the research questions and the research design deployed to address them. Section 1.3 provides a brief outline of the succeeding chapters.

### **1.1 The challenge for universities at the turn of the 21<sup>st</sup> century**

It is widely accepted in the field of science, technology and innovation studies “that the innovative capacity of a nation depends not only on the strength of individual ‘players’ (firms, universities, government research laboratories) but perhaps more importantly on the links between those actors” (Morlacchi and Martin, 2009: 578). There is substantial evidence showing that well-functioning university-industry links have a positive effect on the economic performance (Mansfield, 1991; for a review see Salter and Martin, 2001). Publicly funded research makes contributions to the economy (and society) by increasing the stock of commercially useful knowledge, by training skilled graduates, by developing new instrumentation and methodologies, through the creation of social networks in which knowledge is shared informally, by helping to solve complex industry problems, and by creating new companies (Salter et al., 2000; Salter and Martin, 2001). Some of these benefits are delivered through the commercialisation of academic research. For instance, Cardozo et al (2011) estimate that the commercialisation of academic inventions in the United States (US) resulted in the introduction of more than 3,100 new products between 1998 and 2004. They estimate also that \$1 billion of licensing income received by universities in that period represents \$20–\$50 billion total sales of products and services based on IP licensed from universities.<sup>1</sup> Following the same logic, I estimate that academic inventions in UK universities resulted in a contribution of £1.1billion to £2.9 billion of firm sales in the year 2009/10 as total UK university licensing income in 2009/10 was £58m (HEFCE, 2011a).

The commercialisation of academic research benefits societies not only by stimulating economic growth, but also equally importantly through the application of

---

<sup>1</sup> Estimate based on the premise that licensing income typically represents 2%–5% of sales made by businesses that licensed the IP



this research to satisfy societal needs, such as health or environmental problems. A famous example of this is the commercialisation of the irradiation technique developed at the University of Wisconsin-Madison. The technique stimulates living organisms to produce Vitamin D and its applications in the early 20<sup>th</sup> century helped to eliminate rickets (George, 2005).

Given these potential economic and societal benefits, it is not surprising that the commercialisation of academic research is of great interest to public policy makers. Governments are motivated to support the commercialisation of academic research because of its potential beneficial effects on the economy and society and also to respond to increased demands for public accountability, which require some demonstration of the returns on public investment in science (Martin and Etzkowitz, 2000; OST, 1993). Governments around the world are trying to foster the development of closer links between universities and industry by supporting the creation of university KTOs and other intermediary organisations, by subsidising collaborative research, by creating ‘seed capital’ funds to nurture university spin-out companies, and by ensuring that national legislative frameworks support university commercialisation activities (Mowery and Sampat, 2005b). A prime example of such legislation was the 1980 US Bayh-Dole Act. This produced a ‘step-change’ in relation to the ownership of IP generated by federally-funded research. Previously this IP was the property of the US Federal Government. The Bayh-Dole Act transferred ownership to the universities, which means that universities have the right to license all IP generated by publicly-funded research. This type legislation has been emulated in other countries to varying degrees, but experts have cautioned that the mere replication or adoption of Bayh-Dole type laws is unlikely to be effective because of cross-country differences in the structure of higher education systems, the history of university-industry interactions, and institutional contexts (Nelson, 2001; Mowery and Sampat, 2005a).

The increased commercialisation of academic research has been driven also by the needs of industry and the universities. Etzkowitz and Leydesdorff (1997) make three main arguments. First they argue that in a knowledge-based economy characterised by economic growth driven by the generation and dissemination of knowledge, globalisation and tough competition, commercial organisations increasingly source knowledge from other organisations, including universities, to cope with shorter product life cycles and limited internal capabilities. Second, they argue that developments in new scientific fields, such as information and communication technologies,

biotechnology and nanotechnology, have opened up new avenues for science-based innovation and stimulated the emergence of new high-tech industries, which continue to work closely with academic scientists. Third, they argue that universities are diversifying their sources of funding in the face of declining public support for research. Knowledge transfer activities, including commercialisation, are perceived as providing a potential income stream (Dexter et al., 2007). The commercialisation of academic research is being driven also by the agendas of individual academics (Ding and Choi, 2011), and the intensity of engagement in commercialisation activities has been shown to depend on individual values and beliefs (Haeussler and Colyvas, 2011), their contacts with industry (Thursby and Thursby, 2004) and the characteristics of research groups (Bercovitz and Feldman, 2011).

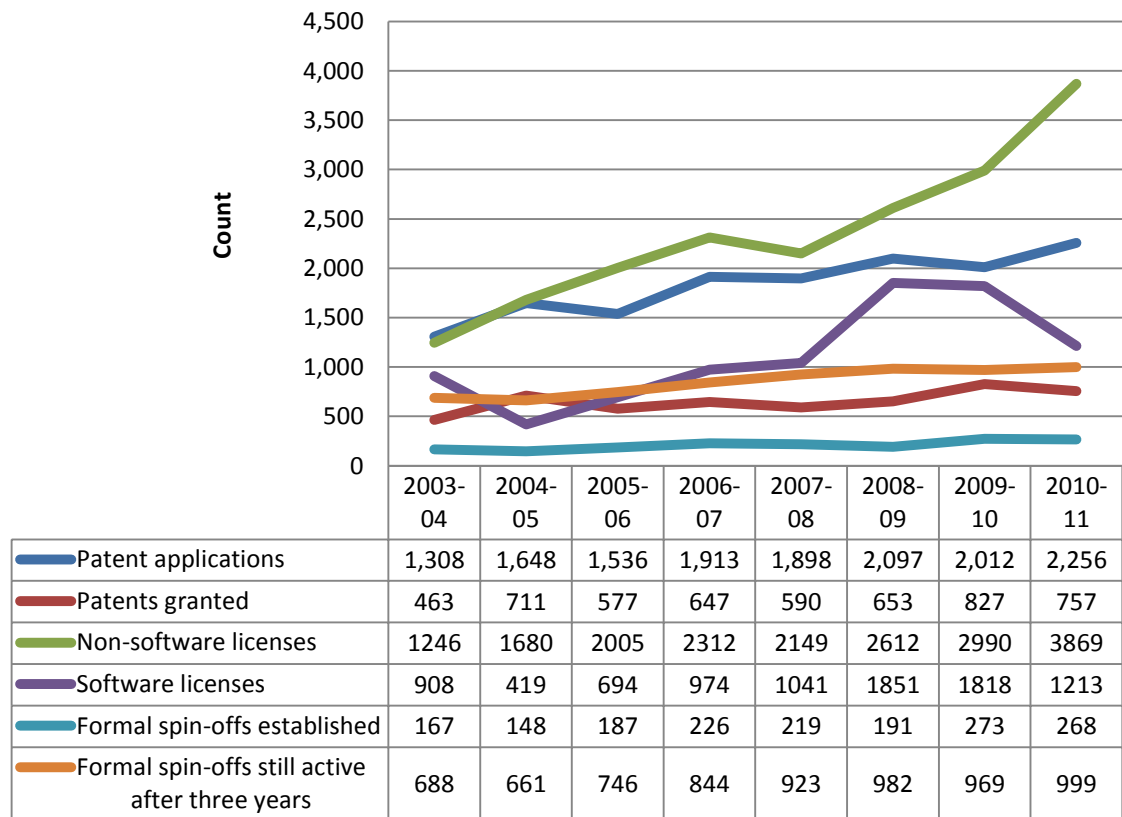
Driven by developments in science, by the needs of industry and universities, and by government policies, the role of universities has been changing. Universities have been more closely linked to industrial and societal needs since the 1980s than in the period 1940-1980, but not necessarily more than in the 19<sup>th</sup> century (Etzkowitz and Leydesdorff, 2000; Martin and Etzkowitz, 2000). Some scholars refer to the emergence of the 'entrepreneurial university' (Etzkowitz and Leydesdorff, 1997; Clark, 1998). Others talk about the changing social contract that is obliging universities to make both short- and long-term contributions to society and the economy as opposed to previous expectation of only long-term contributions (Guston and Keniston (1994) cited in Martin and Etzkowitz, 2000).

Serious concerns have been raised about the potential unintended consequences of the changing role of universities and, in particular, consequences of the increased engagement of academics in commercialisation activities. First, there is a possibility that close industrial ties may shift the attention of academics away from basic research towards applied research (Dasgupta and David, 1985; Noble, 1977). This issue was also referred to as the 'corporate manipulation thesis' (Noble, 1977) or the 'skewing problem' (Florida and Cohen, 1999). Basic research is important for long term technological progress and therefore such a shift would be deeply worrying. The empirical evidence, however, remains inconclusive and includes both findings supporting the 'skewing' problem' (Blumenthal et al., 1996) as well as findings that do not support this concern (Van Looy et al., 2006). Second, concerns were raised about the effects of university-industry collaboration in the research commercialisation on the dissemination of knowledge (Dasgupta and David, 1985; Slaughter and Leslie, 1997).

Firms prefer to minimise or at least delay public disclosure of research findings in order to file a patent application and increase the appropriability of rents generated from product and process innovations. The evidence shows that engagement in entrepreneurial activities indeed can restrict publication (Blumenthal et al., 1997). Some scholars have argued that restricted disclosure could diminish research quality as research methods and results would not be laid bare in the public domain and made available for the scrutiny of peer scientists (Cohen, 1998; Nelson, 2004). The emerging evidence however suggests that the quality of research and patenting or contract research go hand in hand (Calderini and Franzoni, 2004; Agrawal and Henderson, 2002; Van Looy et al., 2004). Besides lowering research quality, restricted publication could also lead to the duplication of research efforts (Cohen, 1998) and restricts data sharing within the scientific community (Campbell et al., 2000). All three unintended consequences of the restricted disclosure of research findings could impede technological and scientific progress in the long term (Nelson, 2004). More evidence is needed to draw unequivocal conclusions about such impacts. Other concerns over research commercialisation raised by scholars include the loss of time for basic research, loss of teaching and teaching preparation time, departure of academic staff to industry and legal fees and cost of patenting (Slaughter and Leslie, 1997).

Despite the aforementioned concerns, there has been a significant increase in the commercialisation of academic research. Figure 1.1 illustrates the growth in commercialisation activities in the UK. It shows a significant increase in patenting activity (72% increase in patent applications and 63% increase in patents granted), licensing (210% increase in non-software licences and 33% in software licences) and spin-out activities (60% increase in number of new established spin-outs and 45% increase in number of 3-year old spin-outs) in UK universities between 2003/4 and 2010/11. At the same time, universities' income from licensing and sales of shares in spin-out companies has increased by 56% from £44m in 2003/4 to £69m in 2010/11 (HEFCE, 2012).

Figure 1.1 Commercialisation activities in UK universities between 2003/04 and 2010/11



Source: Higher-Education Business and Community Interaction Surveys 2006-2011

However, the engagement of academics in commercialisation activities compared to other modes of knowledge transfer has been rather modest (Hughes and Martin, 2012). Also, some universities are clearly better than others at commercialising the outputs of academic research. In econometric studies of commercialisation performance (discussed below), universities that generate the most commercialisation outputs (e.g. highest licensing income) from a given amount of inputs (e.g. research income or invention disclosures) are considered to demonstrate best practice and to be ‘relatively efficient’; an inability to generate the same number of commercialisation outputs from a given amount of inputs as best practice universities is described as ‘relative inefficiency’. There are several econometric studies that reveal substantial levels of inefficiency in generating invention disclosures, patent applications, licences, royalties and industry sponsored among US universities (Link and Siegel, 2005b; Siegel et al., 2003; Thursby and Thursby, 2002; Siegel et al., 2008; Thursby and Kemp, 2002). Anderson et al. (2007) found that 47 out of 54 selected US universities were inefficient in 2004 and concluded that had these inefficient universities been efficient in that year, given their

level of inputs, \$659 million additional income would have been derived from licensing, 1,400 more licenses and options would have been executed, over 200 more start-ups, over 6,000 more patent applications, and over 2,300 more patents granted would have been achieved.

Chapple et al. (2005) looked at the efficiency of UK universities using two different methods to analyse data from a 2002 survey of 50 universities. The results of their study based on data envelopment analysis, show that, given the amount of research income and number of invention disclosures, these UK universities potentially could have achieved a five-fold increase in the number of licences and received seven-times more licensing income. The results of their stochastic frontier analysis reveal that four times more licences and three times more licensing income could have been achieved with the same amount of research income and number of invention disclosures. Not only is there discrepancy in performance across universities, but more importantly the differences prevail over time. A 1990s study found that the most efficient US universities were improving while the inefficient ones were showing an inability to catch up (Thursby and Kemp, 2002). This suboptimal performance of some universities suggests that fulfilment of their new role – that of ensuring maximum returns on public investment in science – is far from easy for many universities.

There is a vast body of literature in the science, technology and innovation field on various aspects of commercialisation of university research. Empirical evidence shows that *national policies* legitimise, enable and encourage the commercialisation of academic research (e.g. Latvia: Adamsone-Fiskovica et al., 2009; UK: Grady and Pratt, 2000; Denmark: Gregersen et al., 2009; Russia: Gokhberg et al., 2009; Germany: Krücken et al., 2009; Tanzania: Mwamila and Diyamett, 2009; Vietnam: Ngoc Ca, 2009; Sweden: Pålsson et al., 2009). Universities located in regions with higher *levels of gross domestic product* (UK: Chapple et al., 2005; US: Link and Siegel, 2005a) and higher *levels of research and development intensity* in regional firms are better at commercialising academic inventions (UK: Chapple et al., 2005; US: Friedman and Silberman, 2003; Siegel et al., 2003). Arguably these different levels in performance can be explained by a greater demand for university knowledge and greater absorptive capacity of the firms in these regions. However, pertinent to this thesis is that there is empirical evidence showing that universities can improve their commercialisation performance by:

- (1) adopting *royalty sharing policies* that encourage academics to engage in commercialisation activity (US: Friedman and Silberman, 2003; Lach and Schankerman, 2004; Renault, 2006; UK: Lach and Schankerman, 2008; Lockett and Wright, 2005);
- (2) setting up effective *licensing strategies* (Bray and Lee, 2000) and *spin-out strategies* (Degroof and Roberts, 2004; Roberts and Malone, 1996; Powers and McDougall, 2005);
- (3) ensuring that their KTOs have both legal and non-legal *expertise* (Swamidass and Vulasa, 2009);
- (4) developing *abilities* for (a) protecting IP (Meyer and Tang, 2007), (b) performing technical and commercial assessment of IP (Ndonzuau et al., 2002), (c) marketing academic inventions to potential licensees and investors (Siegel et al., 2004; Markman et al., 2005a), (d) handling contract negotiations (Siegel et al., 2003) and (e) establishing spin-out companies (Lockett and Wright, 2005).

The development of these abilities is not easy; for instance, Lambert (2003: 55) states that the skills required for commercialisation activities are “difficult to find in a small group of people and are expensive to buy in”. Several scholars note that some university KTOs lack certain abilities, such as marketing (Siegel et al., 2004), which they argue are crucial for identifying suitable licensees and potential investors for spin-out companies. Some university KTOs have developed practices that are bureaucratic and cumbersome and are not taking account of the differences between the academic and corporate worlds (Siegel et al., 2003). This suggests that some refinements or development of their abilities is required.

The academic literature on the commercialisation of academic research in the field of science, technology and innovation offers few insights into how university KTOs develop and refine the abilities required for commercialisation. Some scholars comment in passing on the nature of the KTOs’ learning (Debackere and Veugelers, 2005; Mowery et al., 2002; Cardozo et al., 2011), highlighting the importance of learning on the job. Others look at the costs of capabilities development, but do not analyse the learning process (George, 2005). Few, if any, studies look systematically at how the abilities of university KTOs, which are vital for effective commercialisation, are developed and refined over time. This thesis aims to address this evident gap in the literature.

In a context of relative paucity of studies on the processes through which KTO abilities are developed and refined compared to the plethora of work on university knowledge transfer and commercialisation activities, it is important to gain a better understanding of these processes. The insights from my research could stand as recommendations to policy-makers and university managers on how they could support the development and refinement of KTO abilities. In the UK, several efforts have been made to establish training centres for Knowledge Transfer Professionals working in university KTOs. Specifically, in 2002, 'Praxis' launched a national training programme in Cambridge for technology transfer professionals in universities, research institutions, and industry. In 2009, Praxis merged with Unico – the representative body of professionals working on commercialising university and public sector research in the UK. The UK Government subsidised PraxisUnico's delivery of training and conferences in the past, and universities are encouraging new KTO staff to attend PraxisUnico courses. However, if learning occurs predominantly on the job, in everyday work, such one-off training may not be the most suitable learning environment. Instead, a better understanding of the learning process in KTOs would shed light on how learning could be facilitated by policy-makers and university management.

## **1.2 Research questions and research design**

The objective of this thesis is to advance the rather limited understanding of the learning process through which KTOs develop and refine abilities related to the commercialisation of academic research. To achieve this, the thesis addresses the following research questions:

1. What do university KTOs learn?
2. How do university KTOs learn?
3. Why do university KTOs learn?

This thesis argues that the micro-dynamics of the learning process through which KTOs develop their ability to commercialise university research can be understood better by adopting situated learning theory as a conceptual framework. However, in common with other theories, the theory of situated learning theory has some limitations, and this thesis offers some suggestions about how these can be addressed. It proposes a framework that combines concepts from various practice-based studies to guide the data collection and analysis. The research follows a qualitative case study approach. Specifically, six case

studies of learning in purposefully selected university KTOs in the UK are presented. The data were collected from semi-structured interviews with key staff in selected KTOs and information in relevant documents. The data analysis follows the ‘explanation building’ technique (Yin, 2009). Section 1.3 outlines the remaining chapters in this thesis.

### **1.3 Outline of the thesis**

#### ***Chapter 2 Commercialisation of academics research***

This chapter synthesises insights from science, technology and innovation studies into abilities and learning in KTOs. It discusses the significance of certain abilities and points out that our understanding of KTO abilities could be enriched were they investigated simultaneously rather than separately. It reviews what scholars have claimed about the nature of the learning process and what triggers learning in university KTOs. It discusses how our understanding of the learning process could be advanced by a systematic investigation of how KTOs generate new knowledge internally and through engagement with external actors, and by a thorough analysis of the role of staff and management in triggering learning and shaping learning trajectories. The chapter concludes by justifying the choice of the conceptual framework used for the empirical research in this thesis.

#### ***Chapter 3 Theoretical framework***

Chapter 3 combines insights from practice-based studies, namely studies of situated change, situated learning and strategising, to develop a framework for the analysis of learning in university KTOs. The framework assumes first that KTOs learn how to change commercialisation practice through the interactions of their staff within intra-organisational ‘communities of practice’, within cross-organisational ‘networks of practice’ and through interactions across communities of practice, and second that learning can be initiated either by KTO staff or by the KTO and university management. I argue that the framework developed for this thesis research has the potential to develop situated learning theory by shedding light on when situated learning results in incremental and more radical changes in practice.



#### ***Chapter 4 Methodology***

Chapter 4 explains and justifies the thesis research design. I discuss the rationale for the choice of case-study as the research strategy, the selection of the six cases, the data collection methods, operationalisation of the theoretical concepts and methods of data analysis.

#### ***Chapter 5 Institutional context for commercialisation of academic research***

The validity of quantitative research is strengthened by exploring whether alternative theories offer more compelling explanations of the phenomenon being studied. Chapter 5 reviews UK policy on university-industry knowledge transfer and investigates how government policies may have shaped the evolution of commercialisation practices in university KTOs. It discusses the empirical observations that would be expected if national policies were the main factor shaping changes in the commercialisation practices in university KTOs.

#### ***Chapters 6-8 Case studies of learning in six university KTOs***

These chapters contain the empirical analysis of this thesis. Each chapter follows the same pattern. First, I examine KTO abilities in 2010 – that is, at the end of the period under study (2005-2010). I investigate what commercialisation activities are performed and how they are performed in a given KTO, and draw conclusions about the nature of ‘knowing’ embedded in commercialisation practice. Next, I analyse which of these abilities has been developed or refined in the preceding five year period. I identify changes in practice and explain how situated learning has shaped these changes (learning in communities of practice, in networks of practice, and across communities of practice) and whether this learning was initiated bottom-up by KTO staff or top-down by the KTO and/or university top management.

#### ***Chapter 9 Discussion – insights from the six case studies***

Chapter 9 combines the insights from the six case studies to answer the research questions and to address the gaps identified in the literature. It discusses the new insights gained from simultaneous analysis of a range of KTO abilities, and how and why abilities are developed and refined in KTOs. It uses the empirical observations from the cases to derive seven theoretical mechanisms illustrating the role of situated learning and management’s strategic practices in bringing about changes to work

practices; that is, in refining existing abilities or develop new ones. Finally, I consider alternative explanations for changes in practice.

### ***Chapter 10   Conclusions***

This chapter summarises the contributions of this thesis to science, technology and innovation studies, and to situated learning theory. It discusses the implications of the findings for policy makers, universities and for organisations providing training to university knowledge transfer professionals. The thesis concludes with the discussion of the limitations of my research and suggestions for future research.

## 2 Commercialisation of academic research

Scholars have argued that KTOs play an important role in the commercialisation of academic research. They are “guardian[s] of the university’s intellectual property” (Siegel et al., 2003: 31) as well as “boundary spanners” who “mitigate conflict caused by palpable differences in the motives, incentives, and organizational cultures of scientists, firms, and administrators.” (Siegel et al., 2003: 36). They induce faculty to disclose inventions (Jensen et al., 2003). They inform companies about the inventions and expertise in the academic community (Siegel et al., 2003; Macho-Stadler et al., 2007). They communicate the needs of companies to the scientists (Siegel et al., 2003). They play a role in structuring licensing contracts, ensuring that academic inventors cooperate in further development after the licence is executed and securing financial gains for the university (Thursby et al., 2001; Thursby and Thursby, 2002; Jensen and Thursby, 2001). They help to secure the human and financial resources required to start spin-out companies and provide company formation expertise (O’Shea et al., 2005).

In order to fulfil these roles KTOs need a wide range of skills and knowledge:

Protecting and managing IP requires specific legal knowledge. Licensing needs a combination of market awareness, subject-specific knowledge, marketing and negotiating skills. Spinout creation requires entrepreneurship skills, links with business angels and venture capitalists, business planning, management and company formation expertise. (Lambert, 2003: 55)

The development of such a wide-ranging set of abilities in a university KTO is a challenge as “these skills are difficult to find in a small group of people and are expensive to buy in.” (Lambert, 2003: 55). Section 2.1 reviews work that directly or indirectly sheds light on the abilities that KTOs need to develop in order to fulfil the aforementioned roles, and the significance of these abilities. Section 2.2 reviews previous studies that examine how KTOs’ knowledge and abilities are developed through learning and concludes that our understanding of how KTOs learn and why is limited. Section 2.3 compares possible approaches to addressing this gap and a practice-based approach to learning is identified as a conceptual framework for the study of learning in KTO.

### 2.1 Abilities of KTOs

Different theoretical concepts are used in the literature to capture the knowledge and abilities of KTOs. Econometric studies looking at the productivity of KTOs in relation

to technology transfer refer to abilities and knowledge as ‘expertise’ (Swamidass and Vulasa, 2009), ‘experience’ or ‘practice’ (Link and Siegel, 2005b; Siegel et al., 2008; Thursby and Thursby, 2002); studies based on organisational theories conceptualise them as ‘competencies’ (Markman et al., 2005a) or ‘capabilities’ (Lockett and Wright, 2005). These perspectives are discussed below.

### ***2.1.1 KTO experience***

Experience is measured generally simply as the number of years that a KTO has been operating. Thursby and Kemp (2002) suggest that productivity growth in generating commercialisation outcomes could stem from the increased experience and greater knowledgeability of the KTOs.<sup>2</sup> However, evidence of a positive effect of KTO experience on performance in commercialisation is mixed. Studies of US universities show that older KTOs are more productive at generating licence agreements (Link and Siegel, 2005b; Siegel et al., 2008) and licensing income (Link and Siegel, 2005b; Siegel et al., 2003; Siegel et al., 2008). This finding was corroborated by earlier studies of Rogers et al. (2001) and Carlsson and Fridh (2002), which employ different methodologies, but find that the KTO’s experience has a positive effect on commercialisation outcomes. A study of UK universities shows that KTOs’ experience decreases efficiency in generating licence agreements (Chapple et al., 2005). Some studies of UK universities, using different methodologies, find no effect of KTO experience on the formation of spin-outs (Lockett and Wright, 2005; Markman et al., 2005a). The differences in these findings cannot be attributed to different measurements since all these studies use years of operating as a proxy for KTO experience. The differences for the UK and the US might be related to the fact that US KTOs tend to be older than KTOs in the UK, and that any positive effects of KTOs’ experience may be visible only after a certain threshold, which UK KTOs have yet to reach. Alternatively, UK and US KTOs develop different sets of abilities over time.

The studies referred to tell us nothing about the kinds of KTO knowledge and abilities that are important. Interestingly, the studies that find KTOs’ experience to be insignificant, as opposed to those that find it significant, control for some specific KTO capabilities (Lockett and Wright, 2005; Markman et al., 2005a). This suggests that it

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<sup>2</sup> They considered alternative explanations such as reallocation of inputs and change in market demand for university inventions.

might be more productive to look at the importance of specific KTO abilities for the commercialisation of academic research than at their broadly conceptualised experience.

### ***2.1.2 Ability to identify commercialisation opportunities***

First, KTOs need to identify a commercialisation opportunity. Thursby and Thursby (2002: 93) argue that 2.7% productivity growth in the number of invention disclosures results from a modest increase in the propensity of faculty to disclose their inventions, which was “influenced by the policies and practices of university central administrations”. On the basis of survey results, they rejected the alternative explanation that growth in invention disclosures reflects a shift from basic towards applied research. Their study suggests that KTOs need to be able to design appropriate policies and to perform activities inducing disclosure of academic inventions. Academics can disclose their inventions at different stages of research and development – before proof of concept, after proof of concept or after development of a laboratory-scale prototype (Jensen et al., 2003). The earlier the KTO is aware of a potential commercialisation opportunity, the more time is available for assessment of the invention and development of an exploitation plan.

For example, a KTO needs to ensure that there is an appropriate *royalty-sharing policy* in place specifying the inventors’ share of the income generated from exploitation of their invention. This might provide an incentive or a disincentive for academics to disclose their inventions to a KTO. Most universities split the net licensing income among the inventor, the inventor’s lab, department or college, and the university administration. The split of royalty shares can be fixed or can vary with the level of net licensing income. The positive effect of a royalty-sharing policy on commercialisation is confirmed in studies of US universities (Friedman and Silberman, 2003; Lach and Schankerman, 2004; Link and Siegel, 2005b) and UK universities (Lockett and Wright, 2005), which use different methods and different data. Lach and Schankerman’s (2004) study of 102 US universities shows that a 10 percentage point increase in the inventor’s share should generate, on average, a 20%–25% increase in royalty income. However, this positive relationship emerges only when the inventor’s share is at the level of 35%–40% or more. Interestingly, if part of the royalty income is recouped by the inventor’s department, the numbers of licences is lower (Friedman and Silberman, 2003). This indicates that it is incentives at the individual, not the group level, that have a positive impact on performance in licensing activity.

KTOs also need to ensure that *the academic promotion policy* does not discourage engagement in commercialisation. Siegel, Wright and Lockett (2007) argue that recognising knowledge transfer activities in an academic promotion policy enhances the propensity for academics to inform their KTO about potentially commercialisable inventions. Surprisingly little is known about the extent to which universities recognise commercialisation activities in academic promotions procedures, or the impact of such recognition on the effectiveness of technology transfer.

The above studies highlighting the importance of policies, assume that KTOs are reactive in their approaches to identifying commercialisation opportunities. However, Owen-Smith and Powell (2001: 112) observed that “technology transfer offices generally lack the resources and expertise to search for potentially valuable innovation”. It is plausible that some KTOs may develop the ability to search proactively for commercialisation opportunities. For example, they may organise seminars to raise faculty awareness about the support available for the commercialisation of their inventions, an infrequent practice I found (together with Puay Tang) in a study on UK KTOs (Tang et al., 2009a), or undertake periodic audit of on-going research in the university. So far there is limited understanding of what activities are performed by KTOs to encourage invention disclosures.

### **2.1.3 Ability to assess IP**

Another aspect of the KTO's role is to make technological and commercial assessment of an academic invention and in some cases its patentability. The KTO needs the ability to assess the legal aspects of the invention's ownership which requires gathering information on how the research that spawned the invention was funded and who was involved. Technological assessment “requires the ability to assess the extent to which research results are stable and/or sufficiently developed to lead to industrial exploitation” (Ndonzuau et al., 2002: 284). The KTO typically works closely with the academic inventors and sometimes with external partners because it is not feasible for the KTO to encompass expertise in all areas of a university's research.

The KTO assess also whether patent protection can and should be sought. Only inventions that are (1) novel, (2) involve an inventive step and (3) are capable of industrial application are patentable (Junghans and Levy, 2006). The ability to assess the patentability of IP is described as ‘IP capability’ (Degroof and Roberts, 2004). Meyer and Tang (2007) show that UK KTOs typically file a priority patent application

with the national patent office. A Patent Cooperation Treaty (PCT) patent application is made within 12 months of the priority filing and 18 months after this, the KTO must decide whether to submit a patent application to foreign patent offices (Meyer and Tang, 2007). This patenting route allows the major costs of patenting to be delayed. My own research with Puay Tang (Tang et al., 2009a; Weckowska and Tang, unpublished) reveal that KTOs with the highest research incomes and highest number of invention disclosures are more likely to have routines in place for synchronising technological and commercial assessment with the patenting process.

In order to avoid the rather common situation where “only a small percentage of patents get commercialized to produce income” (Swamidas and Vulasa, 2009: 359), it is important to carry out a commercial assessment and ensure that increasing patenting activity does not diminish the commercial value of the university patent. Assessment of its commercial potential requires that the KTO is able to “verify the extent to which there might be a viable market” for the academic invention (Ndonzuau et al., 2002: 284). This involves assessing whether a company commercialising the invention would have the freedom to operate in the marketplace without infringing existing patent rights (Lockett and Wright, 2005), and assessing the dynamics of the marketplace: “What are the different applications of a given technology? Which are the most promising? Who are the key players in those markets? How high are the barriers to entry? Is the potential good enough to build up a viable company?” (Ndonzuau et al., 2002: 284). An assessment of commercialisation possibilities would include some estimate of market size and a rough estimation of the value that the invention potentially would add to existing products, services or processes. This might be difficult in the context of radically new technologies for which there is no definite market. Lockett et al. (2005: 984) note that “there appears to be a need for universities to develop broader approaches to due diligence that go beyond verifying ownership of IP to considering the broad range of commercial aspects of the venture.” I argue that this might apply also to assessing the commercial potential of technologies that are to be licensed to established companies.

There are no studies that look specifically at the effect of the ability to assess ownership of an invention, and its patentability, technical strengths and commercial potential performance. Indirect evidence of the importance of this ability is provided by studies showing that KTOs that are selective about what technologies to patent (Weckowska and Tang, unpublished) and what technologies to license to start-ups and

small companies (Powers and McDougall, 2005; Roberts and Malone, 1996) tend to form spin-outs that are more successful.

#### ***2.1.4 Ability to market academic inventions***

The dissemination of information about the inventions and expertise of the academic community in order to identify licensees and potential investors in spin-out companies is one of KTO tasks. However, Siegel et al. (2004: 134) note that the marketing aspect of the KTO “is often given short shrift”. In order to market IP to established technology-driven firms, entrepreneurs and venture capital investors, KTOs participate in technology fairs to showcase technologies available for licensing and use on-line services to provide information on available technologies to prospective licensees (Cardozo et al., 2011). Ideally, KTOs should have a network of industry contacts, but in the absence of such a network the KTO must rely on the costly and time-consuming services of third parties to connect them with networks of industry representatives (Markman et al., 2005a). Jensen and Thursby (2001) in a survey of 62 US KTOs found that around two-thirds tended to identify the licensee before a patent was granted. This early identification of licensees means that, “the precise terms of a patent can be customized to the commercial interests of the licensee, and accordingly the company often reimburses the university for the costs of patenting.” (Graff et al., 2002: 99)

This ability has been shown to have an impact on commercialisation. Markman et al. (2005a: 1065) refer to the ability to identify suitable licensees as competency in “connecting the right discoveries with the right companies at the right time”. They found that this ability shortens the time that KTOs need to license the technology to established companies and newly formed ventures. Thursby and Thursby (2002: 94) argue that negative productivity growth of -1.7% in the number of licences in the period 1994/98 resulted from a low propensity to license, which, in turn, reflects the KTO's “ability and knowledge as well as their aggressiveness in finding potential licensees.”

Markman et al. (2005a: 1067) operationalise this ability as “the average number of industry contacts that your office makes until a suitable and willing party for licensing is identified”. The assumption that more competent KTOs identify suitable licensees by approaching fewer companies is somehow at odds with Powers and McDougall's (2005: 1030) concern that the fit between the technology and the licensee may be worse when KTOs “rely on rubrics of convenience” and sign a licence agreement with companies that have already expressed interest in the technology and/or are conveniently available



to contact and/or are preferred by the academic faculty. These contradictory insights suggest that there is a need for a better understanding of what KTOs do and how they identify suitable licensees.

### ***2.1.5 Ability to handle licensing contracts***

Licensing the rights to make commercial use of a university's IP to established companies and start-ups is one way of commercialising academic inventions. A licence agreement is "a contract under which an owner of IP (the licensor) permits another person (the licensee) to engage in activities that, in the absence of the license agreement, would infringe the licensor's legal rights attaching to the IP." (UNICO, 2006a: 8) The negotiation of a licence agreement focuses on the scope of rights given to the licensees, the revenue that the licensee must pay to the university (in the form of royalty payments on sales, milestone payments or fixed fees), the extent to which the university retains control over how the licensee uses the IP, and the mutual liabilities and indemnities (UNICO, 2006a). If the technology is licensed to a start-up company, the negotiations may also cover the size of the equity stake that the university would take in the company (Siegel et al., 2004; Feldman et al., 2002). The licence agreement also may include some sponsored research, usual when a new technology is at an early stage of development or if the KTO evaluates it as important (Thursby et al., 2001). Some KTOs prefer to avoid incorporating sponsored research into the licence agreement because they are "wary of subsequent disputes over research direction and ownership of the future IP" and prefer to focus on licensing for cash (Markman et al., 2005b: 251). The licence agreements often need to be re-negotiated at a later stage "due to the embryonic nature (e.g. uncertainty) of the technologies and to the fledgling nature of many of the firms that license university-based technologies" (Siegel et al., 2008: 719). Although the licensor typically is a university, research shows that sometimes formation of a spin-out company requires the licensing-in of technologies from other organisations, or cross-licensing (Clarysse et al., 2005). Thus, KTOs must be able to conduct licensing negotiations, to structure licensing agreements in an appropriate commercial manner and, subsequently, to manage the relationship between licensor and licensee.

The KTO's approach to negotiating a licence agreement will depend on its assessment of the value of the technology and its stage of development. The 'price' that the company has to pay is a subject of heated negotiation. Licence fees typically range from \$10,000 to \$50,000, but can be as high as \$250,000; royalty rates are typically 2%

to 5%, but can be as high as 15% (Bray and Lee, 2000: 387). Surveys show that some KTOs try to “drag every nickel out of you” (Siegel et al., 2003: 43) and are very inflexible during negotiations, which is perceived by companies to be a major barrier to engaging with universities. Feldman et al. (2002) found that equity-based licence agreements are easier to negotiate than royalty-based licences.

### ***2.1.6 Ability to form spin-out companies***

Establishing a spin-out company is one of the ways that commercialisation and further development of a university’s IP are arranged. University spin-outs are based on the IP transferred from the university, unlike start-ups, which do not involve the transfer of IP, but are the entrepreneurial act of one or more university employees (Lockett et al., 2005). It has been suggested that KTOs need business development capability to manage spin-out formation (Lockett and Wright, 2005). Lockett and Wright’s (2005) definition of business development capability includes ability to identify commercialisation opportunity, assess inventions, market, and conduct contract negotiations in addition to managing the processes involved in spin-out formation. I would argue that the first four tasks are necessary for both licensing-based exploitation and spin-out-based exploitation routes. I focus on the knowledge and abilities that KTOs need to support the formation of spin-outs in the concept testing and start-up support phases (Degroof and Roberts, 2004). Below I discuss studies that indirectly identify abilities that are necessary for the formation of spin-outs.

Some universities provide support for business plan development. This support ranges from assistance in writing a preliminary business plan to recruitment of external management for the spin-out (Clarysse et al., 2005). If these services are part of the KTO’s remit,<sup>3</sup> then KTO staff must have the abilities to advise on business planning and identify external management teams. If the academic decides to continue in his/her job at the university, it is usually advisable to recruit a ‘surrogate’ entrepreneur to develop the company (Lockett et al., 2003). This allows scientists to combine their university teaching and research duties with an advisory role in the spin-out and mitigates their potential lack of commercial experience. Lockett et al. (2003) note that some universities compile databases of individuals with an interest in managing spin-out companies, or maintain links with business schools that allow them to recruit graduates

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<sup>3</sup> Support for business plan development could be in the form of a university incubator. However, at least in the UK, most university incubators provide office space rather than business consulting.

as surrogate entrepreneurs. The ability to identify a suitable management team is important because there is evidence that spin-out founders who have direct and indirect relationships with venture investors are more likely to secure venture capital funding for their spin-out companies (Shane and Stuart, 2002).

In addition, universities (via their KTO) offer support for securing funding for spin-out activity. This support ranges from the provision of some internal funding to help with applications for finance from external sources (Clarysse et al., 2005). Funding for the early stages of spin-out development is likely to come from public agencies<sup>4</sup> whereas later stage finance will mostly be in the form of investment in exchange for an equity stake, by a corporation or financial intermediary such as a business angel or venture capitalist (Lockett et al., 2005). The KTO will need a good network of contacts with public agencies, large corporations and financial intermediaries in order to help spin-outs to secure venture funding. However, studies report low availability of venture capital finance for university spin-outs in the UK and continental Europe (Wright et al., 2006). The ability to secure venture funding is important: it has been shown that receiving venture capital funding is the most important determinant of spin-out success, measured by its initial public offering (Shane and Stuart, 2002).

On the basis of the above findings, it can be inferred that spin-out formation benefits from the KTO ability to advise on business planning, to identify external management and to secure venture funding. It has been argued that some universities could do more to make their ventures ‘investor ready’ and put more effort into finding venture capital investors (Lockett et al., 2005: 985).

### ***2.1.7 Shortcomings in studies of KTO abilities***

The major shortcoming in the studies reviewed above is that they tend to study KTO abilities in isolation. It is plausible that KTOs develop sets of interconnected abilities. For example, the study by Clarysse et al. (2005) identifies three types of strategies for company formation. Each is related to a different set of routines for the identification of spin-out opportunities, assessment of the idea, business planning, and securing funding for a spin-out. This suggests that KTOs develop sets of abilities in response to the university’s strategy. It is also tenable that there are different sets of routines and, thus, abilities related to licensing.

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<sup>4</sup> E.g., in the UK, government provides funding for earlier spin-out stages via the University Challenge Fund. In the US there is a government funded Small Business Innovation Research Program.

It is also not clear whether all KTOs learn to develop and improve all of the abilities referred to. The findings from a study by Cardozo et al. (2011) suggest that the motivation to learn depends on when the university launched support for commercialisation activities. The motivation for learning reduced after the Bayh-Dole Act because universities were obliged to have a KTO regardless of how effective or efficient the office was. Ineffective and inefficient KTOs, unlike ineffective companies, are protected from market forces that could force them ‘out of business’ (Cardozo et al., 2011). For these reasons, Cardozo et al. argue, newer KTOs may have less motivation to learn how to assess commercialisation opportunities and, consequently, pursue marginal opportunities.

In the light of these shortcomings, there is a need for better knowledge about what KTOs learn. This thesis investigates *simultaneously* what KTOs learn in order to identify commercialisation opportunities, to assess IP, to market academic inventions handle licensing contracts and to form spin-out companies. The first research question in this thesis is: ***What do KTOs learn?***

## **2.2 The process of learning and what triggers learning in KTOs**

The studies discussed in Section 2.1 provide some insights into the knowledge and abilities that are developed in university KTOs. However, the process of learning tends to be ‘black-boxed’ in these studies. For example, studies that equate learning with KTO experience (as number of years of operation) (Link and Siegel, 2005b; Siegel et al., 2003; Siegel et al., 2008), tell us very little about the learning process. Studies of KTO capabilities focus on examining their effects on commercialisation performance rather than the process through which the capabilities were developed (e.g. Markman et al., 2005a; Lockett and Wright, 2005). These studies show the importance of a KTOs’ experience, capabilities and competences. They show also *what* some KTOs have learnt. However, they do not systematically explore *how* KTOs become experienced and/or capable and *why* learning occurs. This thesis addresses these gap

s by investigating the following questions:

***How do KTOs learn? and Why do KTOs learn?***

Below I discuss previous work that allows the formulation of propositions about how KTOs learn and why.

### **2.2.1 How are KTOs' abilities developed?**

To my knowledge few if any studies focus on the process of learning in university KTOs, which limits our understanding of how new abilities to commercialise academic inventions are developed and how existing abilities improve over time.

Some scholars tangentially refer to the nature of the learning process in KTOs. For instance, Debackere and Veugelers, (2005: 339) note that “shaping the ‘right’ culture for effective technology transfer and learning as to how to optimize the various transfer mechanisms and monitoring processes through experimentation” takes time. Thus they suggest that new knowledge is generated in KTOs by experimenting with how to commercialise academic research. Similarly, Mowery et al. (2002), after examining changes in commercialisation performance, argue that KTOs learn about patenting by doing. Both studies suggest that abilities are developed internally within the KTOs.

Cardozo et al. (2011) suggest that knowledge about how to commercialise academic research is shared across KTOs. They found that KTOs founded before and after 1990 differed in size, but less so in relation to productivity in generating invention disclosures, patents and licence agreements. They argue that

The observation that the newest institutions differ less in efficiency than in size from their older counterparts may in part reflect diffusion of knowledge through the industry as it matures. Personnel at newer entrants may have come from older institutions, and surely have been exposed to their experiences through publication and professional contacts (Cardozo et al., 2011: 191).

The above quote infers that the abilities of KTOs can be developed both internally and also through contacts with other KTOs. It is plausible also that ‘older’ KTOs founded before 1990s learn from one another.

In summary, the arguments made in these studies suggest that learning within as well as across KTOs may be important for the development and improvement of commercialisation activities. This thesis contributes to our understanding of how KTOs learn by investigating both forms of learning.

### **2.2.2 Why are KTO abilities developed?**

Again, to my knowledge few if any studies focus explicitly on what triggers learning in university KTOs. Previous work seems to suggest that there are two important factors shaping learning trajectories.

First, it has been suggested that the university and the KTO management influence what KTOs do and how they do it (Debackere and Veugelers, 2005; Litan et al., 2008). Litan et al. argue that some universities have enabled their KTOs to develop effective support for commercialisation of academic inventions, but “in too many other cases, university leaders have backed policies that encourage KTOs to become bottlenecks rather than facilitators of innovation dissemination.” (Litan et al., 2008: 32). These authors are particularly concerned with the practices of centralised KTOs operating within universities that focus too much on maximising the revenues from licensing rather than maximizing the volume of innovation outputs. It can be concluded that a top-down management strategy can affect what the KTO learns.

Second, some scholars contend that the KTO staff shape what is done in the KTO and how academic research is commercialised. For example, Lockett and Wright argue that “the availability of skilled technology transfer office staff to manage the commercialization process is vital to the development and implementation of these routines [for] creation of university spin-outs.” (Lockett and Wright, 2005: 1048). In similar vein, Debackere and Veugelers (2005: 339) note that universities “should provide the interface or liaison units with the necessary autonomy and incentives to become more professional”. On the basis of these quotes, it can be concluded again that KTO staff affect what is learnt in a KTO.

Thus, learning in a KTO can be triggered and shaped by top-down strategies and bottom-up initiatives. This thesis takes both drivers of learning into account.

In summary, Sections 2.1 and 2.2 have discussed previous studies of KTO abilities and argued that our understanding of how and why some abilities are developed or refined is limited. This thesis aims to contribute to the literature on commercialisation of academic research by exploring: What do KTOs learn? How do KTOs learn? and Why do KTOs learn?

### **2.3 Selection of a conceptual framework for this study**

The research questions call for a conceptual framework that explains the process of learning through which the abilities for commercialising academic research are developed and refined. Some previous studies looking at the commercialisation of academic research make use of the concept of competences and capabilities (e.g. Lockett and Wright, 2005) and, thus, the dynamic capability framework is one approach

I considered. Other studies refer to ‘practices’ to express what KTOs are able to do (Siegel et al., 2003), which led me to consider one of the practice-based frameworks, namely, situated learning theory. Comprehensive comparison of these two theoretical approaches to learning in organisations is impossible within the scope of this thesis. Instead, Table 2.1 provides a brief summary of each theoretical approach and the key issues are discussed below.

Table 2.1 Comparison of alternative conceptual frameworks

Theory	Dynamic capability	Situated learning
Key authors	(Eisenhardt and Martin, 2000; Teece, 2007; Teece and Dosi, 1994; Teece and Pisano, 1994; Teece et al., 1997)	(Amin and Roberts, 2008a; Lave and Wenger, 1991; Brown and Duguid, 1991; Brown and Duguid, 2001)
Knowledge in organisation	Knowledge is stored in organisational capabilities.  Organizational capability is defined as “a high-level routine (or collection of routines)” (Winter, 2003: , p. 991) that allow performance of “a coordinated set of tasks utilizing organizational resources, for the purpose of achieving a particular end result” (Helfat and Peteraf, 2003: 999).	Knowledge is embedded in practice.  Practice is defined as a set of observable recurrent activities that are related to a particular organisational function, and in which knowing and doing are inseparable (Carlile, 2002; Gherardi and Nicolini, 2000).
Learning outcomes	Change in organisational capabilities (radical or incremental)	Change in organisational practice and/or changes in individual ability to participate in practice
Learning process	Understanding of the process of developing organisational capabilities is limited. New capabilities are created by dynamic capabilities. This assumption brings little explanatory value.	Learning occurs through interactions within communities of practice, networks of practice and interactions across communities of practice  Through interactions individuals learn how to engage with each other, what to do and how to do it
Forces of stability	Past capabilities	Past practices, identities of practitioners
Triggers of change	External: Strategies developed in response to changes in external environment	Internal: Opportunities and problems identified by members of the communities of practice  External: Management can shape learning in communities of practice
Key limitations	Relatively limited theoretical apparatus for analysis of the learning process.  Poor conceptualisation of internal forces of change	Rarely differentiates different types of changes in practice  Relatively limited conceptualisation of the role of management in shaping situated learning in communities of practice

Source: Constructed by the author

Situated learning theory has two main advantages compared to the dynamic capability framework, which make it a more suitable framework for the analysis of learning in university KTOs. Firstly, situated learning theory offers an arguably better explanation of the learning process. The practice-based view of learning conceptualises evolving practice as the outcome of learning and participation in that practice as the process of learning. The dynamic capability framework, on the other hand, focuses on learning outcomes (i.e. capabilities) rather than on the learning process. Specifically, development of capabilities is explained in terms of other capabilities, namely dynamic capability (Teece and Pisano, 1994; Teece et al., 1997). This explanation is problematic because if a capability is always developed by deployment of another capability then it is impossible ultimately to understand the original source of the capability (Collis, 1994). Increasingly, numerous scholars have begun to recognise the limited explanatory value of the dynamic capability concept and have argued for a better understanding of the micro-foundations of capabilities (Teece, 2007; Felin and Foss, 2009). Abell et al. (2008: 490) note that the concepts of dynamic capabilities is “useful shorthand for complicated repetitive patterns of individual action and coordinated interaction” and that explanations of the origins of capabilities and the relation between capabilities and organisation-level outcomes could be improved by a focus on the actions of individuals and the interactions among individuals. Prominent scholars in the field of strategic management have promoted the idea that organisational learning is required to develop and maintain organisational knowledge assets (Teece and Abdulrahman, 2011; Winter, 2003).

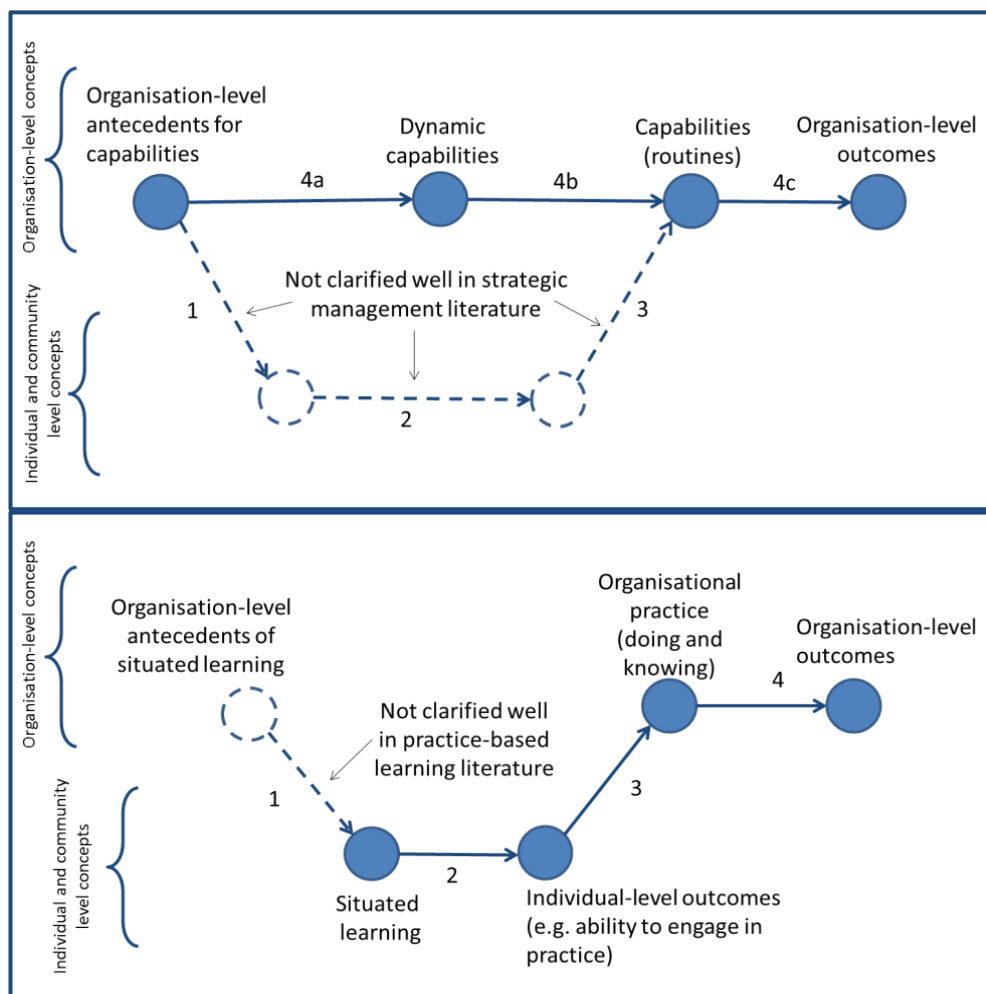
A conference paper by Vera and Salge (2011) argues that dynamic capability can be understood as practice-based learning. The literature on practice-based learning introduces the concepts of situated learning and communities of practice, which explain the processes through which new knowledge is created by individuals in social interactions. In other words, situated learning theory pays explicit attention to the learning processes at the individual and group level of analysis, that are black-boxed in the dynamic capability framework (compare arrows 2 and 3 in the upper and lower parts of Figure 2.1 below). In order to shed light on how university KTOs learn and why it is important to choose a theoretical framework that allows the learning process to be conceptualised. The situated learning framework is more appropriate.

Secondly, each theoretical approach conceptualises organisational level learning outcomes in a different way (change in capabilities vs changes in practice). Changes in



capabilities entail changes in the way organisational resources, including competences, are coordinated. This conceptualisation is less suitable for explaining how new competences are developed. Moreover, the capability framework directs attention towards changes in routines whereas situated learning theory encourages investigation of changes in practice, which comprise changes to routines as well as actions, methods, tools, words, stories, gestures and symbols (Wenger, 1998). It would be inaccurate to assume that the commercialisation of academic research has been routinised in all university KTOs. Some universities have only introduced institutional support for this activity in the 2000s; also, each commercialisation project is likely to be different making it difficult to routinise actions. Thus, again the practice-based view of learning seems to be more appropriate for the purposes of this study.

Figure 2.1 Comparison of explanatory power of alternative conceptual frameworks



Source: The upper part of the figure is adapted from Figure 2 in Abell et al. (2008: 494). The lower part was constructed by the author.

Based on the above considerations I concluded that the practice-based approach to learning was more suitable for an analysis of learning in university KTOs, than the dynamic capability framework. However, it is important to note that the limited explanation of the interplay between organisation-level phenomena (e.g. strategies) and individual/group learning (arrow 1 in Figure 2.1), in the practice-based theorising, is problematic. This interplay is important for an analysis of learning in university KTOs since previous studies show that strategy influences the development of commercialisation practice (Degroof and Roberts, 2004; Roberts and Malone, 1996; Powers and McDougall, 2005; Bray and Lee, 2000). Conceptualisation of the relationship between situated learning (individual/group learning) and strategic practices of management is developed in Chapter 3. My study of learning in university KTOs potentially should contribute to practice-based theorising on learning by shedding light on the interplay between management's strategic practices and situated learning.

### 3 Theoretical framework

Chapter 2 highlighted the limitations of our understanding of learning in university KTOs. This thesis addresses this gap in the literature on university-industry links. The last section of Chapter 2 discussed two alternative approaches to learning and argued that situated learning theory is the most suitable approach for this study. This chapter presents the theoretical framework that guides my analysis of what university KTOs learn, how they learn and why.

I first explain the epistemological and ontological assumptions of situated learning theory (Section 3.1.1 and Section 3.1.2) and introduce its two main concepts – the *notion of practice* (Section 3.1.3) and the *concept of a community of practice* (Section 3.1.4). In the following sections of this chapter I present the theoretical framework for the study of learning in university KTOs. Section 3.2 addresses the question of “What do KTOs learn?” – and explains that changes in work practices reveal what has been learnt by the organisation. Section 3.3 addresses the question of “How do KTOs learn?” – and argues that changes in work practices can result from learning through interactions within communities of practice (COP), within networks of practice (NOP), and across COPs. Section 3.4 addresses the third research question – “Why do KTOs learn?” – and argues that changes in practice can result from learning in COPs, NOPs or across COPs, initiated either by COP members or by management in a top-down manner.

In developing the theoretical framework for the analysis of learning in university KTOs, I highlight a gap in our understanding of how situated learning transforms work practices. I make theoretical propositions on the basis of findings from previous studies, which are tested empirically. This work aims to make a conceptual contribution to situated learning theory.

#### 3.1 Introduction to situated learning theory

The purpose of this section is to present the basic concepts and assumptions in situated learning theory. This theory is the starting point for the development of the theoretical framework that is described in detail in Sections 3.2, 3.3, and 3.4. The discussion in this section is fairly generic, but contains some references to the empirical context of my study – university KTOs – in order to relate them directly to the theoretical concepts of situated learning theory.

### ***3.1.1 Epistemological assumptions and intellectual heritage***

Situated learning theory takes a social constructivist perspective on learning and knowledge, which is based on different epistemological assumptions to traditional cognitive theories of learning. The epistemological assumptions and intellectual heritage of this perspective are discussed briefly here.

Situated learning theory (Brown and Duguid, 1991; Lave, 2008; Lave and Wenger, 1991; Wenger, 1998) is one of several practice-based theories of learning and knowledge creation. Others include activity theory (Engeström, 1999), actor network theory (Latour, 2005), and a cultural perspective (Yanow, 2000) on organisational learning (for a review of all these theories see Gherardi, 2000; Nicolini et al., 2003b). As noted above, situated learning theory, similar to other practice-oriented theories of learning, takes a social constructivist perspective on learning (Easterby-Smith et al., 2000). The social constructivist perspective is based on the assumption that “learning occurs, and knowledge is created, mainly through conversations and interactions between people” (Easterby-Smith et al., 2000: 787). This means that knowledge is socially constructed during these interactions, through the active process of meaning construction or meaning inference (Hislop, 2005: ch.3). The terms ‘perspective making’ and ‘perspective taking’, coined by Boland and Tenkasi (1995), help to clarify what we mean when we say that knowledge is created through ‘negotiations of meaning’ between individuals. This social constructivist perspective on learning and knowledge creation implies that knowledge is not simply transmitted from one person to another. Instead, it is assumed that person A constructs meaning (‘makes a perspective’), for example, by reifying his or her experience (by putting it in words, or creating a procedure, or writing down a law) and person B constructs the meaning of this particular experience of interaction with person A, or of interaction with ‘things’ created by person A (person B ‘takes a perspective’). This does not mean that after the interaction person B has acquired exactly the same knowledge that person A attempted to convey, but person B, nevertheless, might have constructed some new knowledge, that is, person B might have learned.

Proponents of the social constructivist approach critique cognitive approaches for understating the importance of the social context in which learning occurs and argue that “human minds develop in social situations, and they use the tools and representational media that culture provides to support, extend, and reorganise mental functioning” (Lave and Wenger, 1991: 11). They argue also that learning is situated in a

specific cultural and historical context and takes place in a web of relations with other people. The idea that learning arises from interactions with the social environment is not new. It has been present in the theories of learning in cultural-historical psychology (see Lev Vygotsky's 'zone of proximal development' (Vygotsky, 1962 cited in Chaiklin, 2003), which inspired social constructivist perspectives on learning.

The social constructivist view on learning and knowledge creation also entails certain assumptions about the knowledge that is learned. As already explained above, this view assumes that knowledge is socially constructed and thus contestable. Moreover, it is presumed that "a great deal of knowledge is both produced and held collectively" (Brown and Duguid, 1998: 91), that knowledge is culturally embedded, embodied in people and "embedded in the technologies, methods, and rules of thumb used by individuals in a given practice" (Carlile, 2002: 446), and that knowledge always has a tacit component (for a discussion on knowledge from a social constructivist perspective see Hislop, 2005). Some authors who adopt the social constructivist perspective favour the term *knowing* over the more conventional knowledge (Amin and Roberts, 2008b; Gherardi, 2000; Orlikowski, 2002; Blackler, 1995). Knowing is part of practice (or action) as opposed to knowledge, which is understood as an object possessed by individuals or groups (Cook and Brown, 1999). Knowing is reflected in one's doing. Cook and Brown (1999: 388) encourage everyone to see "knowledge as a tool at the service of knowing not as something that, once possessed, is all that is needed to enable action or practice.". They explain that "an accomplished engineer may possess a great deal of sophisticated knowledge but there are plenty of people who possess such knowledge yet do not excel as engineers" (Cook and Brown, 1999: 387). This conceptualisation of learning illustrates an epistemological shift in studies of learning. Cook and Brown (1999) refer to it as a shift from the 'epistemology of possession' (characteristic to cognitive learning theories and focusing on acquiring knowledge that is then possessed by individuals or groups) to an 'epistemology of practice' (focusing on developing the ability to display 'knowing' in action/practice). The 'epistemology of practice' implies that in order to understand knowing, one needs to look at what people do, rather than at what knowledge they possess.

A milestone in theorising about learning through interactions *between* people was the inspiring ethnographic work published by Jean Lave and Etienne Wenger (1991) in their *Situated Learning: Legitimate Peripheral Participation*. As the title implies, this theory suggests that learning and knowledge creation take place in the *situation* in

which the knowledge will be used. This work is concerned with ‘apprenticeship-like’ learning, in which novices learned to become masters of a certain practice through interactions with other practitioners and through increasing participation in the shared practice. They referred to this process of learning by novices as ‘legitimate peripheral participation’. Lave and Wenger use the *notion of practice* in order to express the social constructivists view that “learning is a social and participative activity rather than merely a cognitive activity” (Gherardi, 2000: 215). They argue that “learning is an integral and inseparable aspect of social practice” (Lave and Wenger, 1991: 31). People learn by *participating in social practice*, that is, through interactions with others in the pursuit of activities in a particular social and historical context. People do not learn by mere reasoning *about practice*, as suggested by some cognitive approaches to learning. They do not acquire knowledge about practice. They develop *knowing*, that is, they learn to perform activities in a manner that is seen as competent by the social group of practitioners to which they belong, known as a COP (discussed in detail in section 3.1.4). Brown and Duguid (1991: 48) capture the essence of Lave and Wenger’s situated learning theory in their comment that “learning, from the view point of LPP [legitimate peripheral participation], involves becoming an ‘insider’” in a COP. In other words, the theory aims to explain how individuals learn to function in a particular COP.

Situated learning theory (Lave and Wenger, 1991) not only focuses on learning through engagement in actions and interactions that take place in a particular cultural and historical context, that is, within a certain social structure, but also contends that at the same time “through these local actions and interactions, *learning reproduces and transforms the social structure in which it takes place*” (Wenger, 1998: 13, emphasis added). In other words, learning takes place in a particular historically and culturally embedded practice and, at the same time, can transform that practice. Here Lave and Wenger are drawing on Giddens’s (1979) theorising about social structures and human agency, which highlights that the structure can shape the action, and that actions create and recreate the structures. The importance of experience built through interactions for the transformations of organisational practice is discussed in the wider literature on organisational change. Tsoukas and Chia (2002: 567) argue that, if organisational change is approached from the perspective of on-going change, it can be seen as “*the rewaving of actors’ webs of beliefs and habits of action to accommodate new experiences obtained through interactions.*” They encouraged researchers to explore the social micro-processes that construct experiences and embed them in practice, to gain a

better understanding of how change is accomplished. The assumption that learning in communities of practice reproduces and transforms work practices is a key assumption in this thesis and I examine how learning in communities of practice in university KTOs transforms the practices of commercialisation of academic research.

In summary, situated learning theory assumes that people learn and create new knowledge through interactions with others during participation in social practice. It suggests also that learning plays an important role in the reproduction and transformation of practice. Section 3.1.2 clarifies further the epistemological and ontological assumptions present in practice-based theorising.

### ***3.1.2 The comparison of practice-based and cognitive theories of learning***

The practice-based theorising on knowledge, including the situated learning theory, emerged as an alternative to cognitive theories of learning. These two approaches differ on a number of epistemological and ontological assumptions. So far I have discussed the epistemological assumptions of the situated learning theory and only hinted at the differences between practice-based and cognitive theories of learning. For the purpose of clarity, this section discusses the differences between the assumptions of these two theoretical paradigms in greater detail.

These two approaches are clearly distinguished in the literature (e.g. Sfard, 1998). As already mentioned above, Cook and Brown (1999) note that an “epistemology of possession” underpins the cognitive theories whereas practice-based theories are based on the “epistemology of practice”. Gherardi (2000: 11) differentiates between “a mentalistic vision of knowledge” and “practice-based theorising” while Scarbrough (1998) refers to the ‘content’ theory of knowledge and the ‘relational’ view of knowledge. The key differences in the epistemological and ontological assumptions of these two approaches are summarised in Table 3.1.

Table 3.1 Differences in ontological and epistemological assumptions of cognitive and practice-based theories of learning

Cognitive theories of learning	Practice-based theories of learning
Selected authors (Anderson, 1983; Bruner et al., 1956; Fiske and Taylor, 1984; Newell and Simon, 1972; Grant, 1996; Nelson and Winter, 1982; Piaget, 2001; Teece et al., 1997; Winter, 1987) <sup>5</sup> Review: (Easterby-Smith et al., 2000)	Selected authors: (Lave and Wenger, 1991; Orlikowski, 2002; Gherardi, 2000; Cook and Yanow, 1993; Nicolini et al., 2003a; Wenger, 1998) Review: (Gherardi, 2000)
Acquisition of knowledge is the outcome of learning	Development of identities (ways of being) and modes of action (ways of doing) are the outcomes of learning
Knowledge is an disembodied asset possessed by individuals	Knowing and doing are inseparable Knowing is a process Knowing is embodied in people
Knowledge is static	Knowledge is emergent, dynamic
Knowledge is objective - mental structures and language are mirror-like representations of external, independent phenomena (representationalist approach)	Knowledge is subjective (value laden), embedded (situated, context dependent), socially constructed, negotiated, indeterminate, contestable
Knowledge acquisition is based on intellectual processes, such as reasoning, intuition and perception, and leads to the creation of new mental structures. Pre-existing cognitive structures guide perception and function as a heuristic in people's information-processing strategies	Becoming knowledgeable requires 'perspective making' and 'perspective taking'. It takes place through immersion in practice and social interactions. Understanding of social phenomena emerges from a mutually constitutive process in which the individual interacts with the environment.
Learning is individualistic	Learning is social
Context is a static, container-like backdrop	Context is enacted - its elements simultaneously have an influence on, are the medium for and result from social activity

Source: Constructed by the author on the basis of Hislop (2005) and Marshall (2008)

The cognitive approach has been criticized for a static, functionalist, passive and ultimately individualistic portrayal of learning and for assuming objectivity and representational nature of knowledge (Fox, 2006; Lave and Wenger, 1991). These limitations have been addressed by scholars subscribing to the practice-based view of knowledge and learning, which, nonetheless, also suffers from some shortcomings. The practice-based learning theory has been criticised in particular for being silent on (1) the cognitive content of what is learned by individuals in social interactions (Yakhlef, 2010), (2) what it is that people know in order to become active agents in the reproduction and potential transformation of practice (Marshall, 2008; Fox, 2000), and

<sup>5</sup> Piaget, 2001 is a translation of 1977 classic Piaget's work in French



(3) what it is that people know in order to sustain social practice over time (Marshall, 2008). Moreover, the role of individuals in the process of learning and in making changes to practice is rarely addressed explicitly in practice-based theorising (Yakhlef, 2010; Felin and Hesterly, 2007).

Cognitive and practice-based approaches are often portrayed as incommensurable but some scholars have recently argued that the incompatibility of the two approaches has been overstated and that these two ‘camps’ could learn from each other (Yakhlef, 2010; Marshall, 2008). While a bridge between the two approaches could potentially help to address some of their theoretical shortcomings, it could also lead to inconsistencies in ontological and epistemological assumptions. Any attempt at integration needs to address this challenge in an explicit manner. Marshall (2008) suggests to take an interpretative perspective on cognition but maintains that learning takes place through mental processes of forming and reforming mental schemata (i.e. in effect he maintains the cognitive epistemology). Yakhlef, on the other hand, combines the assumptions of both perspectives and proposes that learning is both cognitive and social. He acknowledges individual agency and the ability of individuals to reflect on their practices but at the same time recognises “(1) their interdependency on one another for their learning, and (2) the centrality of the social, interaction-based learning context” (Yakhlef, 2010: 44). This thesis takes yet another stand. The conceptual framework adopted in this thesis remains committed to the “epistemology of practice” but addresses some shortcomings of practice-based theorising. Specifically, the role of individual agency in the process of learning and change is recognised.

This section elucidated the epistemological and ontological assumptions of situated learning theory. The next section discusses in detail the concept of practice, a crucial building block of the situated learning theory.

### ***3.1.3 The concept of practice***

In the previous two sections I explained how individuals learn and create new knowledge through participation in social practices. What do they learn this way? The answer is: they learn their practice. Wenger (1998: 95) illustrates this point saying that: “Their practice is not merely a context for learning something else. Engagement in practice – in its unfolding, multidimensional complexity – is both the stage and the object, the road and the destination”. The purpose of this section is to define the concept

of practice. I draw on studies of communities of practice and other practice-based studies of learning and knowledge creation.

Although the term ‘practice’ has been used extensively, its meaning is not always clear. Wenger (1998: 47) has pointed out that “the concept of practice connotes doing, but not just doing in and of itself. It is doing in a historical and social context.” Practice is always a *social phenomenon* since it “exists because people are engaged in actions whose meaning they negotiate with one another” (Wenger, 1998: 73). People negotiate what is the right way of doing things, what is acceptable, and what needs adjustments. Thus, practice is social.

Brown and Duguid (2001: 203) argue that the concept’s ambiguity stems from the fact that “it signifies both work itself (the practice of a medical practitioner, for example), and rote tasks or exercises designed to help learn to work (as in piano practice)”. They suggest limiting the meaning of the term ‘work’ by asserting that “by practice we mean, as most theorists of practice mean, undertaking or engaging fully in a task, job, or profession” (Brown and Duguid, 2001: 203). However, Brown and Duguid’s definition fails to make a clear distinction between ‘practice’ and ‘participation in practice’ or ‘engagement in practice’. Handley et al. (2006) argue that it is important to distinguish conceptually between ‘practice’ and ‘participation in practice’ and to limit the understanding of practice to *observable activity*. I argue also that it is more helpful to limit the concept of ‘practice’ to signify activities performed in a certain manner (observable activity) and to use the term ‘participation’ to describe one’s engagement in negotiation of how the activities should be performed and by whom. For this reason, Brown and Duguid’s definition is not adopted in this thesis.

Some scholars define practice as *a set of observable activities performed in a particular manner* (e.g. Gherardi and Nicolini, 2000; Gherardi and Nicolini, 2002; Nicolini et al., 2003b). This understanding of practice derives from Marxist theorising about practice. Gherardi (2000: 215) pointed out that “the important contribution of this [Marxist] tradition to practice-based theorising is its methodological insight that practice is a system of activities in which knowing is not separated from doing”. While this definition of practice is more operationalisable than those of Wenger (1998) and Brown and Duguid (2001), it still is not clear what activities are thought to be part of practice – in other words, how the boundaries of practice are defined.

Previous empirical studies reveal that scholars take different approaches to the definition of ‘the set of observable activities’ that constitute practice. On the one hand,

practice has been defined as a set of activities with a common purpose. This approach is exemplified by the work of Orlikowski (2002), who explores the practice of global product development in a multinational company. This practice includes a range of activities that enabled the company to deal with spatial, temporal, technical, social, cultural and political boundaries in the complex process of new product development distributed across multiple locations. A similar conceptualisation of practice can be found in the work of Gherardi and Nicolini (2000), who focused on safety work practices in building construction sites and in other work places (Swan et al., 2002).

On the other hand, practice has been defined as a set of activities performed by individuals within a particular organisational function or occupation. This approach is adopted by Carlile (2002). Carlile, like Orlikowski, studies the activities of new product development. However, he distinguishes practices along the functional divisions of the organisation. Based on a year-long ethnographic study, he identifies four practices: sales/marketing, design engineering, manufacturing engineering, and production. Carlile's understanding of practice seems to be closer to that expressed by Lave and Wenger (1991) in their *Situated Learning: Legitimate Peripheral Participation*. In four illustrative case studies, they conceptualise practice as a set of the activities of a particular occupational community (e.g. the practices of midwifery, tailoring, nautical navigation and meat cutting).

The empirical studies discussed here illustrate that there is no shared understanding of the activities that constitute practice. Practice can be defined as a system of activities that is related to either a particular purpose or a particular organisational function/occupation. Both approaches seem legitimate and can serve different purposes. However, if the aim is to understand the complexity of commercialisation practice in a particular organisation, for example, as in the case of the university KTO, it would be undesirable to limit oneself only to activities aimed at successful exploitation of academic research, such as securing IPR, marketing academic inventions, negotiating licensing contracts or formation of spin-out companies. This is because other activities, such as identifying academic inventions, record keeping or assessing academic inventions might also be an important part of the whole commercialisation practice, yet may be driven by different purposes. For example, the assessment of academic invention could be aimed mainly at the efficient use of organisational resources; patenting is a costly process and, therefore, judicious assessment of which inventions should be patented would result in more efficient use of resources. Thus, Carlile's

(2002) approach seems to be more suited to studies that try to build a holistic understanding of commercialisation practices in KTOs (the aim of this thesis) than to purpose-specific practices.

Practice is defined as a set of observable recurrent activities that are related to a particular organisational function, and in which knowing and doing are inseparable.

In the context of this thesis, I adapt Gherardi's (2000) and Carlile's (2002) understandings of practice to define it as a set of observable activities that are related to a particular organisational function, and in which knowing and doing are inseparable. I argue that the commercialisation of academic research is a kind of social practice. There are always a number of actors that engage with one another and negotiate how the commercialisation activities should be performed. It consists principally of such activities as: (1) identifying commercialisation opportunities; (2) assessing academic inventions; (3) protecting IP (if necessary); (4) identifying commercial partners; (5) negotiating contracts between the university and the commercial partner; (6) identifying funding sources; (7) creating spin-out companies; (8) documenting commercialisation projects. This thesis investigates the learning processes that transform these activities.

In this section I define the concept of practice. Participation in practice is the medium of learning and practice is an outcome of the learning. The thesis focuses on changes in practice that result from learning by the members of communities of practice in an organisational context. Section 3.1.4 introduces the notion of COP.

#### ***3.1.4 The concept of a community of practice***

A COP is a social locus for learning in practice (Brown and Duguid, 1991; Lave and Wenger, 1991; Wenger, 1998). The concept of COP was proposed by Lave and Wenger (1991) in their ground-breaking work on situated learning, and was used to describe an informal, emergent group of people who “participate in an activity system [practice] about which participants share understanding concerning what they are doing and what that means in their lives and for the community” (Lave and Wenger, 1991: 98). Given Lave and Wenger's assumption that people learn through social interactions, the term COP was used to conceptualise the social structure in which learning takes place. That is, the concept of COP was proposed to describe a group of people involved in a shared learning process.

As the result of the shared learning through interaction, members of a COP develop a shared understanding about what to do and what not to do, and how to do it, how to engage with others, what routines to follow, what tools to use and how and under what conditions, etc. An individual's actions are considered competent only if other members of the COP recognise them as such. In other words, COPs have a socially negotiated view on how - competently – to participate in the shared practice. Wenger (1998: 136) refers to this socially negotiated understanding of competent ways of participating in practice as the community's 'regime of competence'. However, this is not to say that all the individuals agree with one another or know the same things. It implies that the regime of competence is situated, and that what is considered as competent action in one COP may not be seen as so in another community. Newcomers to the community need to learn to act in a way that is considered competent by that particular community. In the KTO context this means that the commercialisation practices of COPs in different KTOs may vary because these communities may have developed different regimes of competence.

The concept of COP is applied in many academic disciplines including anthropology, computer science, education, engineering, gender studies, health care, higher education, political science, public administration, social psychology, social work as well as organisational and business studies (for reviews see Murillo, 2011; Koliba and Gajda, 2009). As "learning is an inseparable and integral part of all organisational practices" (Gherardi, 1999: 113), it is not surprising that the concept migrated quickly to organisational studies. Brown and Duguid (1991) were the first to apply the concept to the organisational context in their reinterpretation of Orr's (1990) study of learning and knowledge creation in a community of copy machine technicians in Xerox. Their work was the first to highlight the role of COPs in innovation in a workplace. Other examples of COPs in an organisational context include nurses in a hospital (Wenger, 1996), insurance claim processors (Wenger, 1998), meat cutters in a supermarket (Lave and Wenger, 1991), web designers in an IT company (Thompson, 2005), management consultants in a consultancy company (Anand et al., 2007), and design engineers, technicians and assemblers in a semiconductor equipment manufacturing company (Bechky, 2003). Over time, the COP concept was used to create a new way of understanding the organisation:

Every organisation is made up of many communities of practice in which learning is not a matter of conscious design or recognisable rationalities and

cognitive frames, but a matter of new meanings and emergent structures arising out of common enterprise, experience and sociability – learning in doing. (Amin and Roberts, 2008b: , p.107)

This thesis adopts the above assumption that organisations comprise many communities of practice. However, this does not mean that all employees engaging in work practices belong to a COP. My interest is in the COPs that may be present in a university KTO since studying learning and knowledge creation in these communities allows me understand how KTOs learn, what they learn, and why. This requires finding a robust way to identify COPs. The seminal book by Etienne Wenger (1998) entitled *Communities of Practice: Learning, Meaning and Identity*, is an authoritative source for studies of COPs and was helpful in this endeavour.

In this book, Wenger (1998) remained faithful to the original conceptualisation (Lave and Wenger, 1991) of a COP as a group of people involved in a shared process of learning. He clarifies what learning through participation in practice involves. In particular, he explains *what individuals learn* when they learn how to function in a particular COP, by introducing three learning processes: ‘evolving mutual engagement’, ‘evolving understanding of a joint enterprise’, and ‘evolving repertoire of practice’ (Wenger, 1998).<sup>6</sup> The presence of these learning processes implies the presence of a COP in a particular workplace. As these processes are crucial for identifying the COPs in university KTOs, I discuss them in detail.

Firstly, learning in a COP involves *evolving mutual engagement*, that is, through interactions with others learning how to engage with other members of the community in order to get the work done in a manner that is perceived as competent by others in the community. The members of a COP learn to work within a net of social relations. These relations may involve cooperation and conflict, alliance and competition, trust and suspicion, power and dependence, friendship and hatred. Through evolving mutual engagement, individuals learn to be part of their social environment. They learn who knows what, who is good at what, how to help and how to receive help, and how to share information and opinions. They know where skills or talents overlap and where

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<sup>6</sup> Note that these concepts are used in Wenger’s (1998) book for different purposes. Firstly, Wenger says that mutual engagement, joint enterprise and shared repertoire are sources of coherence in communities. Second, he proposes evolving mutual engagement, evolving understanding of joint enterprise and evolving repertoire of practice as learning processes in a community of practice. Thirdly, he argues that the abilities to engage mutually, to negotiate joint enterprise and to make use of the repertoire of practice comprise a community’s regime of competence. I adopt his second meaning of these terms.

they complement each other. Members of communities of practice in university KTO will be expected to learn or to have learned who does what, who knows what, who is good at what, how to help and how to receive help. In other words, they will be expected to learn or to have learned to engage with others in a way that is recognised by other members of a community as a competent way of acting.

Secondly, Wenger (1998) has explained that learning in a COP entails *evolving understanding of a shared enterprise* (i.e. practice), that is, learning through social interactions:

what matters and what does not, what is important and why it is important, what to do and what not to do, what to pay attention to and what to ignore, what to talk about and what to leave unsaid, what to justify and what to take for granted, what to display and what to withhold, when actions and artefacts are good enough and when they need improvement or refinement. (Wenger, 1998: 81)

Stated simply, evolving understanding of a joint enterprise means learning what to do and how to do it in order to be perceived as competent by others in the community. In the case of a KTO, members of communities of practice in a KTO will be expected to learn or have learned what to pay attention to, what to do and what not to do, and what needs improvement.

Thirdly, learning in communities of practice involves *evolving a shared repertoire of practice*, that is, learning through interactions with others what “routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions or concepts” (Wenger, 1998: 83) to use to get the work done in a manner that is perceived as competent by the other members of the community. Then the repertoire of practice involves the tangible and intangible resources available to individuals to guide their actions, and evolving the repertoire of practice means learning how to make use of these resources in everyday work. The members of communities of practice in a university KTO will be expected to learn or to have learned how to use the repertoire of practice, for example, how to perform a routine, how to use a disclosure form or how to record data in the database in the way that is recognised as competent.

These three learning processes are used in this thesis to identify the communities of practice in university KTOs (see also Chapter 4, Section 4.5 on operationalisation). Wenger (1998) also provided a list of characteristics of communities of practice including among other things shared ways of doing things, quick set up of a problem to

be discussed, and rapid flow of information. While it is tempting to use this checklist to identify communities of practice in organisations, this would go against the original definition of the concept, which emphasises that it is the shared learning process that gives life to the COP. Therefore, for the purposes of this thesis:

A COP is defined as an informal group of individuals that have developed some shared practice through learning in their interactions with one another. Learning involves (1) evolving mutual engagement, (2) evolving understanding of a joint enterprise and (3) evolving a shared repertoire of practice.

This thesis uses a definition of communities of practice derived from early work by Lave and Wenger (1991; Wenger, 1998), rather than some more recent definitions (for an excellent discussion of the ontological shifts and drifts in the community of practice literature see Thompson, 2011). For instance, it has been suggested that COPs may be used as problem-solving tools which can be created and controlled by management and leveraged to achieve strategic advantage (Saint-Onge and Wallace, 2003; Wenger et al., 2002; Wenger and Snyder, 2000). Some management consultants train managers to develop and manage COPs. However, communities created by managers often do not exhibit the processes of learning in the original proposition of the concept (Lave and Wenger, 1991; Wenger, 1998). The notion of *formally formed* COPs has been strongly critiqued. For example, Duguid (2008: 8) laments that the “diagnostic power of the concept has been lost in claims for its healing potential”, which are despite communities of practice not always advancing organisational goals. Similarly, Lave (2008) points out that situated learning theory “was specifically *not* intended as a normative or prescriptive model for what to do differently or how to create better classrooms or businesses. Many who use the concept of ‘communities of practice’ now seem ignorant of the original intent (and its limitations), and simply assimilate it into conventional theory” (Lave, 2008: 283, emphasis in the original). This thesis defines COPs as learning groups that emerge organically.

The concept of COP (in both the original and recent forms) has been criticised also for its neglect of the power relations within a community, the predispositions of community members, issues of trust, and overlooking of differences across communities in terms of size, space and pace of development (Roberts, 2006). Some authors argue that the concept of COP is not helpful for explaining changes in



organisational practices and innovation. In particular, Fox (2000: 860) points out that “community of practice theory tell us nothing about how, in practice, members of a community change their practices and innovate”, while Fenwick (2008: 235) laments the “weak analysis of innovation offered by community of practice conception”. I address the issues of change in communities of practice in the remaining parts of this chapter.

To summarise, this section discussed the concept of COP which describes the immediate social environment in which an individual’s learning and knowledge creation occurs. The previous sections discussed the epistemological assumptions in situated learning theory and the notion of practice as a medium and outcome of learning. All these assumptions and concepts form the basis for the development of a theoretical framework for this thesis research. In the following sections, I develop this theoretical framework for my analysis of what KTOs learn (Section 3.2), how KTOs learn (Section 3.3) and why KTOs learn (Section 3.4).

### **3.2 “What do KTOs learn?” – Emergent work practices**

This section discusses how organisational learning is conceptualised in a practice-based view of learning and knowledge creation. First, I explain that changes to work practices exemplify organisational learning. The terms ‘change of practice’ and ‘transformation of practice’ are used here synonymously. I go on to argue that the nature of changes to work practices has not been adequately problematised. The section concludes with a conceptual model for the analysis of changes in the work practices of university KTOs in order to address the first research question – What do KTOs learn?

#### **3.2.1 *Outcomes of situated learning***

Section 3.1.1 discussed how “learning reproduces and transforms the social structure [i.e. practice] in which it takes place.” (Wenger, 1998: 13) and explained that, according to situated learning theory, new knowledge is socially constructed during social interactions, through the active process of meaning construction or meaning inference. At times, the knowledge created in interactions may be new only to a particular individual involved in the interaction and already known to other members of a COP. These cases should be considered examples of individual learning and reproduction of practice. Transformations of individual ability to ‘practise’ the COP’s practice are an outcome of learning at the individual level. At other times, the knowledge created in

interactions will be new to *all* the members of a COP. If this new knowledge is embedded in the community's work practices, the practice of the COP is transformed. This is an outcome of learning at the collective level and can be regarded as organisational learning. For these reasons, practice, and particularly changes to practice, is the primary unit of analysis in studies of organisational learning. Since this thesis aims to shed light on organisational learning in university KTOs, changes in practice (as opposed to changes to individual ability to practise and reproduction of practice) are the main interest here.

The literature on situated learning assumes that “communities of practice are valuable to organizations because they contribute to the development of social capital, which in turn is a necessary condition for knowledge creation, sharing, and use” (Lesser and Prusak, 2000: 124). The dominant assumption that communities are good for the organisation arguably directs the attention of organisational scholars towards identifying different COPs, and examining the antecedents to situated learning and COP formation. However, our understanding of the effects of situated learning on organisational practices remains limited. Amin and Roberts (2008c) note the assumption in the more recent literature that COPs are capable of generating incremental and path-breaking changes; however, the evidence is limited and fragmented. Stated simply, the nature of the changes to practice resulting from situated learning is not adequately addressed in the literature. I argue that our understanding how situated learning transforms practice could be enriched by examining the relation between different forms of situated learning (in communities of practice, in NOPs and across communities of practice) and different types of practice changes. Section 3.2.2 synthesises the insights the nature of changes to practice arising from previous studies.

### ***3.2.2 The nature of changes to practice***

For the purpose of this thesis, and as explained above, practice is defined as a set of observable activities that are related to a particular organisational function, in which ‘knowing’ and ‘doing’ are inseparable. Therefore, changes to practice will involve changes in both ‘doing’ and ‘knowing’. Orlikowski (2002) in her study of new product development practice observed work activities and inferred what ‘knowing’ was necessary to perform these activities. Orlikowski looks at ‘practice’, not at ‘change in practice’. However, I argue that a similar approach can be taken to understand changes in practice. Changes in ‘doing’ are observable, and changes in ‘knowing’ (ability to

perform an activity) can be inferred from the changes in ‘doing’. By examining changes in the commercialisation activities of KTOs I can draw conclusions about how their abilities change.

The seminal work of Wenger (1998) does not deal with changes in practice in a very explicit manner, but does provide some valuable insights. Wenger (1998) argues that learning in COP transforms practices when the members of the COP learn something that falls outside of the community’s regime of competence. As already explained, the regime of competence is socially negotiated and defines what activities a competent member of a given COP should be able to perform and how he or she should do them. In other words, the regime of competence defines what abilities COP members should display. When a COP member has a new experience and alters the community’s regime of competence to include this new experience, the new knowledge is embedded in work practice and practice is transformed. It goes without saying that altering the community’s regime of competence may not be an easy process (Fox, 2000). Wenger (1998: 138-139) explains how individuals ensure that their new experience is embedded in practice:

As a way of asserting their membership, they may very well attempt to change the community’s regime [of competence] so that it includes their experience. Towards this end, they have to negotiate its meaning with their community of practice. They invite others to participate in their experience; they attempt to reify it for them. They may need to engage with people in new ways and transform relations among people in order to be taken seriously; they may need to redefine the enterprise in order to make the effort worthwhile; they may need to add new elements to the repertoire of their practice.

The inference is that a change in the COP’s regime of competence is associated with changes in practice. First, there may be changes in *how* the activities that constitute practice are performed – for example, how individuals engage with one another and what elements of the repertoire of practice they make use of. Second, when the shared enterprise is redefined there may be changes to *what* activities are performed within the practice. A study by Gherardi and Perrotta (2011) makes a distinction between these two aspects of practice. In a study of the effect of the national institutional context on local medical practice, Gherardi and Perrotta (2011: 5) proposed “to study practice as an order-producing device, integrating the what it [sic] is done (the activities performed within the practice), with the how it is done (the subjective and situated meaning of the

practice for its practitioners)” (emphases in the original). Neither Wenger (1998) nor Gherardi and Perrotta (2011) shed light on how the changes to *the what* and *the how* relate to changes in the regime of competence.

In fact, most studies that examined the effect of situated learning on practice (Anand et al., 2007; Brown and Duguid, 1991; Meeuwesen, 2007; Orr, 1990; Wenger, 1998; Mørk et al., 2008; Wenger and Snyder, 2000) pay little attention to changes in the regime of competence. A notable exception is Nooteboom (2008), who argues that because of COP’s narrow cognitive focus (similarity in knowledge bases and values) situated learning in COPs generally will lead to refinements in the existing competences through incremental changes in practice, whereas learning across COPs may lead to the development of new competences through more radical changes to practice.

The insights from these studies suggest that changes in practice can be considered on two dimensions: (1) the scale of the change – radical or incremental; and (2) the scope of the change – change in how activities are performed or what activities are performed. Juxtaposing these dimensions identifies radical changes in ‘the how’, radical changes in ‘the what’, incremental changes in ‘the how’ and incremental changes in ‘the what’. If one accepts Nooteboom’s (2008) argument that incremental changes relate to refining existing abilities,<sup>7</sup> then there are two ways in which abilities are refined: incremental changes to the how and incremental changes to the what. Similarly, assuming that radical changes in practice relate to development of new abilities (Nooteboom, 2008), new abilities can be developed in two ways – radical changes in the what and radical changes in the how.

To understand these four types of changes, it is helpful to take a closer look at the structure of activities that constitute practice. To this end, the work of Leontiev (1979), by which situated learning has been inspired, is very helpful. Leontiev (1979) argued each activity is directed to *an object* and comprises of *actions* (or tasks) which can be performed differently depending on the conditions in which action takes place. Given that practice comprises activities, the practice change may involve

- Change to what activities are performed within the practice – For example, an addition of a new activity to existing practice would require the members of

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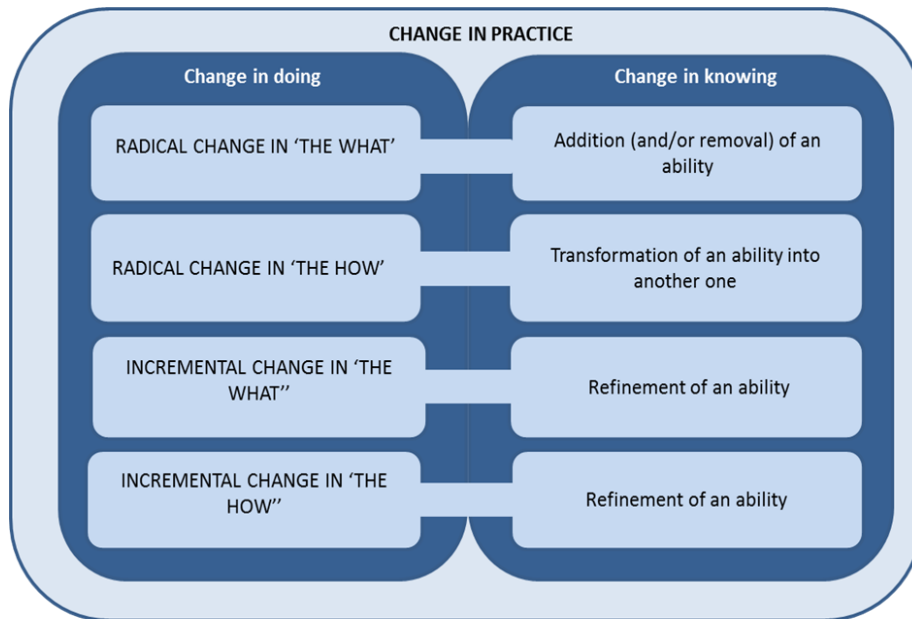
<sup>7</sup> I use the term ‘ability’ rather than the term ‘competence’ used by Nooteboom. The term competence is commonly associated with the capacity to do something successfully whereas the term ability typically indicates the capacity to do something. The COP regime of competence refers to the abilities to do something in a way that COP members perceive as competent, but does not mean that these abilities lead to successful outcomes. Therefore, the term ‘ability’ is preferred here to the term ‘competence’.

COP to develop an ability to perform this activity (e.g. using a computer for book writing, introducing intracytoplasmic sperm injection method to a reproduction clinic ). If at the same time another activity was to be discontinued (e.g. using a typewriter for writing books), the ability to perform this activity would become obsolete. I will refer to this kind of change as a ***'radical change in the what'***.

- Changes to the object of an activity within the practice – The change of the object of an activity would entail changes in the way the activity is performed (e.g. serving food fast rather than providing quality experience in a restaurant). This kind of change arguably requires COP member to transform their ability to do X (ability to perform activity aiming at X) by an ability to do Y (ability to perform activity aiming at object Y). I will refer to this kind of change as a ***'radical change in the how'***.
- Changes to what actions are performed to execute a particular activity – This could involve an addition (or discontinuation) of an action (e.g. addition of a new selling technique). In this case COP members already have the ability to perform a particular activity but may need to refine this ability to be able to perform a new action. I will refer to this kind of change as an ***'incremental change in the what'***.
- Changes to how actions are performed to execute a particular activity – This could involve refining some tools or developing new one or introducing a procedure to standardise the way in which actions are performed. In this case COP members already have the ability to perform a particular activity but may need to refine this ability to be able to perform some actions, which constitute this activity, in a different way. I will refer to this kind of change as an ***'incremental change in the how'***.

My conceptual model of outcomes of situated learning at the organisational level practice – that is, changes in practice – takes into account the four aforementioned types of change and is presented in Figure 3.1. This conceptual model allows investigation of what is learnt in organisations and addresses the first research question – What do KTOs learn?

Figure 3.1 Conceptual model of changes in practice



Source: Constructed by the author

In this section I have argued that the changes in practice resulting from situated learning have not been sufficiently problematised in the literature. I have proposed a model showing that practice changes vary in scope and scale. Can situated learning result in any of the above four types of change? COPs may be motivated to improve their existing abilities through incremental changes to practice. Do they also initiate radical changes that will require development of new abilities or make current abilities obsolete? Do COPs learn to make radical changes in practice if forced to do so? Is the new knowledge generated through interactions among the COP members? Also, COPs are informal groups that have no formal control over organisational resources. Given that changes to what is done (radical and incremental) are likely to require resources (e.g. time, money), it is plausible that situated learning will require some sort of support from management.

I have argued that our understanding how situated learning transforms practice could be enriched by examining the relationships between different ways of situated learning (in communities of practice, in NOPs and across communities of practice) and different types of practice changes. In Section 3.3, I discuss previous work that may shed some light on the relationship between ways of situated learning and incremental/radical changes to 'the what' and 'the how'.

### 3.3 “How do KTOs learn?” – Learning and knowledge creation in COPs

The previous section explained that learning through interactions between individuals generates new knowledge that can transform work practices. The next three sub-sections provide a review of the literature on *how* learning and knowledge creation occur in COPs, NOPs, and across COPs. The section concludes with a conceptual model for how new knowledge is created by commercialisation staff in university KTOs. This model is used to address the second research question – How do KTOs learn?

#### 3.3.1 *Learning through interactions within a COP*

Social interactions among the members of a COP can be a source of learning experiences in which an individual learns something that is new to the whole community. The early COP literature (Brown and Duguid, 1991; Lave and Wenger, 1991; Wenger, 1998) discusses how knowledge is created within a community.

Wenger (1998) gives the example of hiring a new person providing opportunities for the COPs' incumbent members to encounter new experiences. The interactions between a newcomer and the incumbent members of a COP awaken interest, the enterprise is redefined and the repertoire of practice is adapted. The COP's regime of competence is redefined and practice evolves. Wenger (1998) does not explain whether the changes in practice are incremental or radical. Brown and Duguid's (1991) study of copy machine technicians shows that practice evolves also through a negotiation of meaning among the incumbent members of a COP. A technician tried what he knew to fix a copy machine and failed. He discussed the problem with other technicians and together they came up with a new understanding of the problem with new solutions which were tried out with success. In other words, new knowledge was created in interactions among incumbent members of a community. The success story was discussed informally with other technicians and the knowledge created through experimentation entered the community's repertoire of practice in the form of a story. The routine for diagnosing copy machine problems changed. This example suggests that interactions among community members can lead to *incremental changes in practice*. The solutions invented by COP members are likely to be similar to existing ways of doing things because over time community members develop a shared view of what to do and how to do it. The diversity in the skills, abilities and cognition is low in a COP and therefore their ability to innovate is also low (Justensen, 2004; Nooteboom, 2008). For this reason

the COPs may not be the ideal structures for the creation of new knowledge based on combining different points of view.

Amin and Roberts (2008c) suggest that situated learning within ‘craft-based COPs’ (e.g. flute makers, insurance processors) and ‘professional COPs’ (e.g. healthcare or education professionals) tends to generate incremental innovation, but that situated learning in ‘expert or high creativity COPs’ and ‘virtual COPs’ (Amin and Roberts, 2008c) can result in radical changes. Indeed, Anand et al. (2007) found that a COP of consultants played a key role in developing new areas of practice (i.e., radical changes in ‘the what’). In the context of KTOs, it is expected that COPs of knowledge transfer professionals will display the characteristics of a ‘professional COP’, such as, the importance of specialised expert knowledge acquired through education and training, the collocation of COP members, and the development of formal regulatory institutions (Amin and Roberts, 2008c). Hence, it is expected that learning by knowledge transfer professionals through interactions within the COPs in the KTO will result in incremental changes in practice. These might be interactions involving a newcomer (e.g. new employee) and the incumbent members of a COP, or interactions among existing COP members.

In summary, on the basis of the findings from previous studies I propose that learning in COPs in university KTOs can result in incremental changes to practice. Learning through interactions within COPs in the KTO is an important element in my theoretical framework. Section 3.3.2 discusses learning through interactions with other COPs.

### ***3.3.2 Learning through interactions across COPs***

Social interaction by the members of a local COP with ‘outsiders’ can be a source of ‘something new’ for the whole community, and can trigger or inform transformations to local practice. This section focuses on interactions between COP members with ‘outsiders’ who engage in different practices. In other words, this section is about learning through interactions across COPs.

Communities performing different practices develop different ‘knowing’ in practice. Nooteboom (2008) claims that radical changes are more likely to result from interactions *across* COPs, than from interactions within a COP, because of the dissimilarity in knowledge bases across COPs. Amin and Roberts (2008c) argue that even ‘professional COPs’ can generate radical innovation through interactions with



other communities. However, Brown and Duguid (2001) note that sharing knowledge across COPs can be problematic because different practices entail also different languages (or professional jargon), values, norms and general worldviews. There is a consensus in the literature that “The boundaries between communities of practice represent, on the one hand, a barrier between different sets of practice and, on the other, an opportunity for cross-fertilization and for the discovery of different perspectives.” (Tagliaventi and Mattarelli, 2006: 295).

Carlile (2004) identifies three types of boundaries between communities: a syntactic or information-processing boundary; a semantic or interpretative boundary; and a pragmatic or political boundary. He suggests that crossing these respective boundaries requires: the transfer of knowledge, the translation of knowledge; and the transformation of knowledge. Despite difficulties involved in sharing knowledge across the boundaries between COPs, there is evidence that learning occurs in cross-community interactions (Carlile, 2002; Gherardi and Nicolini, 2000; Scarbrough and Swan, 2008; Bechky, 2003). The difficulties involved in sharing knowledge across COPs can be mitigated by the use of boundary objects<sup>8</sup> (Swan et al., 2007), the use of generic terms to communicate (Bechky, 2003; Tagliaventi and Mattarelli, 2006), working side-by-side or ‘operational proximity’ (Tagliaventi and Mattarelli, 2006), engagement in joint projects (Scarbrough and Swan, 2008; Carlile, 2002), the work of knowledge brokers, and shared organisational values in the case of COPs within the same organisation (Tagliaventi and Mattarelli, 2006; Nooteboom, 2008).

Tagliaventi and Mattarelli (2006) found that individuals from different COPs ‘taught’ one another their respective practices. In their study, doctors in the oncology unit ‘taught’ technicians how to make certain decisions, while the technicians ‘taught’ the doctors how to use the irradiation equipment. However, an individual can learn from interactions across COPs regardless of whether the members of the other community ‘teach’ them or not. A member of a COP learns something new as he or she “comes to understand how knowledge from another community fits within the context of his own work, enriching and altering what he knows” (Bechky, 2003: 321). I argue that interactions between COPs can potentially provide new insights into how to engage with colleagues to get the work done, what to do to get the work done, and what tools, routines, words, or rules of thumb to use. In the context of KTOs, we would expect

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<sup>8</sup> “artefacts, documents, terms, concepts, and other forms of reification around which communities of practice can organize their interconnections” Wenger (1998: 105)

technology transfer staff to learn through interactions with members of other COPs, such as academics, research support staff, university finance managers, patent agents, business consultants, venture capitalists, etc. The learning takes place regardless of whether or not there is a conscious attempt to ‘teach’ one another.

Interactions across COPs often occur during joint projects. However, they do not necessarily have lasting effects on practice (Carlile, 2002). Joint projects could be particularly relevant to KTOs since they involve technology transfer professionals engaging with academics, venture capitals, patent agents, and licensees. Scarbrough and Swan (2008) examined learning in projects using a practice-based view of learning. Although their study does not focus explicitly on learning via interactions across COPs, it does provide some relevant insights. Scarbrough and Swan described a project that involved members of different occupational COPs, aimed at improving cataract treatment in a Midlands Hospital, involving optometrists, general practitioners (GPs), nurses from the hospital’s eye unit and surgical consultants. All involved had the opportunity to learn about the skills and capabilities of the members of other professional groups. Interactions between members of the optometrist community and members of the community of GPs provided the optometrists with opportunities for learning and resulted in a new understanding of what optometrists could do to speed up diagnosis of a cataract. The optometrists in their interactions with GPs learnt what diagnostic tools and routines they could adopt. As a result of these interactions, the diagnosis activity became a part of the optometrists’ practice. Thus, learning through interactions across COPs led to a *radical change in what is done* by the optometrists.

This section has shown that learning occurs through interactions among members of a COP with ‘outsiders’ with different practices. Some scholars argue that interactions across COPs result in more radical innovation (Amin and Roberts, 2008c; Nooteboom, 2008), but there is little empirical evidence to substantiate these claims. The study by Scarbrough and Swan (2008) gives some indication that this form of learning generates radical changes in ‘the what’. However, there is no reason to suppose that incremental changes would not be informed by learning across COPs. This aspect is addressed in my empirical analysis.

Section 3.3.3 discusses learning through interactions with ‘outsiders’ with similar practices, based in different locations, that is, learning within NOPs. This can be also an important mode of learning for university KTOs.

### 3.3.3 *Learning through interactions within NOPs*

The social interactions of members of a local COP with ‘outsiders’ who engage in the same or very similar practice elsewhere (Brown and Duguid, 2001) can be the source of learning something new for the whole community, and can trigger or inform transformations in local practice. Brown and Duguid (2001) coined the term ‘networks of practice’ to describe the network of people engaged in the same or very similar practice, who are dispersed geographically. In such networks, knowledge can be shared relatively easily based on the individuals’ common understanding of their practice (i.e., overlapping knowledge bases). The authors base their conceptualisation of these networks on the study by Knorr-Cetina (1999), showing that microbiologists and high-energy physicists are able easily to share knowledge with other scientists in their respective disciplines.

Brown and Duguid argue that “practice creates the common substrate” in NOPs (Brown and Duguid, 2001: 205). Their definition highlights that a NOP is a network of COPs with the same practices (Brown and Duguid, 2001). This should not be confused with a network of COPs that engage in different practices discussed in the previous Section. This distinction is crucial since knowledge is exchanged more easily within NOPs than across COPs (Brown and Duguid, 2001). Some studies fail to make this distinction (Agterberg et al., 2010; Wenger, 2000), which questions the validity of their conclusions about the conditions under which knowledge is shared in NOPs. It should also be stressed that a NOP differs from a COP in a substantial way as concern has been raised over the lack of clarity in the definition of these networks (Vaast, 2004). In a NOP “relations among network members are significantly looser than those within a community of practice.” (Brown and Duguid, 2001: 205). Members of NOPs do not necessarily engage with one another to pursue their everyday activities, but they engage in similar kinds of activities. The sharing of knowledge in NOPs takes place “through venues such as conferences, journals, mailing lists, online communities” (Tagliaventi and Mattarelli, 2006) or intranets (Vaast, 2004).

Brown and Duguid (2001) focus on the ‘leakiness’ of organisational knowledge through NOP. Others emphasise the flows of knowledge from NOP into organisational COPs (Delemarle and Laredo, 2008; Tagliaventi and Mattarelli, 2006; Agterberg et al., 2010). Tagliaventi and Mattarelli (2006: 296, emphasis added) argue that “networks of practice provide their members with the opportunity to *confront, modify, and combine their practices*, resulting in new knowledge available to their own communities and

organizations.” Although their study focuses on sharing knowledge across five different professional groups in oncology units, it provides an example of changes to practice resulting from learning through interactions with members of wider NOP. Specifically, a new procedure for positioning breast cancer patients on irradiation machines (i.e. accelerators) was introduced to incorporate what one doctor had learnt during a conference. In other words, the doctor learnt through interactions with his NOP about how to use a particular tool (accelerator) and how to adjust the current routine of irradiation. This example suggests that learning in a NOP can lead to *incremental changes in how* activities within the practice are performed. As members of NOPs are engaged in similar practice and have similar knowledge bases, learning in NOPs is more likely to result in incremental than radical changes. There is no evidence, to my knowledge, showing that learning in NOPs resulted in radical changes in practice.

Despite the potentially great benefits of learning in NOPs for the evolution of organisational practice, flows of knowledge in these networks cannot be taken for granted. A study by Ormrod, Ferlie, Warren and Norton (2007) on the diffusion of new practices in the field of psychodynamic psychiatry highlights that there can be different ideologies within NOPs that erect a barrier to the spread of knowledge and new practices. There are also concerns about the extent to which formally constructed NOPs can become sources of continuous improvements to local practice. Agterberg et al. (2010) show that networks that are constructed in a top-down manner and were told what knowledge to share persisted only as long as there was pressure from management to do so. This highlights the importance of some self-organisation in NOPs.

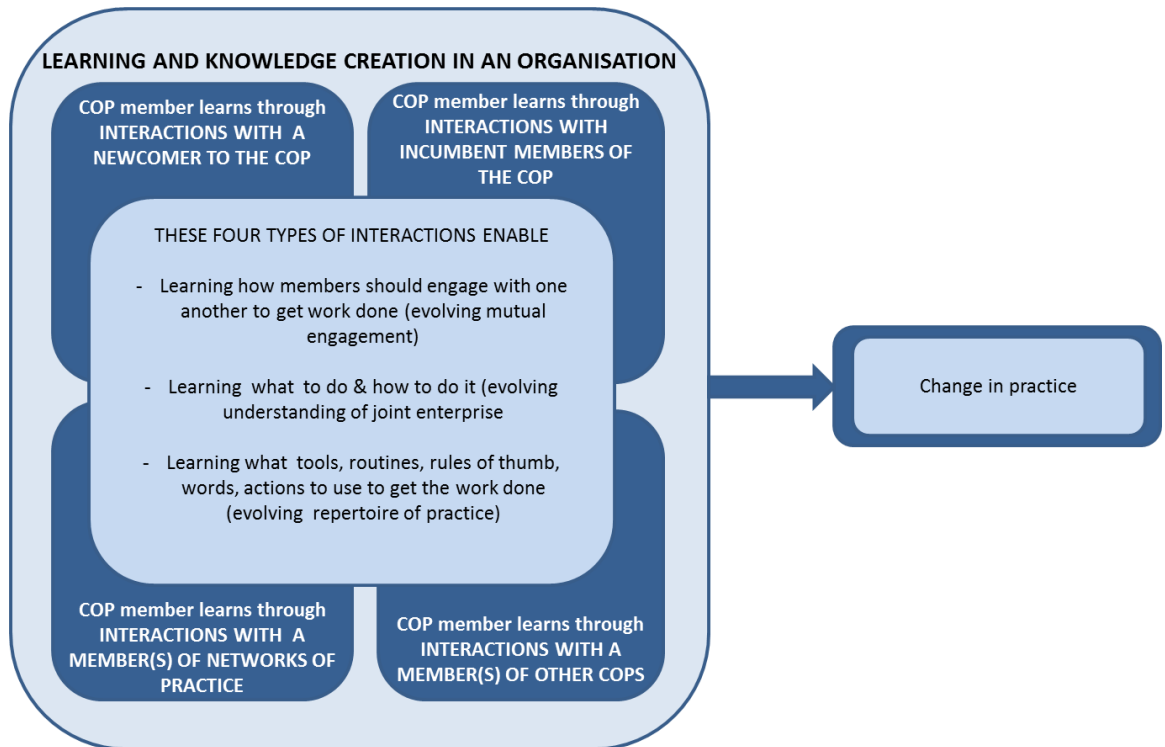
This thesis adopts Brown and Duguid’s definition of a NOP as a self-organising, loose network of people who are engaged in the same practice, but are geographically dispersed. In the context of university KTOs, a NOP would include the knowledge transfer staff from various organisations who interact informally, during conferences, training courses, regional meetings and other events as well as online fora and mailing groups. Since it has been proposed by Cardozo et al. (2011) that KTOs may learn from each other, I include learning in NOPs in my theoretical framework. On the basis of previous studies, we would expect learning of commercialisation staff in NOPs to result in incremental changes to ‘the how’.

### 3.3.4 Summary

Sections 3.3.1, 3.3.2 and 3.3.3 set out to explain how learning occurs in organisations in order to create a conceptual model to address the second research question – *How do KTOs learn?* Wenger (1998) argued that individuals learn through interactions, how to engage with one another to get the work done (evolving mutual engagement), what to do and how to do it (evolving understanding of the joint enterprise) and what tools, routines, rules of thumb, words or actions to use to get the work done (evolving repertoire of practice). In Wenger's work these three learning processes are introduced predominantly to explain how individuals learn to behave in a way that is aligned with the community's regime of competence (i.e. the reproduction of practice over time). I argued that the same three learning processes allow the individual to learn something that is outside COP's regime of competence (and lead to changes in practice).

I argued also that, in order to understand how learning and knowledge creation take place in organisations, we need to account for learning and knowledge creation in interactions within COPs, within NOP, and across COPs because any of these interactions potentially can provide the individual with new insights into how the members of the local COP should engage with one another to get the work done, what the joint enterprise of the local COP should be about, and what tools, routines, words, or rules of thumb the members of the local COP could use to get the work done. I have combined insights from various studies of COP and NOP to design my conceptual model, which is depicted in Figure 3.2

Figure 3.2 Conceptual model of organisational learning and knowledge creation



Source: Constructed by the author

Previous studies tend to look separately at the role of learning within a COP, a NOP and across COPs, in relation to changes to organisational practices. The exception is the study by Tagliaventi and Mattarelli (2006), which looks at sharing knowledge across COPs within the same organisation as well as in NOP, but pay little attention to changes in practice. My conceptual model has the potential to provide new insights for work on COPs by providing a framework to analyse how learning in COPs, NOPs and across COPs affects practice, by paying attention to the nature of change (radical or incremental change in ‘the what’ and ‘the how’).

In the next section I discuss the interplay between COP members and management in instigating situated learning and shaping its trajectory.

### 3.4 “Why do KTOs learn?” – Bottom-up and top-down drivers of situated learning

The studies discussed in Section 3.3 explain how new ‘knowing’ is created in practice through interactions in COPs, NOPs and across COPs but pay little attention to *why* situated learning occurs – what triggers it and what shapes its trajectory. These studies assume that even when the practice is influenced by external

situations/conditions, practice, to some extent, is always a collective response of the community to what community members understand to be their situation. This is a constructivist view of context, according to which context or a situation “is considered to be something that acquires form and springs from the actors involved in the situation, who select the elements of that situation” (Gherardi and Perrotta, 2011: 3). This view highlights the agency of COP members who “select” the problems and opportunities to which they respond and downplays the need to conceptualise the context in which COPs operate. I argue that this approach does not allow realising the full implications of the fact that COPs are embedded within hierarchical organisations. I show below that the studies that explicitly look at the relation between management practices and situated learning provide a more comprehensive account of organisational processes leading to changes in organisational practices.

*Management practices and situated learning.* Macpherson and Clark (2009) contend that management shapes the learning trajectories of COPs, but they do not analyse changes to practices. James (2007) shows that management actions generate on-going changes within employment relations, which have the effect of reconfiguring and redefining the identities of the members of COPs; however, she does not look at changes in practice. Cross et al. (2006) show the impact of management on the extent of knowledge sharing in a COP but also do not analyse changes to practice. Gongla and Rizzuto (2004) refer briefly to changes to the organisational mission and changes in leadership and organisational priorities that trigger evolution of COPs, but do not go into detail. In conclusion, it is commonly acknowledged that “management’s role in defining the context – responsibilities, structures, systems and processes – that circumscribe work contexts is likely to be an influential part of the process of shaping situated learning trajectories” (Macpherson and Clark, 2009: 554) but there is little evidence for these assertions (similar argument was made by Swan et al., 2002; Thompson, 2005). The remaining part of this section discusses a few previous studies that shed some light on the role of management in triggering and shaping situated learning that brings about changes to practice.

*Management practices, situated learning and radical change to ‘the what’.* Previous studies show that management can stimulate the formation of a new COP in order to develop new practices (Swan et al., 2002; Anand et al., 2007; Thompson,

2005). Swan et al. (2002) show that *direction-setting practices* of management (referred to as ‘discursive practices’) can help in the formation of a COP. Swan et al. show that managers used discourse on COPs to promote the adoption of a radical innovation in the treatment of prostate cancer, known as brachytherapy. These authors seem to subscribe to the view that COPs can be a ‘*real thing*’ created by management and used as tools for the development of new practices. Similarly, other scholars propose step-by-step guides for establishing a COP (Wenger et al., 2002; Saint-Onge and Wallace, 2003). However, whether communities launched by management as COPs display the characteristics of a COP as proposed by Wenger (1998), or whether they represent other forms of social groups, such as cross-functional teams, project teams or committees (Murillo, 2011) is unclear.

Others treat the concept of COPs as *an analytical concept* that allows us to look at situated social learning in organisations but recognise that the situated social learning can be facilitated or hindered by the actions of management (Macpherson and Clark, 2009; Roberts, 2006; Thompson, 2005; Anand et al., 2007). This group of scholars take the view that “communities, like gardens, must be cultivated and gently nurtured if they are to thrive and multiply” (Ward, 2000: 3). For example, Thompson’s (2005) study of a community engaged in web-design practice in a large information technology company revealed that management supported the emergence of this community in two ways. First, it created ‘seed structures’, such as tools and artefacts that became part of the community’s repertoire of practice; second, they encouraged interactions amongst individuals. Thompson refers to these as structural and epistemic parameters of a community of practice. Anand et al. (2007) found that managers supported the formation of new COPs within management consultancy firms by *providing resources and sponsorship*. In their study, situated learning that led to new practices was triggered by staff members rather than by the management. Similar to Anand et al. (2007) and Thompson (2005) I use the COP concept for analytical purposes and I argue that situated learning in university KTOs will be affected by the actions of the KTO and the university’s management.<sup>9</sup>

In summary, the above studies suggest that the management can trigger the development of new work activities (i.e., radical change to ‘the what’) by setting new directions, fostering the emergence of new COPs and providing support and allocating

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<sup>9</sup> A COP is an analytical category, not a ‘real thing’, thus, management does not manage a COP.



necessary resources. Situated learning by COP members then informs the performance of the new activities.

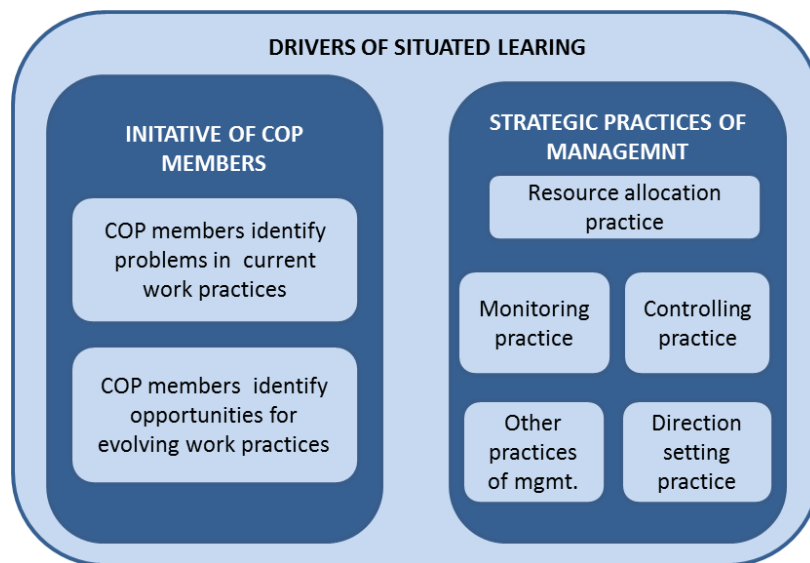
***Management practices, situated learning and other types of change to practice.***

The relationship between management and situated learning in bringing about other types of changes in practice – radical change in ‘the how’ and incremental changes in ‘the how’ and ‘the what’ – is not that clear. Roberts (2006: 630) notes that “radical change may be very difficult to bring about within existing communities, and may be more easily introduced through the destruction of old communities and the emergence of new ones”. As explained in Section 3.1.4 COP members invest in developing abilities that are considered to be important within a COP’s regime of competence. They thus may be unwilling to make changes to practice that will make their existing abilities obsolete and will require them to develop new ones instead. There is, however, limited evidence to support these claims. The role of management and situated learning in the transformation of existing activities (i.e., radical change to ‘the how’) is poorly understood. Moreover, the understanding of the role of management in triggering and shaping situated learning that brings about incremental changes is also limited as there is often an assumption that incremental changes happen unnoticed by the management. It is, however, plausible that management may identify ways of improving some activities and identify areas for growth, but by doing so they affect learning and knowledge creation in COPs. I argue that management practices, such as direction setting, resource allocation or controlling practices, which were found to trigger situated learning of COP members and shape their learning trajectories in the process of bringing about radical changes to ‘the what’ (Gongla and Rizzuto, 2004; Swan et al., 2002; Anand et al., 2007), may also play a role in the introduction of other types of changes in practice.

***Conceptual model of situated learning drivers.*** In order to conceptualise management practices that potentially trigger and shape learning and knowledge creation by COP members, I refer to studies that take a practice-based view of organisational strategy. These studies understand strategising as practice (Johnson et al.,

2003; Pye and Pettigrew, 2006)<sup>10</sup> and blur the boundaries between strategising and organising by emphasising daily managerial practices involved in making strategic decisions and organising work. These strategic practices include: controlling practices, communicating practices (Whittington et al., 2006), direction-setting practices, monitoring practices and resource allocation practices (Jarzabkowski, 2003). As argued above, these strategic practices may change the cognitive, material and social resources available to COP members and, therefore, trigger and shape the learning trajectories of these communities and the evolution of their practices. While taking into account the impact of management on situated learning, I recognise that some changes to practice may be introduced on the initiative of the COP members. The problems and opportunities may arise in the pursuit of practice and COP members may spontaneously respond to them (Brown and Duguid, 1991; Anand et al., 2007). Figure 3.3 illustrates bottom-up and top-down drivers of situated learning.

Figure 3.3 Conceptual model of situated learning drivers



Source: Constructed by the author

<sup>10</sup> Note that, although studies of strategising and organising look at strategies using a practice lens, they do not fully embrace the practice-based view of learning and knowing. There seems to be an implicit cognitive view of learning and knowledge according to which the role of managers is to provide information and knowledge to be processed by employees and implemented (e.g. Jarzabkowski, 2003). In the practice-based view of learning, the role of managers is to change the patterns of participation and interaction through which learning occurs, or to engage with employees in order to give particular meaning to employees' activities and, in this way, to try to alter staff practice. This thesis takes a practice-based view of learning and thus rejects the possibility that managers simply transfer their knowledge to employees.

In the context of university KTOs, first, managers can allocate resources for strategic hiring of new staff members or for subcontracting of some work, which will create opportunities for KTO staff to learn through interactions with the new staff or the subcontractors. In other words, management is providing opportunities for the creation of new knowledge through interactions *within* a KTO's COP or *between* the members of a KTO's COP and members of other COPs (e.g. patent agents to whom work is subcontracted). Second, the KTO management can allocate resources to develop new elements of the COP's repertoire on communities (e.g. a new patent database). The KTO management could change its control and monitoring practices, which might stimulate changes to the way individuals work together and/or to procedures, tools, routines and other elements in the repertoire of practice. Third, direction-setting practices could entail discussions between management and members of the KTO's COPs. Through engagement in meaning-making, management could shape the community's understanding of what their enterprise is or should be about. This is not to suggest that all the directions set by the KTO's management will be followed by the COPs. However, they will have to respond to the new directions set by the management and decide how to act under these new circumstances.

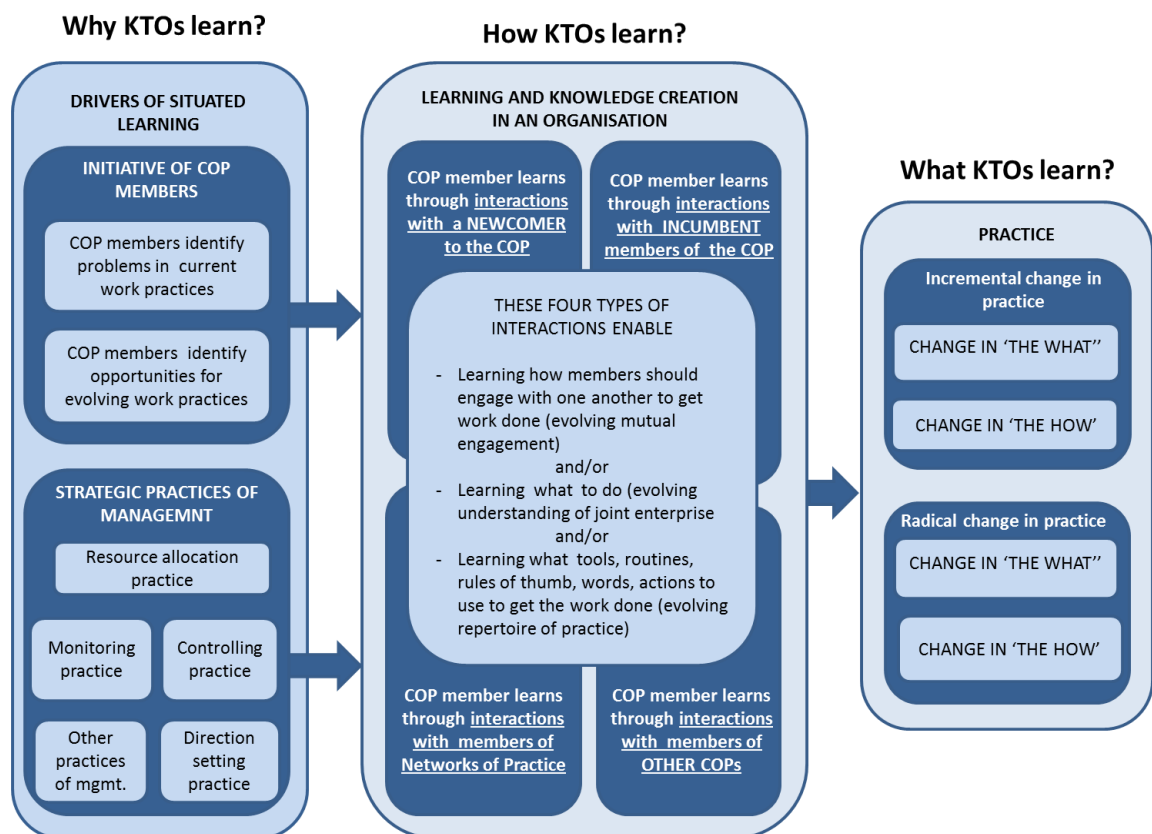
To summarise, I argued that in order to understand *why* KTOs learn, that is why certain changes to practice occur, it is necessary to examine the bottom-up and top-down drivers of situated learning. The review of the literature on COPs revealed that previous studies show the impact of management practices on situated learning in the process of bringing about change to what activities are performed but do not explore in depth the interplay between management's strategic practices and situated learning in the introduction of other types of changes to practice. Understanding *how management practices trigger and shape situated learning* by COP members (through interactions in COPs, NOPS, and across COPs) that transforms a community's practice is limited. This thesis aims to shed more light on this issue.

### **3.5 Summary of the theoretical framework**

This chapter discussed practice-based studies of learning and knowledge creation in order to develop a theoretical framework for an analysis of learning in university KTOs. According to this theoretical framework, changes in practice are the outcomes of situated learning, which can be spontaneous or instigated by management. I referred to previous work on learning in COPs, NOPS and across COPs in constructing a

conceptual model of situated learning and knowledge creation in organisations. Previous practice-based studies of strategising were used to conceptualise the activities of management to initiate situated learning. Drawing on these studies, Figure 3.4 illustrates the theoretical framework for an analysis of what KTOs learn (changes in practice), how they learn (in COPs, in NOPs, across COPs) and why (spontaneous learning or instigated by the management).

Figure 3.4 Theoretical framework



Source: Constructed by the author

In developing the theoretical framework, I highlighted a gap in the COPs literature and made some proposals about how it should be addressed. Thus, in addition to contributing to the literature on university-industry links, I hope to make a conceptual contribution to the COPs literature. For purposes of clarity, I recapitulate the gap identified in the COPs literature and my theoretical propositions.

Gap in the literature:

- insufficiently problematised nature of changes to practice;

- limited understanding of learning processes that lead to different kinds of changes to practice
- limited understanding of the relationship between strategising and situated learning

My theoretical propositions:

- Propositions about the nature of changes to practice: I distinguish between radical and incremental change in the ‘the what’ and ‘the how’.
- Synthesis and careful reinterpretation of previous empirical findings allows the following theoretical propositions to explain different kinds of changes to practice:
  - 1) Incremental changes in practice result from situated learning in COPs (e.g. Amin and Roberts, 2008c; Brown and Duguid, 1991) or in NOPs (e.g. Tagliaventi and Mattarelli, 2006) initiated by COP members;
  - 2) Radical changes in ‘the what’ result from learning in COPs (e.g. Anand et al., 2007) or across COPs (e.g. Scarbrough and Swan, 2008) spontaneously initiated by COP members, but may need to be endorsed by the management (Anand et al., 2007);
  - 3) Radical changes in ‘the what’ result from learning in a COP instigated by management (e.g. Thompson, 2005).

I argued that management’s strategic practices may also play a role in initiating and shaping situated learning that results in incremental changes to practice and radical changes in ‘the how’. The empirical analysis in the following chapters explores these possibilities.

## 4 Methodology

This thesis involves six case studies of UK university KTOs to investigate learning in KTOs. This chapter explains and justifies the research design of the thesis. I discuss the rationale for the choice of case-study as the research strategy, the selection of cases, and the methods for data collection, operationalization of theoretical concepts and methods of data analysis. Below, for reasons of clarity, I repeat the research questions.

**Research questions.** The review of the literature on university-industry links (Chapter 2) revealed limited understanding of learning in university KTOs. This study addresses this gap by investigating following research questions:

1. What do university KTOs learn?
2. How do university KTOs learn?
3. Why do university KTOs learn?

This thesis research seeks to explain learning outcomes (i.e. changes in practice) by looking at ‘how’ learning occurs in KTOs (in COPs, in NOPs, across COPs) and ‘why’ learning occurs (on the initiative of COP members or instigated by the management). These ‘how’ and ‘why’ research questions require an explanatory research strategy (Yin, 2009). Section 4.1 outlines my choice of a research strategy.

### 4.1 Rationale for a case study approach as the research strategy

Three explanatory research strategies were considered – experimental, historical, and case study. Yin (2009) argues that the choice of research strategy should be based on its relevance to the research questions, but also should take account of the level of the investigator’s control over the phenomenon being studied and the time-frame. In this research, the investigator has no control over the studied phenomenon because, unlike in some educational studies of learning where the investigator can create different situations for learning and investigate their effects, the investigator has no means of manipulating how and why learning occurs. An experimental research strategy was rejected on these grounds. Historical analysis was excluded because the commercialisation of university research via KTOs is a fairly recent phenomenon. Therefore, a case-study approach seemed the most appropriate for the proposed study.

Yin (2009: 13) defines a case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. The greatest advantage of a case study method is that it does not reduce the complexity of social phenomena to a few variables, but allows the holistic and meaningful characteristics of real-life events to be retained. In this thesis research, the phenomenon under inquiry is commercialisation practice and, more specifically, changes in this practice. The immediate context shaping practice is comprised of COP in KTOs, where members perform the practice. The intermediate context shaping the commercialisation practice is comprised of NOP, other COP, and the university and KTO management. As explained earlier, members of a COP learn through participation in practice, and what they learn is their practice. Thus, the boundary between the phenomenon and the context is blurred and a case-study approach allows to deal with this complexity. Case studies reveal the detail in complex social situations and enable examination of how the many parts of an immediate and intermediate social context affect one another (Denscombe, 2003: 31). This research strategy is that suitable for analysis if interplay between strategic practice of management and situated learning. Furthermore, the case-study approach enables the use of multiple sources and types of data, which enhances our understanding of the complex social context shaping work practices. Finally, case studies can be used for theory-testing and theory-building (Yin, 2009). The ability of cases study research to contribute to scientific developments has been contested by some, but there are many examples, such as the famous case studies conducted by Galileo, Albert Einstein, Niels Bohr and Charles Darwin, that prove that case studies have the potential to make theoretical contributions (Flyvbjerg, 2011). My research aims to build learning-based explanations of changes to work practices and thus to contribute to developing situated learning theory; a case-study approach is an appropriate research strategy for the research problem being investigated.

The decision to adopt a case-study strategy has implications for the scope and scale of the study. The results of my analysis are not generalisable to all KTOs - in the UK or in the world. The aim is to achieve analytic generalisation, or a generalisation to the theory, in addition to some practical implications. The findings may have implications, in particular, for universities and governments related to how support the development of commercialisation practice in university KTOs.

## **4.2 Units of analysis and of observation**

Before describing the selection of the cases for this research, we need to define the unit of analysis and the unit of observation. In case-study research, the case is the unit of analysis. Stake (1995: 2) explains that “the case is a specific, a complex, functioning thing. (...) The case is an integrated system. The parts do not have to be working well, the purpose may be irrational, but it is a system”. The ‘case’ in my research is commercialisation practice. Practice has been defined as a set or a system of observable activities that are related to a particular organisational function, in which knowing and doing are inseparable. In fact, in practice-based studies, practice is the primary unit of analysis. Participation in social practice is a medium for learning while transformations to practice are the outcomes of learning in COP. The unit of analysis in this study is commercialisation practice in a university KTO. Operationalization of the concept of practice is discussed in Section 4.5.

In order to analyse practice, I observe commercialisation activity. In other words, the unit of observation in this study consists of activities aimed at the commercialisation of academic research, performed by staff in university KTOs in the UK. The UK is among those European countries with arguably the most advanced infrastructures supporting university-industry knowledge transfer. Some universities established university KTOs in the late 1980s after Margaret Thatcher’s Conservative Government eliminated the British Technology Group’s monopoly rights to exploit publicly funded research and put the universities in charge of the exploitation of government-funded research (Lambert, 2003). Others established KTOs in the late 1990s and early 2000s when Tony Blair’s Labour Government introduced funding to build capacity for knowledge transfer in universities. By the end of the first decade of the 21<sup>st</sup> century, nearly all UK universities had some form of KTO. The UK is, therefore, an appropriate empirical context.

## **4.3 Selection of case-studies**

Yin (2009) underlines the importance of theoretical concepts in the selection of case-studies. Case-study research aims to make generalisations that contribute to the theory and, thus, it is essential that the research design is well connected to the theoretical concepts.

In order to gain an understanding of learning in KTOs, it is necessary to look at learning in more than one KTO since there are differences among these entities. This



points to the suitability of a multiple rather than a single case-study design. Also, multiple case studies allow for more robust interpretations of a particular phenomenon, in this thesis – change in commercialisation practices. This section explains the rationale for the selection of the six case-studies.

#### ***4.3.1 Selection of case-studies – conceptual level***

Yin (2009) suggests that case selection should be based on replication logic, that is, one should think of multiple cases as multiple experiments. This means that a second (and a third, and so on) case-study should either reveal another aspect of the studied phenomenon or corroborate the findings from the first case-studies: “This is far different from a mistaken analogy in the past which incorrectly considered multiple cases to be similar to the multiple respondents in a survey (or to the multiple subjects within an experiment) – that is to follow a “sampling” design.” (Yin, 2009: 54). Yin distinguishes between literal and theoretical replication. Literal replication entails the selection of cases with the same outcomes in order to show that the same outcomes occur for the same reasons. Theoretical replication involves, for example, the selection of cases with contrasting outcomes in order to show that these contrasting outcomes have theoretically based explanations. Theoretical replication may also be claimed when the cases support a certain theory, but do not support a plausible rival theory. Thus, multiple cases can allow the exclusion of alternative explanations, and increase the internal validity of the research design.

Since this study aims to verify some theoretical propositions, it was important to select cases that allow for theoretical replication. The ideal approach is to select a number of cases with different learning outcomes and show that the differences in outcomes arise for predicted reasons (or theoretical propositions). In other words, it is desirable to select cases of different kinds of changes in practice – radical and incremental, changes in ‘the what’ and changes in ‘the how’. However, information on changes in each KTO’s practice was not available prior to the fieldwork. I use *change in commercialisation performance* as an imperfect approximation of changes in a KTO’s practices. Information on commercialisation performance is available in the *Higher Education – Business and Community Interaction* (HEBCI) surveys published by the UK Higher Education Statistics Agency. *For this practical reason, the performance measures became the starting point for the selection of cases.*

Based on the assumption that different patterns of changes in commercialisation performance are related to different changes in commercialisation practice, I looked at two measures of performance: number of inventions disclosed by academics to the KTO, and number of licence contracts arranged by the KTO. The number of internal invention disclosures is strongly correlated with the number of patent applications. It is supposed that these measures are related to different subsets of commercialisation practice. It is assumed that increases in the number of disclosed inventions will be related to changes in technology transfer managers' approach to identifying inventions, assessing inventions and managing IPR. High rates of improvement in the number of disclosed inventions should be associated with more radical changes in these activities, and low rates of improvement should be related to incremental changes in these activities. Change in the second measure of performance – number of completed licensing deals – is believed to be associated with changes in the approach of technology transfer managers to market academic inventions, identify licensees, and negotiate licence contracts with established companies or spin-out companies. Again, high increases in the number of licences are assumed to be associated with radical changes in these activities and low rates of improvement are presumed to be related to incremental changes in these activities.

Following Yin's suggestion that multiple cases should be treated as multiple experiments, the cases were selected to show that the same learning outcomes occur for theoretically known reasons (literal replication) and that different learning outcomes occur for theoretically known reasons (theoretical replication). The logic for the selection of cases is depicted in Figure 4.1. I expect learning outcomes to differ among the four types of cases - (1) Cases A and B, (2) Case C, (3) Case D and (4) Cases E and F - but that learning outcomes will be the similar for Cases A and B and for Cases E and F.

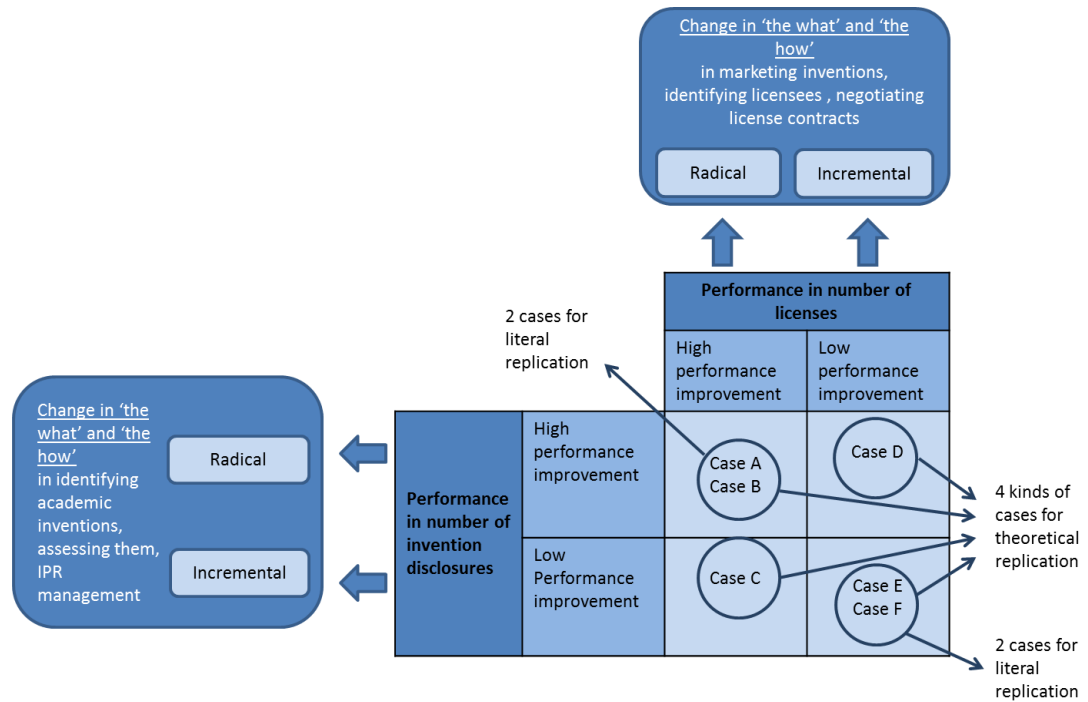
I identified two Cases (A and B) where I expected to observe radical changes in *what* technology transfer managers do and *how* they identify commercialisation opportunities, assess the inventions, manage the IPR, market the inventions, identify licensees and negotiate licence contracts. According to my propositions, radical changes (in 'the what') should result from (1) learning in COPs instigated by management or (2) from learning of technology transfer managers in COPs or across COPs (e.g. academics, venture capitalists, patent agents, licensees) on the initiative of staff, but endorsed by

management. These two Cases should be examples of literal replication since the same learning outcomes are expected for theoretically known reasons.

The selection of Cases E and F was based on the expectation of observing learning outcomes that would be different from Cases A and B (theoretical replication). Specifically, I expected to observe incremental changes in *what* technology transfer managers do and *how* they identify commercialisation opportunities, assess academic inventions, manage IPR, market inventions, identify licensees and negotiate licence contracts. According to our proposition, incremental changes in what technology transfer managers do and how they do it should result from learning within local COPs in a KTO and learning through interaction with members of NOPs (technology transfer staff of other KTOs), initiated by COP members. These two cases were selected for literal replication of findings.

I selected two more cases for the purpose of theoretical replication. The Case C with (expected) radical change in what is done and how to market inventions, identify licensees, negotiate licensing contracts and (expected) incremental changes in what is done and how to identify inventions, assess them and manage IPR, and Case D with (expected) incremental change in what is done and how to market inventions, identify licensees, negotiate licensing contracts and (expected) radical changes in what is done and how to identify inventions, assess them and manage IPR. These two cases were selected to provide more fine-grained insights into how technology transfer managers learn and why they learn to transform some commercialisation practices more than others.

Figure 4.1 Replication logic in case study selection



Source: Constructed by the author.

#### 4.3.2 Selection of case-studies – operational level

As explained above, changes in commercialisation performance were used as an imperfect approximation of changes in a KTO's practice. Information on commercialisation performance was taken from the HEBCI surveys. All the annual HEBCI reports available at the time of the case-study selection, were combined into a dataset of the commercialisation activities of 160 UK higher education institutions in the period 2002-2009. HEBCI did not begin to report information on commercialisation performance at the institutional level until 2002.

First, I set the boundaries for the selection of universities. Universities with an average annual research income in 2002 to 2009 of less than £500,000 were excluded on the basis that research outcomes were a necessary precondition for commercialisation activity. This left 120 universities. I also excluded universities that in 2002/09 reported either no or very few commercialisation outcomes. The theoretical framework assumes that learning occurs in practice, and in these cases commercialisation 'practice' was almost non-existent. Universities whose sum total of internal invention disclosures, patent applications, patents granted, licences and spin-

outs was less than 100 in the six-year period were also excluded. This left 79 (out of 120) institutions.

Second, improvements in performance related to identifying commercialisation opportunities were captured by average annual growth rates in the number of internal invention disclosures in the period 2002/03 to 2008/09 for each of the remaining 79 universities. Improvement in licensing performance was measured as the average annual growth rate in the number of licences in the period 2002/03 to 2008/09. First, the percentage growth rate between 2002/03 and 2008/09 was calculated for each university using the formula:

$$\% \text{ growth rate} = (\text{Present value} - \text{Past value}) / \text{Past value} * 100$$

The average annual percentage growth rate was calculated by dividing the result of the above equation by the number of years, in this case six.

$$\text{Average annual \% growth rate} = (\% \text{ growth rate}) / 6 \text{ years}$$

This excluded a further 16 universities (out of the remaining 79) because there were no data on growth in disclosures and/or growth in licences in 2002/09.

Third, the continuous variables of average annual growth in disclosures and licenses were transformed into categorical variables with three values (categories). This operation allowed me to identify universities with high and low levels of improvement in commercialisation performance on both measures. Those universities constituting the lowest 33% (i.e. the first tertile) on the average annual growth in invention disclosures measure received a value of 1D and included universities with an average annual growth rate of less than 2.5%. The second tertile includes universities with an average annual growth rate of between 2.5% and 19% (assigned the value 2D). The third tertile includes the top 33% of universities with average annual growth rates for invention disclosures of more than 19% over the period 2002/09 (assigned the value 3D). An ANOVA test shows that the three groups (tertiles) of universities differ in terms of average annual growth rates for disclosures ( $F(2,52)=4.91$ ,  $p<.05$ ). Post hoc comparisons based on the Games-Howell test show that universities in the first tertile ( $\bar{x} = -5.91\%$ ,  $SD = 6.21$ ) exhibit significantly lower levels of growth in disclosures than universities in the third tertile ( $\bar{x} = 89.78\%$ ,  $SD = 170.89$ ) and the second tertile ( $\bar{x} = 8.21\%$ ,  $SD = 5.36$ ) at p-values of 0.06 and 0.00 respectively. The universities in the second tertile have a marginally ( $p=0.1$ ) lower level of growth in disclosures than universities in the third tertile.

Universities in the bottom 33% for the measure of average annual growth in licences received a value of 1L and are characterised by average annual growth rates below zero. The second tertile includes universities with positive average annual growth rates of up to 44% (assigned the value 2L). The third tertile covers universities with average annual growth rates in licences of more than 44% over the period 2002/09 (assigned the value 3L). An ANOVA test reveals that the differences among the three groups (tertiles) of universities with different levels of improvement in the number of licences between 2002/09 are statistically significant ( $F(2, 47) = 6.9, p < 0.05$ ). The universities in the first tertile ( $\bar{x} = -8.20\%$ ,  $SD = 6.06$ ) show significantly lower levels of average annual growth in licences than the universities in the second ( $\bar{x} = 22.46\%$ ,  $SD = 10.50$ ) and third ( $\bar{x} = 208.55\%$ ,  $SD = 416.67$ ) tertiles, at p-value levels of 0.00 and 0.02 respectively. The universities in the second tertile show significantly ( $p = 0.04$ ) lower levels of growth in licences than universities in the third tertile. Thus, the universities in the categories created here (based on tertiles) differ in relation to average growth in number of invention disclosures and growth in number of licences.

Fourth, the categorical variable for average annual growth in disclosures (values 1D, 2D, 3D) and the categorical variable for average annual growth in licenses (values L1, L2, L3) were juxtaposed in order to identify nine groups of universities with different combinations of growth rates (combinations: D1L1, D1L2, D1L3, D2L1, D2L2, D2L3, D3L1, D3L2, D3L3). These combinations are presented in Table 4.1. The 63 universities were classified in one of the nine groups. The distribution of universities across groups is shown in Annex 1 (Section 12.1).

Table 4.1 The nine groups of universities according to different levels of improvement in two measures of commercialisation performance in 2002/09

		Improvement in number of licences		
		High	Medium	Low
Improvement in number of invention disclosures	High	Group 1 3D 3L	Group 4 2D 3L	Group 7 1D 3L
	Medium	Group 2 3D 2L	Group 5 2D 2L	Group 8 1D 2L
	Low	Group 3 3D 1L	Group 6 2D 1L	Group 9 1D 1L

Note. 1D – the first (lowest) tertile for annual growth in disclosures 2002-09, 2D – the second tertile for annual growth in disclosures 2002-09, 3D – the third (top) tertile for annual growth in disclosures 2002-09, 1L – the first (lowest) tertile for annual growth in licences 2002-09, 2L – the second tertile for annual growth in licenses 2002-09, 3L – the third (top) tertile for annual growth in licences 2002-09

Finally, the selection of six universities was made. As argued earlier, Cases A and B were selected from the group of universities with high levels of performance improvement in managing invention disclosures, and high levels of performance improvement in managing licensing, that is, from Group 1. Case C was selected from Group 3 of universities showing major improvements in licensing performance but not in the number of invention disclosures. Case D was selected from those universities showing low levels of improvement in licensing performance but high levels of improvement in the number invention disclosures. Cases E and F were selected from Group 9 which includes universities with low levels of improved performance in managing invention disclosures and low levels of improved performance in managing licensing.

Since there were several universities in each group, additional criteria were included in the selection, in particular, to ensure that the selected cases allow the testing of rival explanations of changes to practice. Section 4.3.3 provides some details.

#### ***4.3.3 Rival explanations***

In Chapter 3 I developed a theoretical framework for the empirical data analysis. I proposed that changes in practice would result from learning and that learning can be spontaneous or instigated by management. Specific theoretical propositions were made with the aim of developing situated learning theory to improve our understanding of changes in practice. An important aspect of theory-building is to evaluate whether empirically observed phenomena can be interpreted using a proposed theoretical framework. Should the evidence support the proposed theoretical propositions, it can be concluded that the propositions are valid. These conclusions are more robust if other possible interpretations of the data are excluded. Exploration of alternative explanations of a phenomenon is described as theory triangulation (Stake, 1995). Two alternative explanations of changes in the commercialisation practice of KTOs are considered to allow theory triangulation and increase internal validity.

Commercialisation practice might be shaped predominantly by the organisational culture of the KTO's university. In the UK, there are two generic types of organisational cultures in universities: research-oriented and teaching-oriented. Commercialisation practice in KTOs of research-oriented universities might be expected to be more complex because of the wider range and higher intensity of commercialisation activities

enabled by their higher levels of public funds for research. Teaching-oriented universities (often former polytechnics) perform relatively less publicly funded research and thus have less potentially commercialisable IP generated from publicly funded research. For this reason, their commercialisation of research outputs practice may be different from that in research-oriented universities. Groups of UK universities with similar missions formed associations, which makes it relatively easy to distinguish these types. Research-oriented universities belong to the Russell Group (<http://www.russellgroup.ac.uk>) and the 1994 Group (<http://www.1994group.ac.uk>). Teaching-oriented universities belong to the Million+ group (<http://www.millionplus.ac.uk>). Were the development of commercialisation practice mainly dependent on the type of the university, we would expect to observe convergence in commercialisation practices in KTOs belonging to research-oriented universities (Russell Group, 1994 Group) and in KTOs belonging to teaching oriented universities (Million+). At the same time, we would expect divergence in practices across these two main groups of universities.

Alternatively, it could be argued that commercialisation practice is shaped predominantly by the laws and policies of national governments. Gherardi and Perrotta (2011: 2) note that “relatively few studies have incorporated the institutional environment into the analysis and discussion of the practice under study”. Their study shows that the enactment of a law restricting ‘in vitro’ medical practices in Italy has affected the practice of ‘medically assisted reproduction’ in a number of ways. It is plausible, therefore, that commercialisation practice in university KTOs has been shaped by the institutional environment. In the UK, the empirical context for the present study, government has been trying actively to encourage the commercialisation of academic research since the end of the 1990s (see policy review Chapter 5). If national policies are the main determinants of changes in commercialisation practice in university KTOs, then we should observe similar changes to practice and subsequent convergence in commercialisation practice across all KTOs.

The above two propositions related to transformations to practice need to be addressed and excluded in order to show that, in accordance with my proposition, commercialisation practices in universities KTOs is predominantly shaped by situated learning in COP, NOP and across communities. Thus, the final selection of cases studies included two KTOs from the Russell Group of universities (Cases A and F),



three KTOs from the 1994 Group universities (Cases B, C and D) and one KTO from the Million+ Group or universities (Case E).

#### **4.4 Data collection methods**

Information on learning by knowledge transfer professionals, changes to knowledge transfer practices, and organisational context was gathered primarily through multiple semi-structured, face-to-face interviews. Careful and purposive selection of interviewees aimed to ensure credibility of the data. Some secondary data were collected to corroborate the empirical evidence from the interviews. Collection of information on each case from multiple interviews and secondary data sources allowed for methodological triangulation, which is believed to increase the credibility of the data interpretation (Yin, 2009; Stake, 1995).

##### **4.4.1 Semi-structured interviews**

Interviews are a powerful method of data collection “discovering and portraying the multiple views of the case” (Stake, 1995: 65). In my research, information on how and why changes in a KTO’s commercialisation practice occurred was collected from interviews with staff members in the KTOs. I also collected information on KTOs’ commercialisation practice from academics that had worked with the KTOs on the commercialisation of their research results. Interviews with multiple respondents allow me to corroborate the information provided by each, and to account for the unique experience of each individual.

***Selection of interviewees.*** The interview programme comprised interviews with five or six staff members in each KTO. Interviewees included:

- a KTO director;
- a person responsible for disclosures of commercialisable research outputs;
- a person responsible for marketing university IP;
- a person dealing with commercialisation activities, such as licensing and spin-out creation;
- a person dealing with business development for consultancy (or other ‘soft’ knowledge transfer activity in cases where consultancy support was not within the remit of a KTO);
- an academic who had worked with a KTO to commercialise his/her research.

In smaller KTOs, the same person might be responsible for more than one area. Respondents were selected as follows. First, information from the KTO's website was used to identify the KTO director and the staff responsible for dealing with disclosures, marketing, licensing, spin-outs and business development. The KTO director was approached with a request for participation of the KTO in this study. The director was asked to suggest the most relevant respondents. In cases where interviewees were nominated by the KTO director, I checked whether the individuals suggested were the same individuals identified from the website as the most relevant respondents. Where necessary, access to additional respondents was requested. When the KTO director was not involved in the selection of interviewees, I asked the director or his personal assistant to confirm that my list included the most relevant people. During the interview programme in each KTO, respondents suggested additional relevant people, who were added to the list of interviewees. Thus, the initial purposive selection of respondents was complemented by the snowballing technique. I feel confident that the selection of respondents was unbiased and that the interviews provided an objective view of events in each KTO.

***Interview programme.*** Three pilot interviews were conducted in October and November 2010 as a result of which the interview protocols were adjusted slightly in order to deal with time constraints and to ensure clarity of the questions. The main interview programme was conducted mainly between December 2010 and February 2011. A total of 34 interviews were conducted: 31 face-to-face and two telephone interviews. I mostly managed to secure interviews with all relevant staff in six KTOs. There was one KTO director (Case E), who was not available for interview and information on strategic practice of KTO management was gathered from another senior manager. Unfortunately, five out of six KTOs were unwilling to nominate an academic for interview. Despite these limitations, I believe that interviews with five or six members of the staff in each KTO allowed me to collect robust empirical evidence. The last two interviews at each KTO provided some new insights on changes in commercialisation practice, suggesting the emergence of diminishing returns.

The interviews were arranged by email and respondents were sent a copy of the interview protocol prior to their interviews. I visited each KTO for two to three days. The interviews took place at the KTO's facilities and were conducted one-to-one. They lasted around 1.5 hours, and were digitally recorded and transcribed. At the beginning of each interview, the purpose of the research project was explained and the structure of

the interview outlined. Each interviewee was assured about confidentiality and anonymity. (The names of universities and respondents have been anonymised - see Annex 2 for the list of interviewees, Section 12.2) There were a few instances of interviewees requesting that information was kept confidential in order to protect themselves or the institution's reputation. This information is not revealed in the thesis, but was used to make sense of the data. In my view, the unrevealed information does not affect the objectivity and clarity of the analysis of the studied phenomenon.

#### ***4.4.2 Review of relevant documents***

Although the interviews were the primary source of my data, I also consulted some secondary sources, including university and KTO internal documents, national policy documents, and the literature for knowledge transfer practitioners.

***University and KTO internal documents.*** The credibility of the data on KTO's commercialisation practice and strategic practices of university and KTO management was enhanced by the collection of additional information from secondary sources. Secondary sources were not suited to providing insights into learning processes in the KTO. Information on the KTO's commercialisation activities and the strategic management of knowledge transfer activities was collected from documents available on university websites, or requested from the KTO staff. These documents included:

- information on KTO activities available on the university's website, in marketing brochures and KTO annual reports;
- internal guidelines for the management of knowledge transfer activities, such as disclosure procedure, patenting guides, and consultancy guides;
- tools (elements of the repertoire of practice) such as a standard disclosure form, and standard non-confidential leaflets;
- university knowledge transfer-related policy documents, including policy for ownership and management of IP, and policy for consultancy;
- university knowledge transfer strategy documents.

***Literature for knowledge transfer practitioners.*** Preparation for the fieldwork and construction of the interview protocols required some understanding of commercialisation practice. My involvement in two projects with Dr Puay Tang on the management of IP in UK universities had given me some insight into commercialisation practices in several KTOs. The reports from these two projects (Tang et al., 2009a;

Tang et al., 2008) and transcripts of the interviews related to these projects shaped my initial thinking on the development of commercialisation practice in university KTOs. My understanding of commercialisation activities was further enhanced prior to the fieldwork, through a review of the literature published by professional associations for knowledge transfer professionals and specialised training organisations. These included:

- *Continuing Professional Development Framework for Knowledge Transfer Practitioners*, published by the Association for University Research and Industry Links (AURIL, 2006);
- Guides published by the education not-for-profit organisation PraxisUnico (2010) to handling confidentiality agreements, material transfer agreements, options consultancy agreements, students and IP, licence agreements, spin-out transactions, key issues in managing technology transfer agreements, material transfer agreements, and general legal issues;
- Guides on licensing, company formation and IP management published by a leading KTO – UMIP (The University of Manchester Intellectual Property Co. Ltd.);
- A review of relevant discussions on the Global Innovation Network (GINN);
- Brochures published by the UK Knowledge Transfer Institute, the Association of European Science and Technology Transfer Professionals (ASTP), and the Association of University Technology Managers (AUTM), a non-profit organisation dedicated to managing and promoting university transfer technology in the US.

***National policy documents.*** As already mentioned, rival explanations of changes in commercialisation are explored to verify the validity of my theoretical propositions. One of the proposed rival explanations suggests that changes in the commercialisation practices of university KTOs are shaped predominantly by the external institutional context. In order to investigate this, I reviewed national policy documents. Analysis of these policy documents offers insights into how government perceived the role of universities, in what ways commercialisation of academic research is encouraged, and what instruments are introduced by government to support the commercialisation of academic research. These sources consulted are:

- Policy documents published by the relevant government department (the Office of Science and Technology, the Department of Trade and Industry and the Department for Education and Skills (1997-2007), the Department for Business, Enterprise and Regulatory Reform, the Department for Innovation, Universities and Skills (2007-2009) and the Department for Business Innovation and Skills (since 2009 and present the time of writing this thesis). These documents provide information on government policy related to university-industry knowledge transfer;
- Documents published by the Higher Education Funding Councils for England, Wales and Scotland which provide information on funding for university knowledge transfer activities;
- Independent reviews commissioned by UK government or the UK Research Councils (Dearing, 1997; Gowers, 2006; Lambert, 2003; Sainsbury, 2007; Warry, 2006; Wellings, 2008; Wilson, 2012) which provide reviews of past and current instruments and policies for university-industry knowledge transfer and overviews of the activities in universities and their KTOs;
- Other documents providing information on the institutional context of university-industry knowledge transfer and the intensity of knowledge-transfer activities (e.g. UK IPO, 2011; D'Este et al., 2005).

The review of national policy on university-industry knowledge transfer in the UK based on these documents is presented in Chapter 5.

#### **4.5 Operationalization of theoretical concepts**

Different interview protocols were prepared to guide the conversations with three different types of respondents: (a) KTO directors, (b) KTO staff, and (c) academics.

The first interview questions on each of the interview protocols were general and aimed at establishing a rapport with the interviewee. KTO directors and KTO staff were asked about their position, length of employment in this position, responsibilities, and changes in responsibilities over time, opportunities for professional development, educational background and previous work experience. Academics were asked about their research fields and how they exploited/commercialized their research outputs. Following these personal questions, KTO directors was asked for background information on the KTO, such as how the KTO was related to the university (e.g. internal department, wholly-owned subsidiary), age of the KTO, number of staff, staff

turnover rates, changes in numbers of staff over the previous five years, structure of the KTO (i.e. teams and reporting structure) and changes in the previous five years, sources of funding, formal channels of communication, and formal staff training opportunities.

The last set of questions in each interview protocol gathered data on the commercialisation practice of technology transfer professionals, strategic practices of KTO management, and learning in the KTO through interaction in COPs, NOPs and across COPs. These theoretical concepts were operationalised. An operational definition of each concept was created and appropriate interview questions were designed. Each concept that is part of the theoretical framework for this study is discussed below.

#### ***4.5.1 Commercialisation practice***

According to my theoretical framework, the work practice of an organisational COP represents a learning outcome. Thus, analysing commercialisation practice and changes in this practice are crucial for understanding what has been learnt by the KTO. The concept of practice was discussed in detail in Chapter 3, Sections 3.1.3 and 3.2.2. Commercialisation practice was defined as a set of observable recurrent activities, in which doing is inseparable from knowing. Adopting the approach in Orlikowski (2002), changes to ‘doing’ can be observed and changes in the community’s ‘knowing’ can be inferred from the changes in ‘doing’. The activities constituting commercialisation practice typically include (1) identifying commercialisation opportunities; (2) assessing and protecting IP (if necessary); (3) marketing activities; (4) handling licensing agreements and other contracts; and (5) activities involving company formation and management of spin-out portfolios identifying funding sources, and (6) documenting commercialisation projects. Table 4.2 and Table 4.3 present operational definitions of commercialisation practice and change in practice respectively, along with the pre-prepared questions in the interview protocol that aimed at gathering information on commercialisation practice. Where necessary, in the interviews these questions were supplemented by follow-up questions in order to gain a better understanding of the information provided by each interviewee.

Table 4.2 Operationalization of “commercialisation practice”

Operational definition	Relevant questions in the interview protocol
Commercialisation practice is defined as a set of observable recurrent activities that are related to identification of university IP, evaluation of IP, protection of IP and exploitation of IP.	Questions to commercialisation staff: <ul style="list-style-type: none"> <li>•What knowledge transfer activities are you currently involved in? (a check list of 29 activities)</li> <li>•How do you perform these knowledge transfer activities? Why?</li> </ul>
	Questions to KTO directors: <ul style="list-style-type: none"> <li>•What knowledge transfer services are you offering?</li> <li>•Are some knowledge transfer activities outsourced? Why?</li> </ul>
	Questions to an academic: <ul style="list-style-type: none"> <li>•What kind of support have you received from the KTO office in protection and/or exploitation of your research outcomes? (e.g. defining a commercial potential of an invention, drafting IPR application, securing follow-up funding, identifying a licensee, identifying a partner for collaborative research, identifying a consultancy opportunity, negotiations with a commercial partner, preparation of a business plan, setting up a spin-out company, other)</li> <li>•What kind of help do you wish you had received from your KTO but you did not? Why did you not receive help?</li> </ul>

In accordance with the theoretical framework, the analysis of data will distinguish radical changes in ‘the what’ (addition or removal of an activity) and radical change in ‘the how’ (change of the activity’s object), and incremental changes in ‘the what’ (addition or removal of actions performed to complete an activity) and ‘the how’ (change in the way some actions are performed, e.g. change in tools and methods).

Table 4.3 Operationalisation of “change in commercialisation practice”

Operational definition	Relevant questions in the interview protocol
Change in commercialisation practice is defined as a change in what activities are performed and how activities are performed.	Questions to commercialisation staff: <ul style="list-style-type: none"> <li>•What changes have you perceived in the knowledge transfer activities, which you are involved in, over last five years? For example, changes regarding <ul style="list-style-type: none"> <li>- number of people dedicated to each activity</li> <li>- taking on new activities, giving up activities</li> <li>- the way of dealing with e.g. disclosures, IPR applications, patents, licenses, spin-offs, consultancy, marketing, funding</li> </ul> </li> </ul>
	Questions to KTO directors: <ul style="list-style-type: none"> <li>•How have knowledge transfer services, which you are offering, changed over last five years?</li> </ul>

#### 4.5.2 *Learning in a community of practice*

Since new knowledge underpinning changes in work practice can be created through learning in COPs, it was imperative to identify the presence or lack of such communities in the KTOs. Wenger (1998) suggests that COPs are informal groups

whose coherence depends on mutual engagement (in work activities), negotiation of their joint enterprise (i.e. practice) and a shared repertoire of practice. Table 4.4 shows the operational definition of each concept and gives some examples of questions formulated to gather relevant empirical evidence.

Table 4.4 Operationalization of “a community of practice”

Operational definition	Relevant questions in the interview protocol
<p><b>Mutual engagement of participants</b> (Wenger, 1998: 73-77)</p> <ul style="list-style-type: none"> <li>- individuals work together, which enables mutual engagement</li> <li>- individuals are engaged in actions the meaning of which they negotiate with one another</li> <li>- individuals know each other's competences (their competences may be overlapping or complementary)</li> <li>- individuals know how to give and how to receive help</li> <li>- individuals have interpersonal relations (positive or negative)</li> </ul>	<p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• Whom are you working with on a regular basis? (Within a team/unit and outside) How has it changed over time?</li> <li>• Do you know the expertise of your colleagues in the office? Who are you more and who are you less familiar with? Why?</li> <li>• Did new colleagues join your team/unit (peers or superiors) in the last five years? How has their arrival affected your work activities?</li> </ul>
<p><b>Negotiation of a joint enterprise</b> (Wenger, 1998: 77-82)</p> <ul style="list-style-type: none"> <li>- individuals negotiate what they hold each other accountable for, that is they negotiate “what matters and what does not, what is important and why it is important, what to do and what not to do, what to pay attention to and what to ignore, what to talk about and what to leave unsaid, what to justify and what to take for granted, what to display and what to withhold, when actions and artefacts are good enough and when they need improvement or refinement”</li> <li>- individuals negotiate together how conditions, resources and demands shape their practice</li> <li>- joint enterprise does not mean agreement or that everybody believes the same thing or acts the same way</li> </ul>	<p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• Please suggest three DOs and three DON'Ts for the KT activities that you are responsible for. Would your answer have been the same if I had asked you this question five years ago?</li> <li>• Do you discuss the good and bad practice with your colleagues? How often? What?</li> <li>• In your opinion, is there a general agreement in the office on the best practice in the areas of knowledge transfer which you are involved in?</li> <li>• Do you think that the knowledge transfer activities that you are involved in need further refinement? Why? Do you know if your colleagues share this opinion?</li> </ul>
<p><b>Shared repertoire</b> (Wenger, 1998: 82-85)</p> <ul style="list-style-type: none"> <li>- elements of the repertoire are resources for the negotiation of meaning</li> <li>- they include (1) tangible objects like tools, laws, policies</li> <li>(2) intangible objects, such as stories, concepts, gestures, words and symbols that the community has produced or adopted</li> </ul>	<p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• What kind of tools and systems do you use in your everyday work? (forms, computer software, databases, filing system, templates, guidelines)</li> <li>• Have you worked together with your colleagues to develop or refine any of these tools and systems?</li> <li>• How do you perform these knowledge transfer activities? Why? (procedures, routines)</li> </ul>

The interviews were aimed at identifying how learning in COPs shapes commercialisation practice. The relevant insights were gathered in two ways. First, after



pointing to some changes in practice, commercialisation staff were asked to explain how these changes came about and why. This allowed me to identify changes resulting from learning in COPs. Second, respondents were asked about learning from/with colleagues in the same KTO – whom they learn from and what they learnt. The examples of what is learnt from/with colleagues provides good insights into changes to commercialisation practice resulting from learning in a COP. These two questions often provided complementary information about changes in commercialisation practice. Table 4.5 provides an operational definition of learning in a COP and some relevant questions. I also asked interviewees what facilitated and what hindered learning from/with colleagues in the KTO.

Table 4.5 Operationalisation of “learning in a community of practice”

Operational definition	Relevant questions in the interview protocol
Learning in a community of practice is defined as learning through interactions with knowledge transfer professionals working in the same KTO and belonging to the same community of practice.	<p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• Why were these changes [in commercialisation practice] introduced?</li> <li>• Whom are you contacting (if at all) to solve work-related problem? Has this person(s) you contact changed over five years? Please give examples.</li> <li>• Whom are you contacting (if at all) to get a second opinion on work-related issues? Has this person(s) you contact changed over five years? Please give examples.</li> <li>• Whom do you consult (if at all) when you deal with something new for the first time? Has this person(s) you consult changed over five years?? Please give examples.</li> <li>• Have you worked together with your colleagues to develop or refine any of these tools and systems?</li> </ul>

### 4.5.3 Learning in NOPs

Respondents were asked about participation in formal events organised by professional associations for knowledge transfer professionals and specialist training organisations (regional networks, AURIL, ARMA, ASTP, PraxisUnico, other). Some questions asked about close, personal contacts with KT professionals working in other KTOs. These questions aimed at establishing whether commercialisation staff participate in wider NOPs.

In order to understand how learning in NOPs shapes commercialisation practice I asked about learning from colleagues in other KTOs – whom they learnt from and what they learnt. Examples of what is learnt from other KTOs provides good insights into changes in commercialisation practice resulting from learning in NOPs. To get insights

into the effects of learning in NOPs I asked commercialisation staff to explain how the changes in practice that they had highlighted had come about and why. Table 4.6 provides the operational definition of learning in NOPs and some relevant questions. The commercialisation staff were also asked about factors facilitating and hindering learning from knowledge transfer professionals in other KTOs.

Table 4.6 Operationalisation of “learning in a network of practice”

Operational definition	Relevant questions in the interview protocol
Learning in NOP is defined as learning through interactions with knowledge transfer professionals working in other KTOs.	<p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• Why were these changes [in commercialisation practice] introduced?</li> <li>• What external KT professionals are you contacting (if at all) to solve work-related problem? Has this person(s) you contact changed over five years? Please give examples.</li> <li>• What external KT professionals are you contacting (if at all) to get a second opinion on work-related issues? Has this person(s) you contact changed over five years? Please give examples.</li> <li>• What external KT professionals do you consult (if at all) when you deal with something new for the first time? Has this person(s) you consult changed over five years? Please give examples.</li> <li>• Do you discuss with external KT professionals the advantages and shortcomings of tools and systems that are used in your team/unit?</li> <li>• What external KT professionals do you consult (if at all) when you seek advice on how to develop new tools and systems or how to refine the ones you have already got in place? Please give examples.</li> </ul>

#### 4.5.4 Learning across COPs

Again, two approaches were used to gather insights into how learning across COPs shaped commercialisation practice. Respondents were asked about learning from other professionals and were asked for examples of what was learnt in this way. They were asked also to explain how the changes in practice they had identified came about and why. Table 4.7 provides the operational definition of learning across COPs and some relevant questions.

Table 4.7 Operationalisation of “learning across COP”

Operational definition	Relevant questions in the interview protocol
Learning across COP is defined as learning through interactions with other professionals, such as academics, legal experts, entrepreneurs.	<p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• Why were these changes [in commercialisation practice] introduced?</li> <li>• Do interactions with other professionals, such as researchers, commercial partners, lawyers or patent attorneys, give you opportunities for learning? If not, why not?</li> <li>• What have you learned through interactions with these professionals? Please provide examples.</li> <li>• Are the relations with these professionals on-going or rather short-term and project-related? How have you developed these relations?</li> </ul>

#### 4.5.5 Strategic practices

According to my theoretical framework, learning in organisational COPs can be instigated and shaped by the strategic practices of the university and the KTO management. Analysing strategic practices in each KTO reveals why learning occurs in a KTO. Table 4.8 provides the operational definition of “strategic practices” and some questions from the interview protocols that aimed to provide relevant empirical evidence.

Table 4.8 Operationalisation of “strategic practices”

Operational definition	Relevant questions in the interview protocol
Strategic practices of KTO management include, for example, resource allocation practice, monitoring practice, controlling practice, and direction setting practice.	<p>Questions to KTO directors:</p> <ul style="list-style-type: none"> <li>• What activities related to knowledge transfer are you currently involved in? (e.g. formulation/refinement of knowledge transfer strategy, formulation/refinement of knowledge transfer policies, allocation of funds, reviews of commercial opportunities, reviews of investments, other)</li> <li>• How do you perform these knowledge transfer-related activities? Why?</li> <li>• What changes have you perceived in the knowledge transfer-related activities, which you are involved in, over last five years?</li> <li>• Why were these changes introduced?</li> </ul>
Effects of strategic practices of management on commercialisation practice	<p>Questions to KTO directors:</p> <ul style="list-style-type: none"> <li>• What aspects of knowledge transfer has been developed most over the last five years? Why?</li> </ul> <p>Questions to commercialisation staff:</p> <ul style="list-style-type: none"> <li>• Why were these changes [in commercialisation practice] introduced?</li> </ul>

## 4.6 Data analysis methods

This final section in the methodology chapter describes how the data from interviews and relevant documents were analysed.

### 4.6.1 *Step 1 – Screening the data*

Familiarisation with the case study is an essential precursor to the construction of explanations for changes in commercialisation practice. First, I examined whether learning took place at all in the particular case. I analysed whether (1) commercialisation staff learned through interactions with members of their internal community of practice, (2) whether they learned from their NOPs, and (3) whether they learned through interactions with other kinds of professionals, such as researchers, patent agents, consultants, etc. The presence or absence of learning is reported for each case. Second, I identified all changes in commercialisation practice reported by interviewees. Third, I explored the strategic practices of management in each case.

This initial stage of case study analysis was completed with the help of NVivo, a computer assisted tool for qualitative data analysis. The tool was used to code and categorise textual data collected in the semi-structured interviews and in relevant documents. The guidelines provided by Bazeley (2007) were followed to make the best use of the tool. An initial set of codes reflecting theoretical concepts (learning in COPs, NOPs, across COPS, strategic practices of management, commercialisation practice and changes in practice) was created. In the course of the analysis, more precise codes were created.

### 4.6.2 *Step 2 – Explanation building*

Yin argues that “to ‘explain’ a phenomenon is to stipulate a presumed set of causal links about it, or ‘how’ and ‘why’ something happened” (Yin, 2009: 141). Yin (2009) suggests that the pattern matching technique is one of the most desirable techniques for case study analysis and recognises the ‘explanation building’ technique as a special type of pattern matching. The ‘explanation building’ technique is appropriate when the explanation of the phenomenon is built upon some theoretically significant propositions, but the final explanation is not fully stipulated at the beginning of the study.

This technique is suitable for the present study since I have made some theoretical proposition for explanations of *how* and *why* changes in commercialisation practice come about, and also argued that the final explanation of changes may be more complex than my initial propositions would suggest. In particular, I proposed that learning in

COPs and NOPs initiated by COP members leads to incremental changes in performance of existing work activities (in ‘the how’ and ‘the what’). I have argued also that radical changes in what activities are performed result from learning in COPs and across COPs spontaneously initiated by COP members or from learning in COPs instigated by management. These propositions were derived from previous empirical studies. Common sense dictates that management may also play a role in triggering and shaping situated learning that leads to incremental changes and radical changes in how. Thus, while my analysis is based on some theoretically sound propositions, I develop a final explanation of changes in practice through an iterative process of ‘explanation building’.

Yin (2009) explains that explanation building comprises the following iterative steps:

- “Making an initial theoretical statement or an initial proposition about policy or social behaviour
- Comparing the findings of *an initial case* against such a statement or proposition
- Revising the statement or proposition
- Comparing other details of the case against the revision
- Comparing the revision to the facts of *a second, third, or more cases*
- Repeating this process as many times as is needed.” (Yin, 2009: 143, emphases in the original)

This iterative process, which increases the internal validity of the study, was adopted for the analysis of the six case studies. At the end of each case study, a number of hypotheses about how and why changes in practice occurred were generated, and tested in the succeeding case study. This data analysis method follows the logic of ‘falsification’ advocated by Karl Popper as the most rigorous test to which scientific propositions can be subjected (Flyvbjerg, 2011). “If just one observation does not fit with the proposition, it is considered not valid generally and must therefore be either revised or rejected” (Flyvbjerg, 2011: 305). Cases A and B, where I expected to observe radical changes in practice, were analysed first, followed by Cases E and F, where I expected to observe mainly incremental changes. Finally, Cases C and D, where I expected radical and incremental changes, but in different aspects of commercialisation practice, were examined. The cases are not presented in this order, however; their ordering is aimed at highlighting certain similarities and differences across the cases.

This stage of case study analysis also exploited the NVivo software, and was aimed at creating links between changes in practice and their explanations. The software

helped to organise the empirical evidence illustrating how and why changes in practice occurred in each case.

#### ***4.6.3 Step 3 – Cross-case comparison***

The last step in the analysis was cross case-study synthesis. In accordance with Yin's (2009) recommendations, each case study was treated as a separate study and the cross-case comparison was aimed at aggregating the findings from all six cases. These findings were combined in order to answer the research questions and to advance our theoretical understanding of the role of situated learning and strategic practices of management in bringing about changes in work practices. I looked across cases to explore whether alternative explanations of changes in practice (see Section 4.3.3) were more compelling than the explanations proposed by the theoretical framework.

## 5 Institutional context for commercialisation of academic research

In Section 4.3.3 I argued that work practices may be shaped by the institutional context in which organisations operate rather than by situated learning. In order to explore this alternative explanation of changes in KTO's commercialisation practice, Chapter 5 looks at changes in government policies for university-industry knowledge transfer in the UK, with a particular focus on the first decade of 2000.

### 5.1 The situation between 1945 and 1997

In 1948 the Board of Trade under the Development of Inventions Act established the *National Research and Development Corporation* (NRDC). The function of NRDC (later British Technology Group - BTG) was to support exploitation of inventions resulting from publicly funded research, carried out by government departments, universities and other publicly funded bodies. Throughout the 1960s, industrial and academic scientists were rather suspicious about their respective roles, and it was difficult to develop productive relationships between academia and industry (Grady and Pratt, 2000). In the 1970s there was a widespread debate about Britain's failure to exploit its research base (Grady and Pratt, 2000).

In 1981 the NRDC was merged with the National Enterprise Board<sup>11</sup> to form the BTG. In 1985 the Conservative government eliminated the BTG's monopoly rights to exploit publicly funded research and made universities responsible for the exploitation of government-funded research (Lambert, 2003). This change in policy, arguably inspired by the acclaimed success of the Bayh-Dole Act in the US, was supposed to increase the exploitation of academic research. At that time, universities were being encouraged, but not supported to develop internal capacity for the management of IPR, licensing and company formation activities. Some universities outsourced their commercialisation activities to the BTG, others set up their own KTOs.

More overt science and technology policy was developed after John Major replaced Margaret Thatcher as Prime Minister in 1990. After his re-election in 1992 John Major's government set up the *Office of Science and Technology* (OST) to handle science and technology matters. The OST was charged with advancing scientific

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<sup>11</sup> The National Enterprise Board was established in 1975 by the Industry Act. This public corporation was a vehicle for the Labour government to carry out nationalisations of British companies. Under Margaret Thatcher's government its powers were progressively reduced. Source: <http://www.nationalarchives.gov.uk/cabinetpapers/themes/national-enterprise-board-neb.htm>

knowledge, stimulating the diffusion of knowledge, technology transfer and movement of people between the science base and industry, ensuring the supply of adequately trained graduates and scientists and engineers, and ensuring that “Government expenditure on science and technology is targeted to make a maximum contribution to our national economic performance and quality of life” (OST, 1993). Both the name of the office and its mission statement show that government had a rather linear understanding of innovation, according to which investment in science and technology leads eventually to economic growth.

In 1993 the OST published the White Paper entitled *Realising our Potential: A Strategy for Science, Engineering and Technology* (OST, 1993). The White Paper stressed that a “widely perceived contrast” between the UK’s “excellence in science and technology” and “relative weakness in exploiting them to economic advantage” (OST, 1993: 3). It argued also that steps were needed to bring science, engineering and industry into closer and more systematic contact.

## **5.2 The Labour Government’s approach: 1997-2010**

The Labour Government’s (1997-2010) policy was characterised by a consistent and continuously increasing investment in science, and support for knowledge exchange between higher education institutions and industry and other users.

### **5.2.1 *Our Competitive Future White Paper***

The Department of Trade and Industry (DTI), into which the OST was incorporated, was responsible for science, technology and innovation policy between 1997 and 2007. The DTI published a White Paper entitled *Our Competitive Future: Building the Knowledge Driven Economy* (DTI, 1998).

This White Paper was informed of an enquiry led by Sir Ron Dearing (1997) that argued, among other things, that “universities are the source of strength in the knowledge-based economy of the twenty first century.” The Dearing’s report specifically addressed the commercialisation of academic research:

The nation’s competitiveness in the world market-place will be greatly enhanced by a greater capacity to make leading edge research and technology readily accessible for the various possible end-users. A key feature to improve the entrepreneurial environment in higher education would be to ensure that institutions are professional in their approach to Intellectual Property Rights and have a knowledge of how to do licensing deals. Research staff will need to have a basic understanding of Intellectual



Property Rights, be able to appreciate the commercial problems of exploitation of their inventions and be realistic in their demands. (Dearing Report, 1997, Chapter 11, paragraph 11.79, 11.80)

The quote shows that Dearing's report stressed the need for UK universities to develop a capacity for and competences in handling IPR and licences. It can be assumed that this referred to developing a professional approach to managing university IPR in university KTOs.

In the DTI's *Our Competitive Future* White Paper, Tony Blair's Government made a commitment to support businesses in developing knowledge-based competitive advantage, and recognised universities and research institutes as important sources of knowledge for UK business. It acknowledged that "university R&D is too rarely translated into UK commercial success" (DTI, 1998: 22), and that the number of companies spun-out from the public sector science should increase by 50% by 2002. In accordance with recommendations of the Dearing Report, the DTI's White Paper announced, firstly, the creation of the *Higher Education Reach-Out to Business and the Community (HEROBAC) Fund*, which aimed to encourage universities in England to develop the strategies and the capacity for technology and knowledge transfer. The HEROBAC fund was administered by the Higher Education Funding Council for England (HEFCE), and devolved governments in Scotland and Wales introduced similar funding schemes. Second, it created the *University Challenge Seed Fund*<sup>12</sup> to help leading universities to establish their own seed funds to demonstrate the commercial usefulness of research discoveries in the process of formation of new ventures. Third, it also established a competitive *Science Enterprise Challenge Fund*<sup>13</sup> to support the development of training centres specialising in teaching entrepreneurship and research commercialisation. Finally, the schemes bringing together small businesses and universities were expanded to include the *Faraday Partnerships* scheme and the *Teaching Company Scheme* referred to earlier.

Note that the in 2001 the HEROBAC Fund was transformed into the *Higher Education Innovation Fund* (HEIF). Since 2003 activities originally funded by the Science Enterprise Challenge and University Challenge Seed Fund have been covered by HEIF monies. The number of KTOs has proliferated since the first round of

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[http://www.bis.gov.uk/policies/science/knowledge-transfer/earlier-schemes/university\\_challenge\\_seed](http://www.bis.gov.uk/policies/science/knowledge-transfer/earlier-schemes/university_challenge_seed)

<sup>13</sup>

[http://www.bis.gov.uk/policies/science/knowledge-transfer/earlier-schemes/science\\_enterprise\\_challenge](http://www.bis.gov.uk/policies/science/knowledge-transfer/earlier-schemes/science_enterprise_challenge)

HEROBAC funds in 1999 (UNICO, 2006b). Thus, the fund was successful in helping universities to develop and/or expand their capacity for managing technology and knowledge transfer. So far, the HEIF (and its equivalents in Scotland and Wales) is the main government fund dedicated to developing knowledge transfer capacity in the higher education sector. The HEIF funding increased from £77 million in the first round for 2001-2004, to £150 million per annum in its fifth round for the period 2011-2014 (HEFCE, 2011b).

Following the introduction of HEROBAC/HEIF funding, there was a need to monitor the knowledge transfer activities of universities. Some surveys were carried out in the mid to late 1990s by Tartan Technology and Policy Research on Engineering, Science and Technology (PREST), University of Manchester (HEBCI report 2001), but their scope was limited to relatively few universities. In order to systematise data collection, HEFCE was put in charge of the annual *HEBCI survey*, which covers all higher education institutions in the UK. The first survey covered the academic year 1999/2000. In 2008/09, administration of data collection was passed to the Higher Education Statistics Agency (HESA) in order to align it with the collection of other data on the characteristics of and activities in the higher education sector. HEBCI data were used to guide the selection of case studies for the research presented in this thesis.

### **5.2.2 *The Lambert Review***

In 2003 Richard Lambert was commissioned to conduct a comprehensive review of Business-University Collaboration (Lambert, 2003). The report identified low demand for university research outputs as the main challenge in the UK. It stressed human interaction as the best form of knowledge transfer and highlighted the importance of collaborative research. It identified lack of clarity over ownership of IP from collaborative research as one of the main obstacles to collaboration. Lambert considered adoption of a Bayh-Dole-type model where the IP from collaborative research would be owned by the universities, to be inappropriate and suggested that ownership should be proportional to the intellectual and financial contributions of the parties. The Lambert Report led to the development of *template agreements for collaborative research* to make IP negotiations easier, shorter and more transparent. Five model research collaboration agreements were published in February 2005 (Gowers, 2006) and are available on the Intellectual Property Office of the United Kingdom (UK IPO) website (<http://www.ipo.gov.uk/lambert>).

The Lambert Review also identified low levels of professionalism of university KTOs and the formation of unsuccessful spin-out companies as the second and third main obstacles to effective commercialisation of university IP. It showed that some KTOs lacked good marketing skills, market research skills, license negotiation expertise, and spinout formation experience. The abilities of KTOs is at the heart of my thesis. Lambert argued that the small KTOs could not encompass all of the expertise required in-house and that collaboration among these entities was the way forward. The report recommended that government should use third-stream funding to support the development of regional shared services that would enhance the capabilities of individual KTOs. So far, a regional “hubs and spokes” model has yet to be developed in the UK. A study by Tang et al. (2009b) highlights the many challenges involved in the creation of shared regional services, including identification of an appropriate structure and ensuring resource requirements are met. The Lambert Report encouraged government to increase funding for training in technology and knowledge transfer. Government responded by launching the *Training for Knowledge Transfer Practitioners funding*.<sup>14</sup> A consolidated bid submitted by AURIL, Praxis and Unico was granted £1m (£490,000, £355,000, £155,000 respectively). This was a one-off initiative. Finally, recruitment of individuals with an industry background was recommended as a way to address the shortage of appropriate skills in KTOs.

While the report focused on the characteristics of supply and demand, that is universities (and their KTOs) and businesses, it highlighted the need for a broader understanding of what shapes university-industry interactions; it suggested that Regional Development Agencies (RDA) could play more active roles in promoting interaction.

### 5.2.3 *The Gowers Review*

The Gowers Review (2006) explored the performance of the UK’s IP system and concluded that, overall, the IP system supported innovation, but could be improved by raising awareness of IP issues, facilitating knowledge transfer, providing for better enforcement of IPR and greater cooperation between UK IPO and other national IP offices. In relation to university-industry knowledge transfer, it suggested that there was a lack of clarity over whether the ‘research exception’, which allows academic researchers to use protected IP for experimentation, innovation and education, applied

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<sup>14</sup> <http://www.bis.gov.uk/policies/science/knowledge-transfer/earlier-schemes/http>

to researchers collaborating with industry. On this basis, combined with the absence of case law in this area, the report recommended that section 60(5) of the Patents Act 1977 should be amended. In July 2008, the UK IPO launched a consultation process to address the problem and determine a solution. Gowers suggested also that the UK IPO should develop stronger links with universities to ensure that university IP managers were aware of recent technological developments. The UK IPO has taken a more proactive role towards helping universities develop IP management capabilities and in 2011 published a revised guide *Intellectual Asset Management for Universities* (UK IPO, 2011) and launched its *Fast Forward competition*.<sup>15</sup>

The Hargreaves Review (2011), commissioned by the current coalition government, further reviewed the UK IP framework with the view to reforming it to make it more ‘innovation friendly’.

#### **5.2.4 The Warry Report**

The Warry Report *Increasing the economic impact of Research Councils* (2006) explored how the Research Councils could promote and demonstrate the economic impact of the research they sponsored. Up to 2009, the Research Councils had two main mechanisms to support the exploitation of research outputs – CASE studentships and ‘follow on’ funding for the development of academic inventions. The Warry Report highlighted the important role of the Research Councils in the ecosystem that shapes university-industry interactions. It underlined that they could do more to incentivise universities and their researchers to engage in knowledge transfer. Since April 2009, the Research Councils have required funding applications to describe the impact on the economy and society of their proposed research.

#### **5.2.5 The Sainsbury Review**

The Sainsbury Review *The Race to the Top* (2007) considered the role of the science and innovation system in ensuring UK competitiveness in a globalised economy. On the topic of knowledge and technology transfer, the report noted that “virtually all HEIs now have systems in place to engage with business” and made a series of recommendations (Sainsbury, 2007: 57). First, it argued that the HEIF should be

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<sup>15</sup> The UK IPO’s Fast Forward Competition has been organised annually since 2011. It provides funding of £10,000 to £90,000 for projects proposing development of innovative approaches to knowledge transfer from university to industry. The competition is open to UK universities and public sector research establishments which can apply individually or jointly.

Source: <http://www.ipo.gov.uk/whyuse/research/fastforward.htm>

allocated based on a revised formula that would allow a wider spread of funds across the sector, rather than on a mix of competitive bidding and formulaic allocations. *Fully formulaic HEIF allocations* were implemented in the fourth round of HEIF (2008-2011) and allowed KTOs to employ staff on open-ended contracts, which made KTO employment more attractive and enabled the accumulation of expertise over time. Second, it set out an *increased role of the Research Councils, RDAs and the Technology Strategy Board (TSB)* to facilitate collaborative research and exploitation of research outputs. In 2007, government dedicated £1bn to strategic programmes led by the TSB in partnership with the Research Councils and RDAs. Some of these funds were to support university-industry collaboration. Third, it recommended increasing the number of Knowledge Transfer Partnerships and the knowledge transfer activities of further education colleges. These and other recommendations in the Sainsbury Review, were accepted and implemented by government, and underpinned the Department for Innovation, Universities and Skills (DIUS) strategy presented in the *Innovation Nation White Paper* (DIUS, 2008).

#### **5.2.6 *Innovation Nation White Paper***

The DIUS, responsible for science, technology and innovation policy in 2007/09, published its *Innovation Nation White Paper* (DIUS, 2008). This policy was another important landmark in the evolution of government policy for university-industry interactions. It demonstrated government's broader understanding of innovation and the knowledge exchange agenda which encompassed new disciplines, including the social sciences, arts and humanities, and new sectors such as private and public services. This policy revealed government's approach to stimulating researcher-user interactions based on a relevant national framework. It committed government to helping businesses access university knowledge. Government introduced '*innovation vouchers*' to help small companies engage with universities, and provided increased funding for its *Knowledge Transfer Partnerships* (KTP) scheme (formerly the Teaching Company Scheme). Through this policy, government aimed to help universities to increase capacity for knowledge transfer and expressed a will to implement all the recommendations of the Sainsbury report. It later *increased HEIF funding*. The White Paper referred to the role of other institutions in *developing an ecosystem* for effective engagement between higher education and academia. This involved an increased role of the Research Councils in driving the agenda of increasing the impact of academic

research on economy and society, the increased role of RDAs and the new TSB in brokering and financing collaboration between universities and users, inclusion of impact measures in assessments of research quality via the *Research Assessment Exercises* (now the Research Excellence Framework). A comparison between the DTI's *Our Competitive Future White Paper* (1998) with the DIUS's *Innovation Nation White Paper* (2008) shows that government strategy for stimulating university-industry interactions broadened over the ten year period. In 2008 government focused on building a supporting ecosystem for university-industry interactions that involved also the Research Councils, TSB and RDAs, universities and businesses.

#### **5.2.7 *The Wellings Report***

The Wellings Report *Intellectual Property and Research Benefits* (2008) addressed the question of whether universities should manage IP for their own benefit and for the benefit of the wider society and economy. It stressed that universities should focus not on generating a direct financial return from their commercialisation activities, but on maximising the social and economic impact of the research. Wellings recommended that government and HEFCE should make a clear statement about the purpose of university-industry engagement and monitor the impact of universities. Similar to the Lambert Report (2003), Wellings highlighted the need to enhance the capabilities of KTOs and recommended a “hub and spokes” model where experienced KTOs would operate as hubs at the regional level, or specialist disciplinary hubs would be created.

### **5.3 The policy of the coalition government after 2010**

The financial crisis of 2008 and the change in government in the UK in 2010 entailed some changes in university-industry knowledge transfer policy. Since June 2009 the Department for Business Innovation and Skills (BIS) has been responsible for innovation policy. The approach of the Conservative -Liberal Democrat coalition is still being refined.

The coalition government continues to support HEIF, but has asked HEFCE to *change the eligibility criteria for HEIF* (BIS, 2010a). The previous focus of HEIF on capacity-building has been replaced by an emphasis on effectiveness and performance improvement. Following the fifth round of HEIF (2011-2015), universities are obliged to generate a certain minimum level of external income to be eligible for a minimum funding allocation (the minimum allocation in HEIF5 is £250,000). The required

threshold will vary “reflecting the earnings performance of the sector as a whole” (HEFCE, 2011c).

Another significant change involved the creation of a new organisation in the innovation ecosystem. In 2010 the coalition government committed over £200 million to establish an elite network of *Technology and Innovation Centres*, and the TSB is playing a crucial role in setting up these new centres, referred to as Catapult centres. The Catapult centres are designed as hubs for collaboration between universities and industry in certain strategic technological areas. “The new investment will further bridge the gap between universities and businesses, helping to commercialise the outputs of Britain's world-class research base.” (TSB, 2012). The first Catapult centre was set up in high value manufacturing and opened for business in October 2011. It comprises a number of research centres, specialising in complementary areas of high value manufacturing, located in seven different universities. Other strategic areas targeted for Catapult centres include cell therapy, offshore renewable energy, satellite applications, connected digital economy, future cities and transport systems.

Following publication of the *White Paper Local Growth: Realising Every Place's Potential* (BIS, 2010b), the RDAs were closed down (31 March 2012) and new business-led *Local Enterprise Partnerships* (LEPs) between local authorities and businesses were established. The strategic focus of these LEPs is innovation and university-industry interactions; it remains to be seen how much emphasis is put on each aspect of regional dynamics. Many RDA schemes to support university-industry engagement have been discontinued, including the innovation vouchers scheme and the proof-of-concept funding scheme. *Innovation and Research Strategy for Growth* (BIS, 2011) promised to re-introduce the innovation vouchers scheme.

In February 2012 the *Review of Business–University Collaboration* (Wilson, 2012) was published. It is not known how this will affect government policy on university knowledge transfer activities.

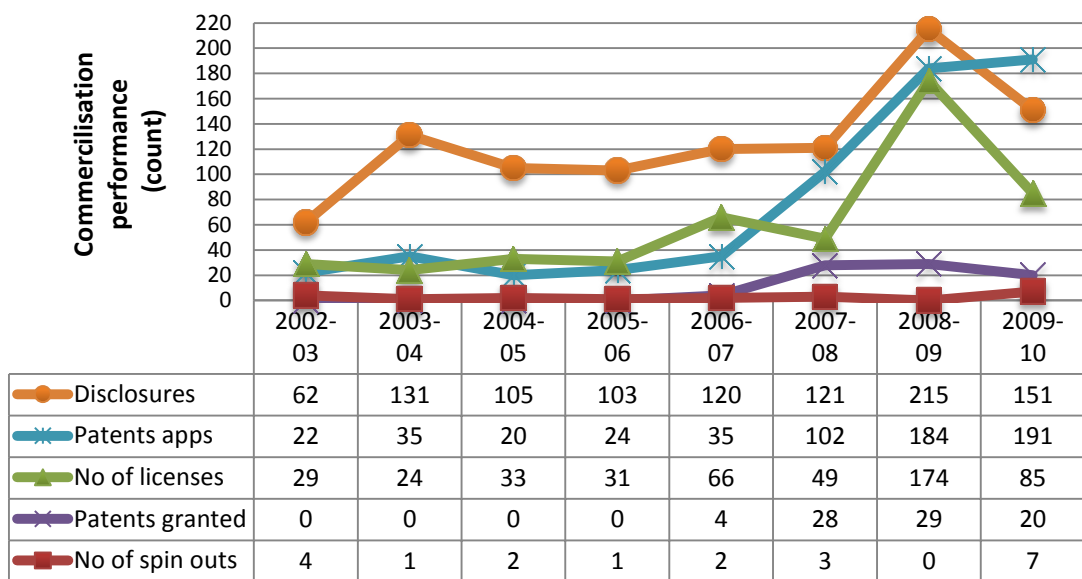
In summary, I have argued that in the second half of the first decade of the 21<sup>st</sup> century, there was a change in UK policy for university-industry knowledge transfer. Specifically, the new policy instruments put greater emphasis on creating collaborative relations and two-way exchange of knowledge as opposed to one-way knowledge transfer. If policy change were the main determinant, we could expect to observe all KTOs moving towards a more collaborative approach to commercialisation. The case studies discussed in Chapters 6-8 show that this has not happened.

## 6 Learning in two types of KTOs: match-making and IP-focused commercialisation practices

### 6.1 Case Study A – background information

This case study is about learning in a KTO in a research-intensive university that is a member of the Russell Group. The university was ranked in the top fifteen in Times Higher Education's Table of Excellence (2008) which is a ranking based on average Research Assessment Exercise (RAE) scores<sup>16</sup> in 2008. Figure 6.1 depicts its volume of commercialisation outputs 2002/10. It shows fairly steady growth in commercialisation outputs until 2008/09. There are no evidence-based reasons to suggest that the performance worsened after 2008/09. Instead I speculate that 2008/09 was an exceptional year, which distorted the picture of steady growth. In 2009/10 knowledge transfer activities<sup>17</sup> supported by the KTO generated approximately £67 million, including income of £1.6m from licensing and spin-out activities.

Figure 6.1 Commercialisation performance of University A



Source: HEBCI surveys, 2006-2011

<sup>16</sup> An exercise undertaken approximately every 5 years to evaluate the quality of research undertaken by UK Higher Education Institutions.

<sup>17</sup> This includes income from collaborative research, contract research, consultancy, Continuous Professional Development courses, regeneration and development programmes and IP licensing and sales of shares in university-owned spin-out companies.



***Information on the KTO.*** The KTO provides support for research and enterprise activities across the whole range of disciplines – science, engineering, medicine, humanities and social sciences. The first internal unit was established in 1969 to support liaison with industry. In 1983 the industrial liaison function was transferred to a wholly-owned subsidiary company. The company initially was responsible for commercialisation, industrial research and consultancy, and eventually supported the development and delivery of Continuous Professional Development (CPD) courses. In 1998 the KTO stopped supporting the delivery of CPD courses, but took on responsibility for supporting all research activities in the university (as opposed to earlier responsibility for only industry-sponsored research). Sixty-five staff members are structured into six teams: (1) business development, (2) company formation and incubation, (3) commercial development (including Licensing and Consultancy managers), (4) research support, (5) legal, and (6) finance and operations team. The KTO receives some 60-70%<sup>18</sup> of its budget from the university's core funding in exchange for its services. This fairly stable stream of income allows strategic retention of staff (compared to where KTOs are fully dependent on HEIF allocations and able to offer only fixed-term contracts for each period of HEIF). In addition, the KTO retains the university's share of licensing and consultancy income,<sup>19</sup> the rest is distributed to the academics. Other revenue streams include running the payroll service for other university companies and doing consultancy work for other KTOs around the world. The KTO's profits are gifted back to the university at the end of the financial year.

***Information on commercialisation practice in KTO A.*** Practice has already been defined as a set of observable recurrent activities that are related to a particular organisational function, in which knowing and doing are inseparable. Following Orlikowski (2002), I discuss 'the doing' in KTO A at the turn of 2010/2011 and conclude by making inferences about 'the knowing' in KTO A. The KTO's commercialisation practice comprises (1) identifying commercialisation opportunities; (2) assessing IP; (3) marketing activities; (4) handling licensing agreements and other

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<sup>18</sup> Some of this comes from the Knowledge Transfer Grant (KTG), which is the Scottish equivalent of the HEIF. The money goes into university central funds and is split between the colleges and the KTO.

<sup>19</sup> The inventor(s) receives a third of the income, the inventor(s) school receives another third, and the university (KTO) receives a third of the income from licensing and consultancy. In the case of licensing income, the inventor(s) receives 50% of the first £50,000.

contracts; and (5) activities involving company formation and management of spin-out portfolios.

*Identification of commercialisation opportunities* is undertaken by the Business Development (BD) managers (10 Full Time Equivalents (FTEs)). They liaise with the schools and have close relationships with the academics. They look proactively for research that potentially could generate commercialisable outputs. It is important that these projects are identified early so that the novelty of the inventions, the commercial appeal or applications and the interest of industry can be explored in a timely manner. This proactive approach helps to avoid situations where an academic approaches the KTO asking for a patent application to be filed because he/she is about to disclose the research outputs, for example, at a conference. Once a commercialisable invention is identified, a disclosure form is completed by the academic and a BD manager and then the BD manager makes a case to the IP approval committee for pursuing the commercialisation prospects of the invention.

*IP assessment activity* is structured around a formal stage-gate process. In the ‘stages’ the commercialisation staff first undertake due diligence and market research, then ‘gate meetings’ (or Go/No Go decision meetings) involve the IP approval committee which makes a decision about whether to proceed to the next stage. The IP approval committee includes the KTO’s senior staff (Head of BD, a senior BD Manager, Head of Commercial Development (CD), and a senior Licensing Manager) and two external commercialisation experts. The members of the committee “mostly have quite different backgrounds and different perspectives and different experience.” (Head of CD). Assessment of the legal aspects (IP ownership, freedom to operate, patentability), technical development and assessment of the commercial potential of an invention is performed during the stages, and the results are reviewed at ‘gate meetings’. In the first ‘gate’ meeting, the committee decides whether or not to apply for a patent – it expects the BD manager to demonstrate patentability and expectation of market demand. The second ‘gate meeting’ takes place about three months after filing a patent application (typically with the UK IPO) to review progress on technical development (of the patented invention) and further the market research for its commercial viability. The third ‘gate meeting’ happens before the PCT filing process and the BD managers are expected to show further evidence of demonstrable market interest. The fourth ‘gate

meeting’ takes place six months after filing a PCT application. At this time, there is expected to be “a dialogue on the way with some potential licensees certainly” (verbatim; Head of CD) with funds secured for further development of the invention. There are similar expectations for the final ‘gate meeting’, which takes place before filing the patent application in foreign national offices. IP assessment in KTO A has a clear focus on assessing market demand as exemplified in the important rule of thumb followed by the committee: “Don’t think you can pick a winner and read the market, (...) suspend your disbelief (...), let the market decide.” (Head of CD). In summary, this approach to IP assessment ensures that information from the technical assessment of an invention and from assessment of its commercial potential are combined and considered stringently in order to specify an “increasingly clear route to commercialisation” (Head of CD).

**Marketing** is the responsibility of the Marketing Manager (1 FTE), BD managers and Licensing managers (3 FTEs). The KTO has developed a range of activities for marketing university IP. At the end of 2010 marketing practice involved the following: (1) online marketing – on the KTO’s website and other free online portals, including the Scottish ‘University Technologies’ portal ([www.university-technology.com](http://www.university-technology.com)) which was launched in 2004, Techquisitions (<http://www.techquisition.com>) which was launched in 2006,<sup>20</sup> and IP.Net (<http://www.theintellectualproperty.net>) which was launched in 2009<sup>21</sup>; (2) preparation of an annual magazine for an external audience, promoting selected research projects and their potential commercial value; (3) production of newsletters for circulation to the biotechnology sector<sup>22</sup>; (4) distribution of the newsletters and magazine to continually increasing numbers of the KTO’s contacts; and (5) preparation of a two-page non-confidential flyer about the technologies, which then forms the basis for online content and targeted marketing. The above activities are conducted predominantly by the Marketing Manager who collaborates with BD managers over collection of content for the marketing material.

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<sup>20</sup> Free portal for sellers and buyers of technologies from all industries and all countries

<sup>21</sup> Free portal open to universities and companies around the world. Organisations can post their technologies or request technologies. The portal was set up by a UK KTO – University of Manchester Intellectual Property Ltd.

<sup>22</sup> At the time of the fieldwork, the KTO sent regular newsletters only to the biotechnology sector as there are many inventions in this scientific field at University A. There are plans to introduce similar newsletters about research in other technological areas.

Identifying licensees is performed by BD managers and licensing staff. The magazine and flyers are used by BD and Licensing managers for targeted marketing (as opposed to general advertising), through emails, letters, and ‘cold calling’. This allows managers to establish a dialogue with commercial organisations that may be interested in an academic invention, or to stimulate interest in these organisations. The identification of potential licensees is based on extensive market research and a clear strategy. A number of companies are approached and the managers try to understand why a particular technology is relevant or irrelevant for a particular company:

we target 25 most likely companies in that field and make sure that we proactively run it past them and call them up and ask for feedback as well – is it of interest? why not? (Head of CD).

Thus the identification of a licensee involves understanding the market and its needs and finding a long-term partner. Marketing activities aim to establish a two-way communication. The information on selected technologies is effectively disseminated across a relevant industry (or sector) and the ‘intelligence’ gathered from this process is fed back to the academics, with the aim of informing their work on proof of concept. The ‘intelligence’ gathered by commercialisation staff may be used to revise claims in the patent applications (when filing in foreign countries).

***Handling of licensing agreements and other contracts*** is arranged by the BD and Licensing managers and the legal staff (6 FTEs). The simple license agreements (“a bit of software here or antibody there”, as the Head of CD described them) are handled by BD managers; whereas more complicated ones, for example for spin-outs, are typically negotiated and dealt with by the licensing team. The legal team supports BD managers (e.g. providing support with the preparation of non-disclosure agreements) and Licensing managers (e.g. support with the preparation of licensing agreements or shareholder agreements) on the legal aspects of licensing. The Licensing Administrator is responsible for the internal distribution of income from licensing. License audits, ensuring that royalties amounts received are correct, are outsourced to an external company.

The Head of CD stressed that: “you do need to seek a win-win deal”, and “in the business of licensing you make money if your partners are making lots of money.” They perceive the licensee as a partner and licensing as part of a more complex long-term relationship with a commercial partner. The Head of CD highlighted that it was

necessary to: “Be aware that many of your licensing opportunities are not that. They are probably collaborative research... hooks for collaborative research.” In line with the “partnership” mind-set, they try to ensure that negotiation of licensing contracts is “fair” and not “adversarial” (Head of CD). The negotiation of deals “is not painting by numbers” and thus needs to be flexible and open to suggestions from the commercial partner. In the negotiations Licensing managers put the emphasis on closing the deal and “not on making the deals perfect” (Head of CD) nor on trying to get the highest possible royalties. They are aware of the tendency to overvalue IP during license negotiations and try to avoid this by stressing other success factors for commercialisation of university research:

You’ve got to hugely value the management team and the investment necessary to make it successful business and the marketing effort to make it successful business. IP is a foundation stone of a business but it is not enough ... It is necessary but not sufficient for business success. (Head of CD)

The focus on building good relations with the licensee does not mean that they will willingly give away the IP rights for the sake of establishing good relations. The emphasis is on *delivering value to business and the community* and on avoiding exclusive world-wide licence deals that “restrict access to technologies” (Licensing Manager). Thus the KTO tries to secure a win-win deal while protecting the university’s interests. The focus on a good relationship with the licensee also does not mean neglecting maintenance of good internal relations with the academics. A Licensing Manager stressed that good practice means “To get people [academics] on board, to get them to buy in to what you are doing, to understand why it is a good thing and get them encouraged and motivated”. After a licensing deal is sealed, the Licensing managers continue to maintain close relationships with the licensee, particularly when the licensee is a university spin-out. The Head of CD explained that “it is actually important to maintain these relations [with spin-outs] because we are an investor and we invest the IP rather than cash.” To summarise, licensing activities are aimed at building good working relations between the academics and industry in the belief that this helps to underpin successful commercialisation activities.

***Company formation activities and management of spin-out portfolios*** are performed by the Company Formation and Incubation Managers (4 FTEs). The Head of the CD

team helps with some of these activities. The activities include: (1) support for business planning for student and staff start-ups, and for spin-outs; (2) help with assessing potential markets for start-ups and spin-outs; (3) help with exploring funding opportunities for start-ups and spin-outs; (4) help with recruiting commercial management team for spin-outs; (5) maintaining relations with a spin-out, for example, a KTO senior commercialisation manager may be appointed to the spin-out board and can provide further advice to the spin-out; and (6) help with securing follow-on investments which enable the company to grow. These activities are also focused on building relations (with commercial managers for spin-outs, or investors) to further the successful commercialisation of the university's inventions.

Orlikowski's (2002) argues that the way that work activities are performed (i.e. 'the doing') reveals knowledge embedded in practice – namely, the 'knowing'. Drawing together the activities described, it becomes apparent that KTO A has (1) the ability (or 'knowing' how) to identify research with potentially commercialisable outputs in a timely fashion, (2) the ability to perform systematic assessment of the legal, technical and commercial aspects of inventions by combining information on the technology and the market, and by managing two-way information flows between academia and industry, (3) the ability to disseminate information about academic inventions into industry through marketing, (4) the ability to identify partners for the academics, (5) the ability to build relationships and partnerships between the university and industry (including spin-outs), (6) the ability to secure human and financial resources for exploitation of an invention in a spin-out company and (7) the ability to manage university's equity in spin-outs.

In summary, IP assessment activities combine information about the technical and commercial potential of an invention in order to understand its real value. Marketing activities are directed at identifying commercial partners who could work with the academics. Engagement with industry is aimed at dissemination of information on academic inventions to industry (marketing) and purposeful gathering of feedback from industry (market research). Licensing is understood as part of a wider partnership. Spin-out-formation activities ensure that technical expertise is complemented by managerial skills.

Thus, the approach to commercialisation in KTO A seems to be based on the implicit assumption that the outputs of research cannot be simply passed on to industry. It is

based on the assumption that the creation of science-based innovation requires coupling of scientific discoveries with the needs and capabilities of industry, two way communication and collaboration of market experts and R&D experts. The same assumptions underpin the ‘coupling model of innovation’ described by Rothwell (1994). I will refer to commercialisation practice underpinned by a ‘coupling model of innovation’ as *match-making commercialisation practice*.

A key question emerges: has KTO A had the match-making commercialisation practice over the five-year period under study and learned only to improve it, *or* has it developed this practice during this period? The next sections present a picture of the learning in KTO A in the period 2005/10.

### **6.1.1 Learning in COPs in KTO A**

The main purpose of this section is to explain what has been learnt through interactions within COPs in the KTO and why this learning has occurred (COP members respond to opportunities and problems on their own initiative or are instigated to learn by management). First, I identify the COPs in KTO A, then I discuss what was learned in these communities and why.

#### **6.1.1.1 COPs in KTO A**

The interviews revealed the existence of two COPs. As it was not possible to conduct interviews with all members of the commercialisation staff, the interview data do not allow us to analyse whether or not all staff members belong to a COP. However, on the basis of the information which was provided by six interviewees we can conclude that there are two fairly distinct COPs. The evidence suggesting the existence of these communities is discussed below.

***COP around IP assessment and marketing activities.*** I identified a COP around IP assessment and IP marketing activities. The community comprises the Head of CD, Licensing managers and BD managers.<sup>23</sup> The work activities of these individuals are both overlapping and complementary, which gives opportunities for mutual engagement. The Marketing Manager works together with both BD and Licensing managers on the preparation of marketing materials, such as the two-page marketing flyers. The pursuit of commercialisation projects is negotiated among the members of

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<sup>23</sup> Interestingly, they were in one formal team before the separation of Licensing and BD.

the community. For example, Licensing managers talk to potential licensees and learn what is perceived as the ‘real’ commercial value of the invention. They then engage with BD managers to explore the possibility of demonstrating the ‘real’ value of invention or adjusting the claims in patent application to capture the value of the invention.

Alongside these informal interactions, there are formal meetings where BD and Licensing managers discuss how to proceed with each project, what is good enough, and what should be improved. These formal and informal interactions provide space for the negotiation of joint enterprise – that is, joint work activities. The BD and Licensing managers also have a shared repertoire of practice – IP assessment routine, IP assessment forms, a template for marketing materials, INTEUM database and an internal database with forms and procedures (“we have a Wiki which contains a lot of detailed information – the guidance documents that are being prepared are available. WIKI means that it is more accessible format because we are in different sites.” – Licensing Manager). The BD, Marketing and Licensing managers draw on these elements of the repertoire in their daily work.

In conclusion, the BD managers, Licensing managers, the Head of CD and the Marketing Manager engage in some joint work activities (‘joint enterprise’). As a group they display three characteristics of a COP - mutual engagement, negotiation of joint enterprise, and a shared repertoire (Wenger, 1998). Against these identified traits, I maintain that there is a community based around the practice of IP assessment and IP marketing.

***COP around licensing activities.*** There is a second community around the licensing activities. It also displays the three characteristics of a COP suggested by Wenger. First, there is mutual engagement among the licensing and legal staff. They work closely together on the preparation of licensing agreements, shareholding agreements and other legal contracts (‘joint enterprise’). Licensing managers are responsible for external liaison and negotiations of licence terms while the lawyers are charged with the legal aspects of the licence terms and review contracts. Their complementary, but closely linked work activities entail the necessity to work together – that is, mutual engagement. Second, the licensing activities – that is, their ‘joint enterprise’ (Wenger, 1998) – is socially negotiated. The licensing negotiations are undoubtedly challenging and Licensing managers who do not have a legal background encounter legal clauses



prepared by the legal team, the consequences of which they do not fully understand. In such situations, they consult with the lawyers to make sense of the specific terms and conditions:

There have been amendments to indemnity clauses, there were warranties something quite legal specific and you read it and you think ‘I think I know what it means but what it means in legal terms?’ So I would speak to one of my legal colleagues. (Licensing Manager)

From the above quote we can infer that Licensing managers and lawyers negotiate how licensing should be undertaken, what legal conditions should be included (or not, or removed), thereby developing a common understanding of how to proceed. Furthermore, developing a common understanding of the licensing process is also undertaken in formal meetings:

in a licensing meeting we try to have a learning piece as well so we might have one of the lawyers come and speak about one of the legal practicalities of licensing, some know-how. (Licensing Manager)

Third, the licensing staff and the lawyers have a shared repertoire of practice. Since there is a long history of licensing by KTO A, it is not surprising that the KTO has an impressive repertoire of legal contract templates. For example, there is a standard software licence agreement; standard agreements for exclusive and non-exclusive patent licences; agreements for sharing revenue from assignments/licences of patents/non-patented IP owned by the university,<sup>24</sup> and agreements for sharing revenue from assignments/licences of patents/non-patented IP that is owned jointly by an number of institutions, to name but a few. The community members have contributed to the development and/or adjustments of these templates. Against these three identified characteristics, I conclude that the group of Licensing managers and the legal staff form a COP.

***Why are there two COPs rather than one?*** One could plausibly expect BD managers to be part of the same COP as Licensing managers and legal staff. BD managers certainly deal with legal aspects of the IP, thereby requiring interaction with the legal staff and some understanding of the legal frameworks concerning business development. Given that the work activities of BD managers involve some engagement with legal staff, the

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<sup>24</sup> The inventor(s) get 50% of the first £50,000 of income. After that the income is shared equally among (1) the inventor(s), (2) the school and (3) the KTO.

question arises as to why the BD managers have not developed as close relations with legal staff as the Licensing managers have; in other words, why are BD managers not part of the IP Licensing COP? The interviews revealed that lack of face-to-face interactions between BD managers and legal staff have hindered the development of understanding how to work together, what to do and how to do it. The Head of CD lamented the “lack of effective mutual understanding” (Head of CD) between BD managers and the lawyers, and attributed it to a “lack of direct communication” (Head of CD). He added “they only send emails to each other (...) missing out on information that could be shared” (Head of CD). The BD managers are spread across the campus as “business development activity is attached to specific Schools/academic institutes that fund this activity” (BD Manager 1), whereas licensing and legal staff are in the main KTO building. The physical separation hampers knowledge sharing “because you don’t have the same relationship with somebody whom you see in the corridor all the time every day as with somebody on the site away” (Licensing Manager). The second reason for lack of direct communication is the prevalence of formal procedures. For example, there is a form that the BD (and Licensing) managers need to complete and send to a secretary in the legal team to instruct the legal staff about what they need. Since BD managers conclude mainly standard licensing deals (e.g. a software licences), there is also much less need for personal interactions with legal staff (as in the case of Licensing managers handling complex licences). As a result, the formal procedure has become less conducive to clarification of misunderstandings and conflicting views than informal interaction would allow. Physical separation and the formal procedure in particular have reduced the personal interactions between BD managers and legal staff.

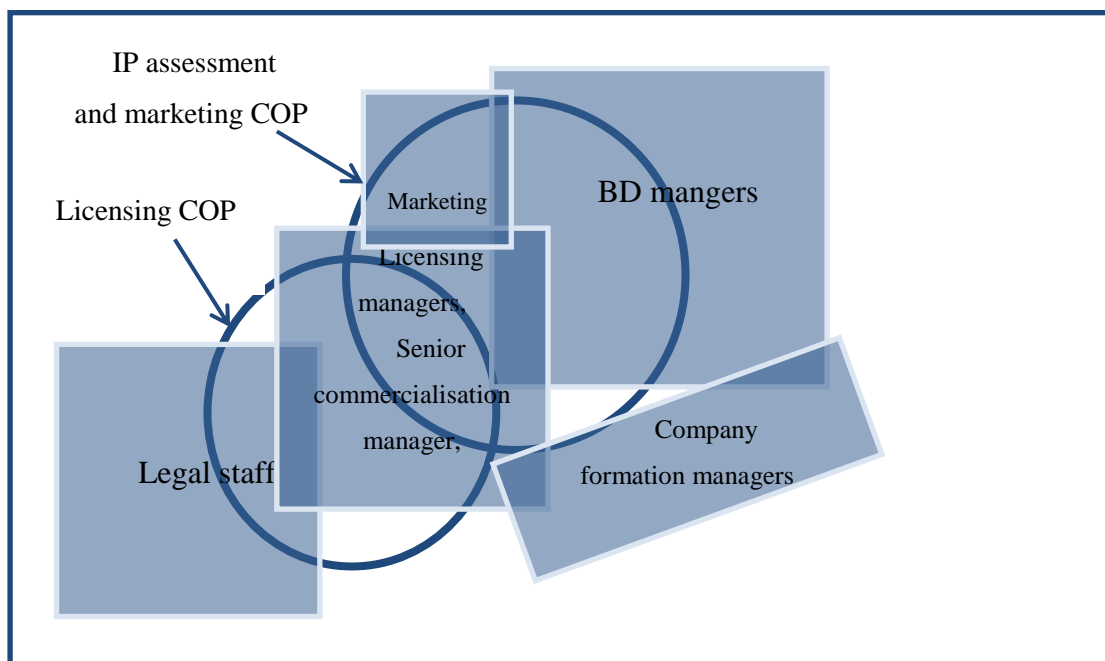
***Why are the Company Formation managers not part of the above two COPs?*** Since no Company Formation managers were interviewed, it is not possible to say whether these four managers form another COP. It was clear from the interviews with the CD and BD managers, however, that the Company Formation managers do not belong to either of the communities described above. In 2006, the team of Company Formation managers was formally separated from the team of BD managers to address conflicts of interest that BD managers might have to manage. Conflicts can arise from a BD manager being “responsible for both trying to help mentor the company and introduce it to advisers” and “for the university transferring of the IP”. The Head of CD explained that: “we actually decided that we needed two people doing these roles because they are

sitting on two different sides of the fence when the deal happens.” Subsequently some BD managers were ‘transformed’ into Company Formation managers. The Head of CD explained that the relations between Company Formation managers and Licensing managers can be problematic:

We have a bit of a Chinese wall between company formation team and ourselves. They have no role in the negotiation of the IP transaction so that they can kind of work with the company completely for the period when they are helping the company to set up, whereas my accountability is not to the company but to the university that a good deal should be done. (Head of CD)

The Licensing managers and Company Formation managers have the same goal – to commercialise knowledge produced in the university - but they have different priorities. Licensing managers want to protect the interests of the university whereas the Company Formation managers seek to protect the interests of inventors and spin-out management. Given these discrete and different priorities and interests, it could be expected that the company formation staff would not be part of the same COP as Licensing managers and BD managers. Figure 2 illustrates the two COPs.

Figure 6.2 Communities of practice in KTO A



Source: Constructed by the author

In summary, the interviews revealed that there are two COPs. Figure 6.2 illustrates the joint activities of staff (overlapping squares) and communities that emerged from joint pursuit of some commercialisation activities (circles). The ‘joint enterprise’ of the first community is IP assessment and marketing activities whereas licensing activities is the ‘joint enterprise’ of the second community. Below I discuss what has been learnt through interactions within these COPs and whether learning was instigated by management or COP members.

#### *6.1.1.2 Learning how to assess the technical aspects and commercial potential of inventions in a systematic and rigorous way*

The stage-gate routine for assessment of academic inventions is a long established part of the repertoire of practice. The routine ensures that technical and commercial viability of an invention are assessed at the appropriate time, as explained in section 6.1. However, the BD and Licensing managers over time realised that the way in which inventions were being assessed was not systematised. In particular, there was variability in the assessment of commercial viability. This meant that there was a danger of securing patents (and incurring patenting cost) for inventions which then were left “sitting on the shelf” because there was no identified route for commercial exploitation. One of the respondents described the problematic situation:

if you had a bright idea, you would ask a really insightful question. But if the people on the panel weren’t informed that day, they might forget to ask about this very insightful question. (Head of CD)

To deal with this problem, the senior BD and Licensing managers on the IP approval committee created IP approval forms in order to ensure that each project is assessed against the same criteria:

we tried to capture them [all important questions] and make them structured. So the form now captures all the important questions and is intended to flesh out all the key material. And we have about four different versions. (Head of CD)

Since then, assessment criteria, which previously were applied on an ad-hoc basis by the senior managers, have been made more explicit. There is a different version of the assessment form for each ‘gate’ meeting. These IP assessment forms guide the activities of BD managers between meetings as well as in the decision-making process of the IP approval committee during the meetings. Thus the forms have become a part of the community’s repertoire of practice. They help to ensure information from the technical

assessment of an invention and from the assessment of its commercial potential is combined in a systematic manner for each commercialisation project. As a result of learning in the COP, IP assessment activity has become more systematised and decision-making activities are standard across projects. This arguably has increased the thoroughness of the IP assessment and has helped the KTO to be a better ‘match-maker’.

In summary, the change in practice was introduced in response to the shortcomings of practice identified by the members of the COP around IP assessment and marketing practice. This example shows that knowledge necessary to address the problem was created through interactions between members of the COP, which led to incremental changes in *how* IP assessment is performed. This empirical example provides support for my first proposition suggesting that incremental changes in practice result from situated learning in COPs initiated by COP members.

#### *6.1.1.3 Learning how to demonstrate the commercial value of inventions in marketing flyers*

The preparation of non-confidential marketing materials is one of the marketing activities. The marketing flyers are a result of the joint efforts of the BD and Marketing managers. The BD managers use a disclosure form that defines what information must be collected from academics. The completed disclosure form is passed on to Marketing Manager, who uses the information to prepare a range of non-confidential marketing material, including the two-page flyers on the technology, newsletters to industry, and online marketing briefs. The two-page flyers are sent by the BD and Licensing managers to selected companies – potential licensees. Thus, all members of the COP (based around IP assessment and marketing practice) are involved in the preparation and/or distribution of marketing materials.

In 2008 the management of KTO A started “to push more outward-facing, proactive marketing and business development activity” (BD Manager 2). The KTO’s management wanted to increase commercial engagement and balance the cuts in public funds with increasing income from knowledge transfer activities. The management set the following strategic goal:

In terms of our licensing we have to get a lot better getting our products out, getting the kind of USP – Unique Selling Point – of the products identified, being far more active in marketing the products. (Director)

This strategy of KTO management encouraged a greater focus on demonstrating the unique value of academic inventions. The direction-setting practice of the management is, according to the proposed theoretical framework, one of the strategic practices that trigger learning in COPs.

In response to the new strategic direction, the members of the community tried to understand how to demonstrate the unique value of inventions in the best possible way. Two conflicting views emerged in informal interactions. BD managers argued that it is appropriate to include detailed technical information on the flyers whereas the Licensing managers argued that the flyer should not include technical language, but should focus on demonstrating the commercial value of an invention. The Head of CD explained how the view of the Marketing Manager and Licensing managers differed from those of the BD managers:

You see we had that argument – they [BD managers] would say – if you can't understand it [the technical two-page flyer], then you are not a customer, which is on one level valid but the response is – what if you are marketing it at the event and the guy who walks past isn't a tech head, he is a finance director. Does he know that he should be taking it and showing it to the tech head? Or does he now understand your waffle. (Head of CD)

The BD, Licensing and Marketing managers subsequently negotiated how to undertake marketing, what information should be included in a marketing leaflet and how it should be presented. Eventually, a new understanding of how to prepare a marketing flyer emerged:

NCD<sup>25</sup> is not intended to give many technical details on how something works necessary. It is really a value statement which hopefully can attract some interest and we can follow up on that. A follow-up pack contains more technical details. (Licensing Manager)

This change required BD staff, who are most in contact with the academics, to start performing new actions (tasks) in order to prepare marketing materials. They have to work with the academics on identifying the commercial value of IP and if necessary, help the academics to translate technical language into commercially-friendly language. Addition of new actions to execute a particular activity was defined as an incremental change in 'the what'. The Head of CD has initiated a formal review process in order to ensure that relevant staff are aware of what is expected of them. He described the review process:

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<sup>25</sup> Non-confidential disclosure = non-confidential marketing materials

We have taken a piece of NCD [non-confidential disclosure] – so marketing material – and we did before and after. So we took one which was full of technological waffle, acronyms and science speak and we turn it into – whose need does this address, and why should you carry on reading this document? – piece of ‘back to basics’ marketing material. And we showed both copies to business development staff – and we said this isn’t good for catching people’s interest – the techy one. It might do as a backup. (...) They [non-confidential marketing leaflets] have actually changed dramatically to actually become a recognisable marketing document and not a lot of science waffle from the academic. Academics write very measured things. So an academic paper will say ‘this may arguably contribute to further insights into research’ whereas we are trying to say ‘this is great, you should buy it’. So we have dramatically changed how these marketing leaflets look like. (Head of CD)

Thus this formal process provided space for the creation of a new NCD ‘template’, which has now become a part of the community’s repertoire of practice. However, the initial interactions among community members, through which new understanding of the best approach to marketing has emerged, were informal. On the other hand, creation of ‘template’ flyers (one element of a repertoire of practice), took place in the formal review process. These findings reinforce the point made by Brown and Duguid (2000: 87), who noted that “knowledge in organizations is generated in practice but implemented through process”.

This example shows that direction-setting practice of KTO A’s management triggered learning in the COP. The interactions among the members of the COP (around IP assessment and marketing activities) resulted in changes to the actions performed in order to prepare non-confidential marketing materials. This incremental change in ‘the what’ arguably has helped KTO A to become better at communicating to industry information on academic inventions. This example reveals that management can instigate situated learning leading to incremental change in ‘the what’. This mechanism shows that the role of management in introducing incremental changes in practice is greater than is typically portrayed in literature on COPs (Brown and Duguid, 1991).

### **6.1.2 *Learning in NOPs in KTO A***

This section explains what was learned in KTO A through interactions of commercialisation staff with members of their NOPs. In other words, what was learnt in KTO A through interactions of its commercialisation staff with knowledge transfer professional in other KTOs. We explore whether this learning occurred spontaneously

or was instigated by management. First, I identify the NOPs in which the commercialisation staff participate.

#### *6.1.2.1 NOPs of commercialisation staff in KTO A*

The management of KTO A is well embedded in NOPs. The KTO Director participates in a number of formal gatherings, including events organised by networks such as ATUM, AURIL, PraxisUnico, meetings of KTO directors of research intensive universities (e.g. Russell Group), and the regional meetings of university KTO directors. Through participation in these formal groups, the KTO's director has developed close personal relations with senior knowledge transfer professionals in other KTOs in the UK and overseas. These personal contacts are a source of advice for the director:

If it is something to do with a particular challenge in terms of tech transfer, licensing – there is a small group of directors and we keep in contact. (...) 'Have you faced it? How did you deal with that? What do you think about?' – These kinds of questions. (Director)

The Head of CD has developed relations with other KTOs. He sees his informal NOPs as greater sources of learning than formal training which, he says, “tends to be at a basic level” (e.g. training by PraxisUnico). The quote below illustrates how close relations across KTOs allow for the exchange and dissemination of information:

[Person] in Newcastle – we are both involved in this visit to CBI so we spoke at that meeting. The guy from Cardiff I met repeatedly at Unico events and we went for coffee after the meeting to keep in touch on what's going on there as well. I know some of the people at Imperial so when I was down in London to visit family last year, I popped in to see the folks in Imperial just to catch up on what they were up to. We have a sort of open channel relationship with UCL in London as well. It is actually a funny relation where we sort of almost formally agreed that we can ask each other questions. So they are allowed to phone us up and we are allowed to call them up... the directors, you know the opposite numbers. (Head of CD)

Interviews with four KTO staff at lower levels revealed that they do not have many personal relations with members of NOPs. Commercialisation staff have attended relevant PraxisUnico courses and other training courses, and also have joined online networks (e.g. discussion groups on LinkedIn) to enhance their personal knowledge and skills. One of them pointed out that “some conferences and informal meetings are hard to attend as they occur around the South-East of England and it's too far to travel regularly” (BD Manager 2). They do not contact colleagues in other KTOs if they need



to solve a problem or deal with something new. When faced with a challenge or problems in practice, they look for advice from their senior colleagues. Should the need arise, the help or advice from other KTOs is sought by senior managers and the KTO Director (“all of that will come with the process review, our manager has been to other institutions to see how they do things – to Imperial for example.” – BD Manager 1). We conclude that in this large KTO, it is mainly senior managers that learn from NOPs on a regular basis.

The Marketing Manager is an interesting exception. Like staff members at lower grades, for many years he had no close relations with knowledge transfer professionals in other KTOs. This changed when a joint marketing project was initiated by the regional group of KTO directors in the early 2000s. The Marketing Manager was asked by the director of KTO A to work with marketing and BD managers from other regional KTOs on development of [www.university-technologies.com](http://www.university-technologies.com) – a website for advertising academic inventions from all Scottish universities. This project allowed the Marketing Manager to develop a network of contacts from a number of KTOs. The Marketing Manager said happily:

We meet every quarter to discuss what is going on with the [www.university-technologies.com](http://www.university-technologies.com) but we will also use that to discuss other things, what is going on within the sector; we will have a chat usually over lunch and just talk about what is going on (...) We will discuss what impact the social media can have on industry, what is happening with the IP.net as they came after U-T.com (...) Before u-t.com I did not have any contacts outside – I operated in the vacuum. (Marketing Manager)

This story illustrates that management (here the KTO Director) can help staff to develop NOPs by brokering (or facilitating) connections between their staff and other KTOs and by providing time for engagement with staff of other KTOs.

To summarise the above discussion, the interviews revealed that the KTO’s senior managers learn in their NOPs while staff members at lower levels, except more recently in the case of the Marketing Manager, do not have close relations with knowledge transfer professionals in other KTOs. Below I discuss what was learnt in KTO A through interactions *with* NOPs and whether learning was instigated by staff or management.

#### 6.1.2.2 *Learning to market inventions online jointly with other KTOs*

Marketing of academic inventions is an important aspect of commercialisation practice. It is important to disseminate information on available technologies and to locate suitable licensee(s). Online marketing is one of the ways to do this. Before 2004, the KTO's online marketing was focused on posting information about available technologies on the KTO's website. As already mentioned, the directors of 13 Scottish KTOs developed the idea of a joint website for marketing university IP, and set up a collaborative project to achieve this goal. The directors of Scottish KTOs hoped that creating a critical mass of university technologies and the apparent "Scottish heritage of innovation" (Marketing Manager) would attract industry interest. Each university nominated one person and KTO A was represented by the Marketing Manager. As it was the first initiative of this kind among UK universities, the staff from different KTOs involved in the collaborative project had to develop from scratch understanding of what good joint online marketing of university IP should be. Network members had to figure out (among other things) what functions the website should have, what information should be provided, what universities would be allowed to provide the technologies, how the online content should be up-dated, and how the website would be financed. They developed the following approach:

The universities all contribute a minimal amount per year of £1000, that is not very much to keep something like that running, and that is the budget we operate on. There are no administrators; that is the unique thing about it. It is a virtual initiative; there are no staff – everything is done automatically through the website. The only people involved in it are the seven members of the steering group. It is a content-managed system. You are going to your own account; everyone has their own account and you can post it; it is an easy form (...) In fact it heavily leans on [our] non-confidential disclosure marketing leaflet – benefits, applications, IP status. (Marketing Manager)

The new portal, in large degree, adopted the good practice of KTO A, thereby resulting in no change in the way that the BD and Licensing managers approach the preparation of marketing materials. This is arguably why there was no resistance (discussed in more detail below) from the BD and Licensing managers to this new way of on-line marketing. *A new action of publishing academic inventions on the joint website, however, became a part of the on-line marketing activity in KTO A and proved effective* ("The bulk of our enquiries come through either our website or through

www.university-technology.com” – Marketing Manager). This incremental change in the ‘what’ resulted from learning in NOPs that was instigated by management.

However, it is not always the case that learning in a NOP results in a change to practice. Resistance to change can emerge. An example of this was provided by the Marketing Manager. Through interactions with members of his NOPs, he explored how social media are used by other KTOs to improve marketing activities. In an attempt to keep up with technological developments and improve marketing, the Marketing Manager set up a YouTube channel and a Twitter account. There are some videos available promoting the university’s technologies on the KTO’s YouTube channel; however, the creation of this video content is not straightforward. It requires financial resources and commitment from a BD manager to create the video content about an academic invention. Not all BD managers perceive the use of social media as a necessity. The Marketing Manager bemoaned the fact that:

I have everything in place but I now need the content and I am trying to push for it ...but I know for sure that one BD had funding to develop video content so I hope again that this is our tipping point and the others will follow and we will get more content for that channel. (Marketing Manager)

In this case the knowledge gained through the interaction of the Marketing Manager with his NOPs has not yet led to change. This change would require the Marketing Manager to set up a new online tool as well as changes to the marketing content prepared by BD managers. It would also depend on acceptance of this new practice by all BD managers. The future will show whether what the Marketing Manager learned through participation in NOPs will change the commercialisation practice in KTO A.

In summary, this section has shown that learning in a NOP, instigated by the KTO director, led to a change in marketing activities. In particular, a new action, namely marketing on a joint IP website, became a part of on-line marketing (activity). Introduction of marketing on a joint IP website is an example of an incremental change in ‘what’ KTO A does since KTO already publishes information on its own website. The change arguably has helped KTO A to become better at communicating information about academic inventions to industry. Creating a website that provides information about technologies from all Scottish universities is also more business-friendly than simple marketing on a university’s website since businesses do not have to search the websites of each university separately. The process through which marketing on a joint website was developed shows that management may have to trigger situated

learning, allocate necessary resources and help staff members connect to external experts for the situated learning in NOPs to occur. This mechanism shows that the role of management in introducing incremental changes in practice is greater than is typically portrayed in literature on COPs (Tagliaventi and Mattarelli, 2006).

#### *6.1.2.3 Learning to make investments in spin-outs*

A KTO, on behalf of the university, can license the IP rights to an academic invention, to a spin-out company, in exchange for an equity stake. Holding shares in a spin-out by virtue of a licence creates some problems for the KTO. For example, there is a danger of dilution/devaluation of university's shares when a spin-out receives the next rounds of investment. Section 6.1.3.2 discusses how KTO A has stopped including certain provisions in its licence contracts, which is helping to protect its university from this danger because these provisions were seen as jeopardising the potential growth of the spin-out. Once KTO A realised that the university's equity stake was not protected in an optimally legal way, there was a need to manage the university's equity stake differently. This became apparent in 2009 when KTO A licensed its "most promising technology" (Head of CD) to a spin-out and faced the potential dilution of its shareholding. There was an understanding among the KTO staff that the dilution of its shareholding could be minimised by university follow-on investments in the successful spin-out company – a practice present in some UK KTOs.

However, until 2009, the KTO A's commercialisation practice did not include equity management and follow-on investments. The opportunity to invest in the "promising" spin-out was presented to management which supported development of new activities. Thus, a learning process was triggered by an opportunity created by the commercialisation of a technology with a great commercial potential and was endorsed by management. Since these investment activities are undertaken by other KTOs, it is not surprising that the commercialisation staff looked for advice from their NOP on how to create an investment fund:

With setting the fund I mentioned (...) We have asked Oxford, Cambridge, UCL, Keele. We asked them what they have done, about their experiences so we can sort of work out. (Director)

The Company Formation managers were charged with the task of raising money for an investment fund. The Head of CD was undertaking the first investment deal and he looked to external experts for help:

This corporate lawyer I was using does hundreds of investment deals. He advises VCs and universities. So he has a perspective that nobody in the university sector has. So I am spending a lot of money on his fees at the moment. (Head of CD)

Thus, interactions with members of the NOPs (other KTOs) and interactions with other COPs (e.g. corporate lawyers) helped to develop understanding of what to do to invest further in a spin-out. Knowledge gained through interactions within NOPs shaped the development of a fund while experience from interactions across communities shaped the way in which the KTO manages contractual issues related to making investments. Management controlled the development of the new activity through a newly set up investment committee, comprising senior KTO managers. This new controlling practice allowed management to monitor the learning trajectory. The outcome of learning was the addition of new activities to the commercialisation practice. Thus these changes in commercialisation practice can be classified as a radical change in ‘what’ the KTO does.

This example reveals that the opportunity to introduce radical changes in ‘the what’ (changes to ‘what’ activities are performed within the practice) can be identified by COP members and that the performance of new activities can be learnt by COP members through interactions in NOP and across COPs. However, the management also plays an important role. The empirical evidence suggests that management endorses changes by allocating resources for development of new activities (e.g. time for Company Formation managers). This mechanism was also described by Anand et al. (2007). I find that management also creates new controlling structures to ensure that the practice, evolving through situated learning, is aligned with organisational goals.

Although the first follow-on investment was officially completed in January 2011, the commercialisation staff are working on developing a systematic approach to equity management. They have raised some money for the investment fund, and set up an equity management committee, whose role is to review the portfolio of spin-outs, and an investment committee to decide on investments. In future the commercialisation staff will need to learn how to: (1) assess investment needs for spin-outs in the university’s portfolio; (2) prepare the investment case and negotiate investment terms internally as

well as with other shareholder of a spin-out and new investors; (3) conduct regular investment reviews; (4) manage relationships with spin-out companies; (5) lead investment rounds; (6) establish quality co-investors; (7) support and assess companies' progress; and (8) prepare companies for sale.<sup>26</sup>

### ***6.1.3 Learning from other COPs in KTO A***

The purpose of this section is to explain what has been learnt in the KTO through interactions of commercialisation staff with other COPs and why this learning occurred. First, I explore what other COPs were a source of knowledge for the commercialisation staff in KTO A.

#### ***6.1.3.1 Connections of commercialisation staff in KTO A with other COPs***

The importance of learning from other communities was highlighted only by the Head of CD who said “there are not that many people I could go to with a specific problem; I go to external people”. He asserted that when he deals with complex spin-out deals then “the answer does not lie in another university”. Instead, he learns from interactions with (1) venture capitalists investing in university spin-outs, (2) entrepreneurs who are recruited to manage university spin-outs, (3) external corporate lawyers who are brought in to consult on a complex spin-out project, and (4) patent agents to whom the filing of patents is subcontracted. The interactions with the former two help him “to understand their perspective on the process and what they need to make a successful business based on the engagement with the university” (Head of CD). Interactions with the corporate lawyers extend his knowledge of investment making and corporate law (“This corporate lawyer I was using does hundreds of investment deals; he advises VC and universities. So he has a perspective that nobody in the university sector has.”), while the interactions with patent agents allow a greater appreciation of the IP valuation process.

Interviews with licensing and BD managers did not reveal interactions with other professionals (across COPs) as an important source of learning. The junior Licensing Manager noted that, when he previously worked in a smaller KTO, he tended to learn from interactions with patent attorneys, whereas currently in the big KTO in University A he can learn from his more senior colleagues.

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<sup>26</sup> List of activities is copied from the website of Imperial Innovation, which has developed strong competence in making investment (see <http://www.imperialinnovations.co.uk/node/553> ).

I discuss in the next section what has been learnt in KTO A through interactions with other COPs and whether this learning was spontaneous or instigated by the management.

#### 6.1.3.2 *Learning how to negotiate ‘win-win deals’ with spin-outs*

Since the 1990s the KTO has been licensing university technologies to spin-out companies, often in exchange for an equity stake. Spin-out companies “were a complete rarity back in the early ‘90s” (Head of CD), and this change in licensing practice posed new challenges to the KTO. They had to learn how to protect the interests of the university in licensing deals that involved transfer of IP in exchange for an equity stake. For many years the staff in KTO A included certain provisions in the licence contracts (e.g. provisions on share options, or new classes of shares) in order to protect the value of the university’s shareholding. However, around 2009, the Head of CD learned from the entrepreneurs, who were brought in to manage a newly spun-out company, and from venture capitalists that their approach may not have been optimal:

Their [entrepreneurs’] job is to set up an investable [sic] proposition and that is potentially quite different from a job of transferring the technology in an appropriate manner whilst protecting the University’s risks. It is even the same with the VCs when I am talking to them – his job as an early venture capitalist is to create an investable vehicle. So there are provisions which I thought were reasonable to keep in the contracts [but] which he wants to get rid of because they can scare off the next round investors. And he is quite an expert on this so I had to listen to his opinion on that. *If that scares off the next round [of] investors, then we all lose* (emphasis added). ...So our instinct is to protect ourselves against that [dilution/devaluation of university’s shares] but in fact in doing so, you might actually be seen as *shackling the company’s freedom to operate*, (emphasis added) (Head of CD)

Thus the Head of CD learnt through interactions with members of other communities (entrepreneurs, venture capitalists) that taking a protectionist approach could jeopardise the ability of a spin-out company to secure further investments. If a spin-out company does not grow, then the university will not gain anything from its equity in the spin-out as they will not be able to sell its shares in that spin-out.

This lesson had implications for the KTO’s licensing practice, in particular, in the way Licensing managers negotiate terms in license agreements with spin-out companies. As a result of learning across COPs, Licensing managers stopped, as a

matter of practice, insisting on the inclusion of the problematic provisions. Their approach can be described as seeking a ‘win-win deal’:

The company has to be empowered to get a lot of money and we will get a share of that money. So it isn’t about pounding the other side into submission in negotiation. It is *about leaving something* (emphasis added) so that everybody can profitably win.(...) you should not tie your licensee up so much that they are not free to respond to the market. (Head of CD)

This view is also shared by other Licensing managers:

it is about reaching agreement on *what they actually need to be successful* because at the end of the day, for the university licensing to be successful, we need our partners to be successful too. So there should be a benefit to both parties. (Licensing Manager - emphasis added))

Thus they have a shared understanding of how to approach licence negotiations underpinned by the assumption that success depends not only on the IP, but also on giving a measure of freedom to the commercial partner. While learning occurred in interactions across COPs, the change had to be approved by the management.

This example shows that interactions with members of other COPs (entrepreneurs, VCs) made COP members realise the limitations of their existing practice and triggered a change in practice. In this case, learning through interactions with entrepreneurs and venture capitalists led to incremental changes in the way a particular aspect of licence negotiations is conducted and contracts are concluded. They have stopped protecting the university’s interests at the cost of a licensee’s (a spin-out’s) ability to grow. The change is in line with the KTO’s view on the importance of partnership, which considers the spin-out licensee to be a partner who also has to be comfortable with and benefit from entering into a relationship with the university. The change also addressed the problem of overvaluing the IP, a well-known complaint of industry as a major barrier to university-industry collaboration. This incremental change in ‘the how’ was introduced through learning that was triggered by problems in practice identified by a COP member and occurred through interactions with the members of other COPs. The previous literature on COPs highlighted the role of learning across COPs in radical changes (Nooteboom, 2008; Scarbrough and Swan, 2008). This empirical example reveals that learning across COPs also shapes incremental changes to practice.



#### 6.1.4 Summary of Case Study A

As noted above, KTO A at the end of 2010 had a match-making commercialisation practice, underpinned by the ‘coupling model of innovation’.

The analysis revealed that in the period 2005-2010 learning in KTO A took place through interaction within COPs and NOPs and across COPs. KTO A learned how to ensure that technical and commercial assessment of academic inventions is systematic and rigorous for each invention. It learned also how to improve communication of information on inventions to industry, by revising the way that marketing flyers were prepared and by introducing online marketing on portals promoting university IP. These changes in marketing activities are directed at improving one-way communication *from* university *to* industry (as opposed to two-way communication), however, they show consideration for the needs and preferences of industry. KTO A learnt also how to build better relations with spin-outs, which are mutually beneficial for the university and the entrepreneurs operating the spin-out company and the spin-out’s investors. These changes to commercialisation practice reported by commercialisation staff were predominantly incremental and aimed at improving already existing match-making practice. In conclusion, KTO A has learnt how to be a better match-maker. Table 6.1 summarises the findings from this case study.

Table 6.1 Summary of what KTO A has learnt, how and why

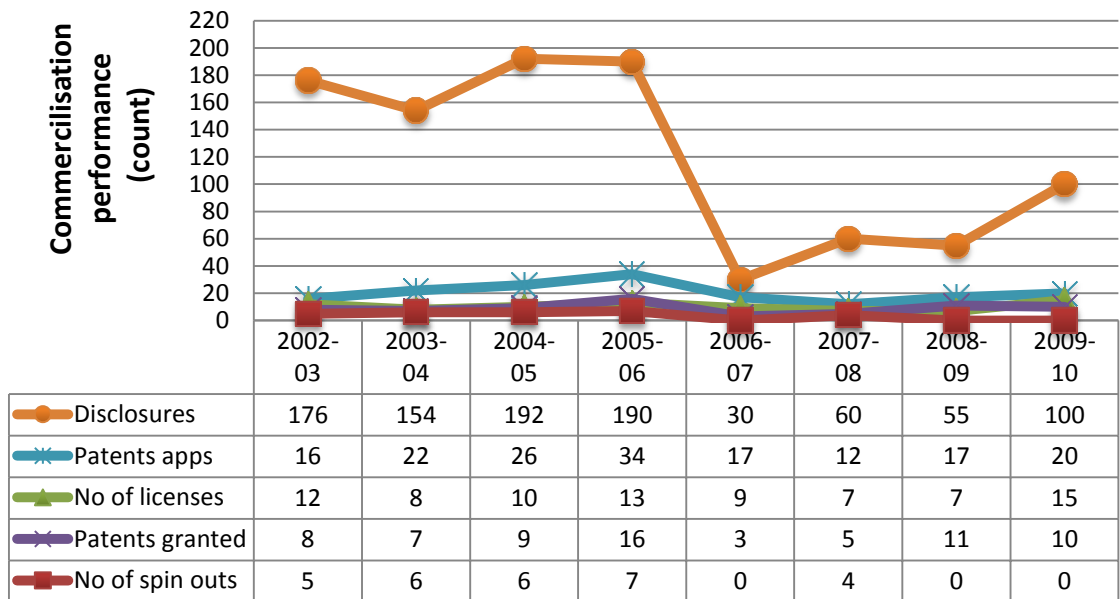
		How has KTO A learnt?		
		Learning in COPs	Learning in NOPs	Learning across COPs
Why has KTO A learnt?	Situated learning initiated by staff	<b>What?</b> assessing technical aspects and commercial potential of inventions in a systematic and rigorous way (incremental change in ‘the how’, see 6.1.1.2)	<b>What?</b> setting up a fund for investments in spin-outs (radical change in ‘the what’, see 6.1.2.3)	<b>What?</b> negotiating ‘win-win deals’ with spin-outs (incremental change in ‘the how’, see 6.1.3.2)  managing contractual arrangements for an investment in a spin-out (radical change in ‘the what’, see 6.1.2.3)
	Situated learning instigated by management’s strategic practices	<b>What?</b> demonstrating a commercial value of IP in marketing flyers (incremental change in ‘the what’, see 6.1.1.3)	<b>What?</b> marketing inventions online jointly with other KTOs (incremental change in ‘the what’, see 6.1.2.2)	

Source: Constructed by the author

## 6.2 Case study F – background information

This case study is about learning in a KTO in University F, a member of the Russell Group. The KTO provides support for research and enterprise activities in all academic departments. The university is in the top thirty in the Times Higher Education's Table of Excellence (2008), ranking UK universities according to average RAE scores. Figure 6.3 illustrates the volume of commercialisation outputs in 2002/10. It shows that performance on all measures dropped significantly in 2006/07 compared to previous years. However, performance has risen steadily since 2006/07. This drop in commercialisation outcomes was related to some temporary personnel problems<sup>27</sup> in KTO F. In 2009/10 knowledge transfer activities supported by the KTO generated approximately £65 million. This included income of £789,000 from licensing and spin-out activities.

Figure 6.3 Commercialisation performance of University F



Source: HEBCI surveys, 2006-2011

**Information on KTO F.** The internal department dedicated to liaising with industry was set up in 1985 (HEBCI, 2007) and the first subsidiary company responsible for commercialisation was established in 1987. The KTO currently works on a hybrid model, in which an internal department and a wholly-owned subsidiary company coexist. There are about 52 people in this KTO. The internal department employs about

<sup>27</sup> Details are not disclosed here for confidentiality reasons.

40 people, working in three teams: (1) Business Engagement and Marketing responsible for supporting development of business assistance projects (consultancy, KTP, CPDs, contract research), business collaboration (collaborative research) and marketing of the university's entrepreneurial activities and patented technologies; (2) Research Support; and (3) Contract Team which provides legal support for research contracts. The wholly-owned subsidiary company employs about 12 staff members and is responsible for IP management, licensing, spin-out formation, consultancy and a Science Park (established in 1986 as a joint venture between the university and the city council). The KTO's budget comes from HEIF and central university funds. The key commercialisation staff members include two IP managers, a Licensing Manager and a Licensing Administrator who are employed by the wholly-owned subsidiary, as well as two Marketing Managers and the Spin-out Manager who are employed directly by the university. Four of these members of staff have been employed since 2007 and the interviews revealed that the new staff members had a rather limited knowledge of commercialisation before 2007. I was unable to gain access to the employees who were there before 2007 and my analysis, therefore, covers changes in commercialisation practices in the period 2007-2010, rather than 2005-2010 as in Case Study A.

***Information on commercialisation practice in KTO F.*** Knowing and doing are inseparable in practice. Practice has been defined as a set of observable recurrent activities that are related to a particular organisational function. Following Orlikowski's (2002) approach, work activities (doing) are observed and then it is inferred from the observations what 'knowing' is necessary to perform these activities. As in the previous case study, the 'doing' aspect of commercialisation practice comprises (1) identifying commercialisation opportunities; (2) assessing IP; (3) marketing activities; (4) handling licensing agreements and other contracts; and (5) activities involving company formation and management of spin-out portfolios.

***Identification of commercialisation opportunities*** is undertaken by two IP managers in charge of recording invention disclosures. They wait passively to be approached by academics or knowledge transfer managers who are based in academic schools (and are not managed by the KTO). Their "job is to interact with the academics and act as a funnel of IP" down to the KTO (Licensing Manager). The IP managers may be informed about commercialisable research outputs by BD managers, who are part of the

Business Engagement and Marketing Team. However, the BD managers do not focus on identifying IP that can be licensed or exploited in a spin-out. They look for ‘pockets of research excellence’ in the university that could be of interest to industry and then try to find sponsors for further research in these areas of excellence. In summary, there is a passive approach to identifying commercialisation opportunities. As explained in Case A, the proactive approach would help to avoid situations where an academic approaches the KTO asking for a patent application to be urgently filed.

*IP assessment* is performed by IP and Licensing Managers. After an invention disclosure is made by an academic, an IP Manager conduct a search for prior art in order to determine if the invention is patentable. Next the three get together to assess whether the invention should be commercialised by the university and decide on a commercialisation route. They use a structured questionnaire to guide their decisions. They then consult with the KTO Director about their decision since his approval is required to proceed with patenting. The Licensing Manager described their approach as follows:

They are IP managers and it is their responsibility to initially talk to academics and find out if they have an invention which is worth protecting. We will then *discuss together whether it is a good area to protect*\_(emphasis added), my two colleagues will then work with patent agents to write patents and when we have the invention protected, and when we have sufficient data I will then start to sell and promote the patent. (Licensing Manger)

This extract indicates that they conduct an assessment of the legal and technical aspects of inventions in order to ensure patentability. Commercial viability is assessed through a desk-based ‘landscape survey’ that allows them to identify companies that might be interested in the licence. The market research makes use of proprietary databases, online searches and the KTO’s database and is performed by the Marketing Manager. There is no evidence that they purposefully gather feedback from potential licensees to improve understanding of the commercial value of the technology. A Spin-out manager expressed some reservations about the way in which market research is done:

I may be a bit wrong... but it seems to be a bit more desk-based research and I think they need to go out to more conferences, more trade shows and doing a lot more trying to understand different markets, which is quite a difficult

thing to do when you have a small team and big portfolio. (Spin-out Manager)

This quote further confirms the conclusion that the commercial value of invention is not systematically assessed. As explained in Case A, gathering ‘market intelligence’ is important because it can shape the further technical development of the invention and can be taken into account in patent applications (and in the revision of patent claims before filing applications abroad).

In summary, IP assessment activities give weight to the legal and technical aspects of inventions. This approach to IP assessment does not ensure that the information from the technical assessment of an invention and the information from the assessment of its commercial viability are combined in a systematic manner.

*Marketing of academic inventions* is done predominantly by three staff members. Two Marketing managers are responsible for (1) preparation of marketing materials: a two-page non-confidential flyer on inventions, a newsletter promoting selected knowledge transfer and commercialisation projects, the annual report of the wholly-owned subsidiary, and posters for advertising campaigns, (2) online marketing: posting the flyers on the university’s own website, posting information on IP.net website and six other IP websites, and (3) preparation of press releases. The above activities disseminate information on entrepreneurial activities taking place in the university, academic expertise and licensable technologies. (Note that general advertising (posters, press releases) were discontinued in KTO A because it was found to be ineffective.) Quarterly newsletters are produced by KTO F aimed at internal and external audiences. Given that the interests of the academic and commercial audiences may differ, the appropriateness of these newsletters’ content and language is questionable. My analysis of the five marketing flyers showed that their value proposition is not always clear and there is often a lot of technical jargon. In summary, the general marketing activities are not always targeted (posters, press release), and marketing materials lack a clear focus on demonstrating the commercial value of inventions to potential licensees and investors.

Identifying licensees is undertaken by the Licensing Manager once “the invention is protected” and when it is felt “they have sufficient data” (Licensing Manager). The Licensing manager noted that good practice involves thinking “widely across the industry where the technology can be applied”. However, the technologies are often licensed to companies with which an academic already has a contact:

the most usual place where you will license invention is with someone who the academic is already working with so it is very important to work with the academics. They often have industry contacts if their work is applied and a lot of work is done as some sort of collaboration with industry. So they are the natural licensees. (Licensing Manager)

Licensing to existing contacts of academics raises questions about how “widely across the industry” the suitable licensees are sought. When approaching a potential licensee the Licensing manager will typically say: “I believe we have a technology that can benefit your industry and help you do things better, cheaper, faster, more profitably” (Licensing Manager). This quote shows that the approach of the Licensing Manager is underpinned by a sales-mind-set. This way of identifying licensees differs from practice in KTO A where Licensing managers always have talks about licensing with a number of companies (around 20) in order to identify a long-term partner who would work with academics on commercialising a particular technology and would be interested in broader engagement in collaborative research. Moreover, as noted in the discussion of assessment activities of KTO F, interactions with potential licensees are not simultaneously used to gather ‘intelligence’ about industry needs and wants. This suggests that KTO F aims at dissemination information about academics’ inventions but not at two-way communication. I conclude that the approach to identifying licensees characterised by (1) relying on contacts of academics, (2) making sales-offers to potential licensees and (3) the prevailing one-way flow of information, reveals that commercialisation staff attempt to identify ‘buyers’, rather than partners, for long-term collaborations.

*Handling of licensing agreements and other contracts* is undertaken principally by four staff members. The Licensing manager is responsible for negotiation of license deals. He tries not to “accept the first offer” and tries not to “allow the academic to take over the negotiations” (Licensing Manager). Maximising revenues is an important goal. IP managers prepare the legal contracts (licence agreements, shareholder agreements, etc.). If the IP is licensed to a spin-out, then the Spin-out Manager is also involved. The internal lawyers provide support if required.

Licensing in KTO F is underpinned by a ‘sales mind-set’, exemplified by the following quotes:

and when we have sufficient data, I will then start to *sell* (emphasis added) and promote the patent. When I have actually got the agreement from someone that they will *buy* (emphasis added) the patent, the [IP managers] will help me put together the necessary agreements. So they specialise in the legal aspects and IP aspects of the business and I specialise in *the marketing and sales* (emphasis added). (Licensing Manager)

and

The people whom we need to contact are distributed globally. They are in very specialised areas. We will probably do a licence, take the money off them over time and never license again to them (...) Apart from maintaining that business or trying to get some additional consultancy business with them, that would be the interaction. (Licensing Manager)

Clearly licensing is perceived as a one-off market transaction. This approach differs from KTO A, where licensing is seen as part of building up a long term research and development partnership.

***Company formation activities and management of the spin-out portfolio*** is carried out by the Spin-out Manager. Company formation activity initially was added to the IP and Licensing Managers responsibility before a Spin-out manager was hired by the university in 2010. Company formation activities include: (1) support for business planning for spin-outs (but not staff and student start-ups), (2) help with securing funding for spin-outs, (3) help with recruiting commercial management teams for spin-outs, (4) negotiation of contractual arrangements for academics (e.g. whether an academic has a fractional post in a spin-out or acts as a consultant) and for commercial managers (e.g. how they are rewarded, whether they receive an equity stake) as well as the contractual arrangements between the university and the spin-out (e.g. equity agreements, lab access contract), and (5) the management of relations with university-owned spin-outs.

As in the previous case study, I follow the approach in Orlikowski (2002) and make inferences about the ‘knowing’ embedded in the commercialisation practice described above. Drawing together the activities, it is clear that the commercialisation staff have the abilities to (1) identify commercialisable IP (as opposed to the ability to identify research with potential for commercialisable outputs observed in KTO A), (2) conduct a thorough assessment of the legal and technical aspects of inventions (as opposed to

ability to assess the legal and technical aspects as well as the commercial viability), (3) manage the dissemination of information on academic inventions (as in KTO A) and (4) identify a buyer for the university's inventions (as opposed to the ability to identify long-term partners for academics observed in KTO A), (5) make one-off transactions (as opposed to the ability to build partnerships e.g. through the means of licensing) and (6) secure human and financial resources for exploitation of an invention in a spin-out company (as in KTO A).

In summary, with the exception of company formation and some marketing activities, commercialisation practice in KTO F differs from the match-making practice in KTO A. KTO F does not ensure that research with commercialisable potential is identified early; IP assessment activities are focused on the technical strengths of the IP and its patentability. Licensees are perceived as buyers and licensing agreements as one-off transactions in which profits should be maximised. I refer to this as *IP-focused commercialisation practice*. This approach to commercialisation in KTO F seems to be based on the implicit assumption that the outputs of research can be passed on to industry, which will turn them into innovation. In other words, there is an implicit assumption that the innovation process is linear and that scientific discovery in the university is followed by technological development in companies, and that there is no need for feedback loops and long-term relations. This implicit assumption also underpins the early model of innovation known as the technology-push or science-push model of innovation (Godin, 2006). Thus, at the end of 2010, KTO F had an IP-focused commercialisation practice underpinned by a 'science-push model of innovation'.

Key questions to emerge include: Has KTO F's IP-focused commercialisation practice been in place over the five-year period under study and has it merely learned to improve it, *or* did it develop this practice during this period? The next section describes learning in KTO F.

### **6.2.1 Learning in COPs in KTO F**

The main purpose of this section is to explain what has been learnt through interactions within COPs in the KTO and why this learning occurred (spontaneously or instigated by management). I identify COPs that emerged in KTO F and then discuss what was learned in these communities and why.



### 6.2.1.1 *COPs in KTO F*

There is a COP comprising IP, Licensing and Spin-out managers, which I will refer to as the IP COP, and a COP comprising BD managers, which is not discussed here because learning in this COP was found not to be related to changes in commercialisation practice.

**IP COP.** Two IP managers and the Licensing Manager are the core members of this community. One of the IP managers is the first port of call for everyone “because he has got the longest experience than anybody [sic]; he has worked in the sector for 10 years” (Licensing Manager). He has a senior position in the IP COP, but in the formal organisational hierarchy he is at the same level as the other three managers (IP, Licensing, and Spin-out). The IP and Licensing Managers jointly undertake assessment of the university’s IP and cooperate to develop the commercialisation project. All three have expertise in different technological fields which undoubtedly is helpful for IP valuation. The IP managers take responsibility for the management of IPR, and the Licensing Manager concentrates on marketing the IP to potential licensees. When they work together to close a licensing deal, the Licensing Manager negotiates with the licensee and the IP managers prepare a legal contract. These joint and complementary activities give them opportunities for mutual engagement. The Licensing Manager noted: “we work very, very closely together”.

They have a shared practice not because they necessarily always agree about what to do, but because their actions are collectively negotiated. They discuss how to proceed with each project on a formal and informal basis:

[Interviewee]: The way we work is to have fortnightly review of all the cases but once every three months we will sit down for a day and discuss very carefully what is happening with each of the cases, what is working and what is not working.

[Interviewer] And on an informal basis?

[Interviewee] oh... We moan all the time about what is working and what isn’t working. We have an open plan office. (Licensing Manager)

These formal and informal gatherings give them opportunities to negotiate their joint work activities.

Moreover, the IP managers and the Licensing Manager have a shared repertoire of practice, comprising an invention disclosure form recording details of an invention, a questionnaire for IP valuation, template agreements, a fortnightly up-dated spreadsheet

to document what potential licensees were contacted, and ‘My IP’ database for recoding information about patents.

The Spin-out Manager, who joined KTO F in mid-2010, is a new member of this community. He gets involved when a technology is exploited via a spin-out company. Before his arrival, spin-out management was undertaken by the IP and Licensing Managers. So far he has not participated in assessing academic invention, but hopes this will change: “as we work together more and more I would expect to hear more about new ideas coming through and to be asked about opinion about that.” (Spin-out Manager). The Spin-out Manager brought his extensive experience in company formation, gained from working in two very prosperous university KTOs in the UK.

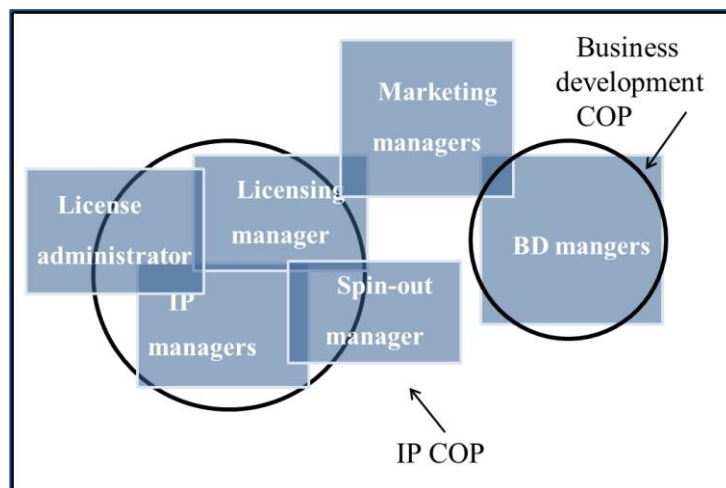
In summary, the informal group comprising IP, Licensing and Spin-out managers displays the characteristics of a COP – mutual engagement, negotiation of joint enterprise and a shared repertoire of practice.

***Why are Marketing managers not a part of this COP?*** Marketing activities require some engagement between Marketing managers and members of the IP COP, for example, during the preparation of flyers for IP marketing or the preparation of press releases. However, a Marketing Manager did not report learning from interactions with the IP, Licensing and Spin-out managers. He tends to learn from people outside the KTO, such as colleagues in the university’s Communications Department and external design agencies. This is because, first, the Marketing managers have been occupied with developing a new brand and this is not something they can get help with from internal colleagues, second, the Marketing managers are not hired by the wholly-owned subsidiary. The formal structure, reinforced by physical separation (i.e. the physical distance between offices) arguably hinders the development of close interpersonal relations which are crucial for informal learning.

***Why are BD managers not part of this COP?*** Similar to IP managers, BD managers identify commercialisation opportunities. The IP managers are interested in research outputs that can only be commercialised via a licence or a spin-out; the BD managers search for all forms of knowledge/expertise that could be of interest to industry (e.g. through contract research, consultancy assignments or CPD courses). Despite undertaking similar activities, there is no mutual engagement between the IP and BD managers. Both groups develop independent approaches to identifying

commercialisation opportunities and have quite distinct repertoires of practice. For example, BD managers take a very proactive approach, analysing the RAE scores of departments or sending out questionnaires to academics, while IP managers tend to be more passive. Both parties reported not learning from each other. The nature of their work activities does not entail working together and cooperation is not encouraged by management. Here, again, the formal structure reinforced by physical separation accounts for the lack of interpersonal relations, which could enable mutual engagement and learning. Although at the beginning of 2010 all KTO staff members were brought into the same building to improve staff knowledge about what people do, they sit in different parts of the building and informal interaction remains limited.

Figure 6.4 Communities of practice in KTO F



Source: Constructed by the author

In summary, the interviews reveal there are two COPs. Figure 6.4 illustrates the joint activities of staff (overlapping squares) and the communities that emerged from joint pursuit of some commercialisation activities (circles). The ‘joint enterprise’ of the IP COP is IP assessment, licensing and spin-out formation. Below, I discuss what was learnt from interactions within this COP and whether learning was spontaneous or instigated by management.

#### 6.2.1.2 *Learning how to recruit commercial management for spin-outs*

The KTO management hired a new spin-out manager to develop more systematic approach to managing company formation. Since joining the KTO in 2010, the Spin-out Manager has been reviewing the spin-out portfolio and has found that some companies

created before 2007 have not shown the expected growth and might benefit from bringing in a strong commercial team. The Spin-out Manager believes that the success of a university spin-out depends partly on the management team that is recruited for day to day management of the company. It is important also that the management team is able to secure further investments for the spin-out. This is a full-time job and the academics who choose to be involved in the management of a spin-out are rarely suited to it largely because (1) management of a new company is extremely time-consuming, and (2) it is not unusual for academics to lack managerial expertise or business acumen. The appetite for investment in early-stage risky ventures decreased in the last decade, making recruitment of “invest-backable entrepreneurs” to manage spin-outs even more important (Spin-out Manager).

The Spin-out Manager consulted with colleagues in the KTO about how this aspect of company formation practice could be improved. He sought the advice of the IP managers and the Licensing Manager (IP COP members) who managed company formation before he arrived. He actively sought the advice of colleagues in academic departments and investors (other COPs) to gain a better understanding of the best way to address the problem. The Spin-out Manager explained:

I had a clear understanding of what I wanted to do in terms of bringing commercial people earlier and I started to test these ideas and see what people think. Talk to the Business School, to people in [KTO], investors, try to see whether it is feasible and see what people thought of that. And over time people gave me some good ideas and the way how I want to approach that has changed over time. (Spin-out Manager)

Through interactions within a COP (IP and Licensing managers) and across COPs (investors, academics), he developed the following approach:

It is sort of a club... club might be too formal word for it but I am trying to bring people who are looking for a next opportunity to work on and the opportunity to engage with academics who we think are working on interesting, high impacting, potentially commercial research and to make this engagement happen much earlier. (...) I am looking at those which are invest-backable. I am doing it in a number of ways – I have a number of contacts already and there are people I have worked with before, so of those have expressed interest, and some of those will give me names of other people who could be interested and I am also talking to investors about that as well. So it is using existing networks that I have got; networks of networks, investors, LinkedIn is also pretty good resource and I got some good names through LinkedIn. (Spin-out Manager)

Thus, the Spin-out Manager has been developing a network of entrepreneurs interested in taking up new ventures. The maintenance of the pool/network has become a new action in the repertoire of practice in KTO F (incremental change in ‘the what’). Previously, recruitment of a commercial manager was ad-hoc. KTO F did not have a systematic approach to coupling technical expertise with excellent management skills for spin-outs. The initiative of the Spin-out Manager has helped to systematise when and how entrepreneurs are recruited. The Spin-out Manager needed the approval of the KTO’s senior management to work on this initiative, but the particular approach was informed by learning in COPs and across COPs. There are still some issues that will need clarification over time (“How are they [entrepreneurs] are going to be paid if we have got funds?” and “Are they going to be remunerated via royalties or share of equity?” – Spin-out Manager).

Introduction of a new way of recruiting commercial management for spin-outs is an example of incremental change in ‘the what’. The company formation identified by management as an area of practice that needs improvement. The direction-set by management triggered situated learning within the COP and across COPs which shaped the development of a new approach to identifying commercial management for university spin-out companies. Similarly to the findings presented in Section 6.1.1.3 this empirical example shows that direction setting practice of management can trigger situated learning leading to incremental changes.

## ***6.2.2 Learning from NOPs in KTO F***

This section explains what was learned in KTO F through the interactions of commercialisation staff with members of their NOPs, that is, with knowledge transfer professional in other KTOs. I also explore whether this learning occurred spontaneously or was instigated by management. First, I identify the NOPs in which commercialisation staff participate.

### ***6.2.2.1 NOPs of commercialisation staff in KTO F***

The IP, Licensing and the Spin-out managers have all participated in many formal events and training for commercialisation staff, such as PraxisUnico courses and AURIL conferences. However, only two have close personal connections with other KTOs –an IP Manager who has worked in KTO F since 2002, and the Spin-out Manager who had worked in university KTOs for eight years, but for only one year in KTO F. They exploit their networks differently. The Licensing Manager said that IP

managers and himself do not discuss the internal practices with managers in other KTO since there is no need (“No need... it is all driven by no need” – Licensing Manager).

The Spin-out Manager said he frequently contacts other KTOs:

I was asking about contractual matters and what the university did, what standard wording it decided on... I can't remember exactly what that was over but I was just trying to get a view. (...) Imperial – I got a call from them a few days ago that they have seen some development here which they thought might be an opportunity for collaboration so we are looking into that. So sometimes it is general questions, sometimes project matters, maybe a bit of advice flowing both ways. (...) Unless it is very sensitive, I have no problem with calling someone external to get the view on what they have done. (Spin-out Manager)

In summary, two members of the IP COP –an IP Manager and the Spin-out Manager – have personal contacts with other KTOs and act as knowledge brokers.

The Marketing Manager, who is not a member of IP COP, has developed some personal relations with managers in other KTOs. Before joining KTO F in 2010, he worked in two other KTOs and has maintained contacts with former colleagues. He reported getting help from his network in relation to branding, and the design of press releases and advertising materials. He is a member of the Chartered Institute for Marketing, where he joined the group of marketing professionals in Higher Education. This group, however, focuses mainly on marketing university taught courses to students and less on marketing of research. Similar to the Marketing Manager in KTO A, he feels there is a lack of formal events and associations for marketing staff in technology transfer activities. He complained “you have got Praxis and things like that but there isn't really a marketing group around the UK that is focused on Tech Transfer and that is something that could be developed” (Marketing Manager). This signals a gap in the market for formal training for marketing staff working in knowledge transfer.

BD managers do not have close relations with managers in other KTOs. All had been in the Higher Education sector for a short time (1-2 years) and had had few opportunities to develop inter-organisational networks. They saw competition among universities as a barrier to knowledge sharing across KTOs (“There are obviously confidential limitations – the fact that we are competing to some extent for funds and for students and for research grants.” – BD Manager 1). The BD managers said that they benefited from networking with managers from other KTOs at formal events. For example, one of the BD managers explained that it is difficult to get an overview of

knowledge in all academic departments and that he had discussed this with managers from other KTOs. Despite the potential benefits, BD managers tend to discuss their practice predominantly with internal colleagues.

The next section discusses what has been learnt in KTO F through interactions of staff involved in commercialisation with their NOPs and whether learning was spontaneous or instigated by management.

#### *6.2.2.2 Learning how systematically to assess the technical aspects of inventions and inventors' motivations*

The IP and Licensing managers who assess academic inventions realise that their assessments have not always been consistent: Licensing Manager explained: “We perceived that we were putting a lot of variability into the questions... our answers. It just deepened on how we felt on that day”. They started looking for ways to systematise their IP assessment and standardise the way in which decisions were made across different projects. After initial mutual engagement amongst themselves, they turned to members of their NOPs for advice. Through interactions with staff from other KTOs they learnt about a structured questionnaire - Commercial Opportunities Appraisal Process (COAP). The Licensing Manager explained that:

The questionnaire is based on Sheffield and Warwick. I think it is called COAP questionnaire, which has already been widely used by TTOs. We started developing our own and then we found out that the questionnaire already existed so we tailored it to our own needs, put some extra questions in, took some questions out.

The managers tailored the questionnaire according to what they considered best practice in their context. The questionnaire became a part of their repertoire of practice. It enabled the creation of a bubble diagram depicting (1) attractiveness of the opportunity and (2) whether the opportunity is suitable for a license or a spin-out. The managers tend to take up spin-outs opportunities with a high level of attractiveness and licensing opportunities with a medium-to-high attractiveness level. The questionnaire consists of multiple-choice questions asking about the technology, the market and the inventor's abilities and motivations. For example, there is a question about the value of the market and the answers are “up to £1 million, £1 to 10 million, £10-50million, £50 to 100million, greater than £100 million”. The responses of IP and Licensing managers to the market-related questions (e.g. market value or anticipated profits) are based on

desk-based market research. The Spin-out Manager noted a shortcoming of desk-based market research:

if you are making assumption on how many sales you may be making in the second year, it is absolutely meaningless unless you have actually spoken to people who have been in that position before and can tell you some of the obstacles that they had to face. (Spin-out Manager)

At the time of data collection for this thesis, the views of the new Spin-out Manager were not influencing IP assessment activities. Introduction of the questionnaire arguably has helped IP and Licensing managers to systematise assessment of the technology and the inventor's abilities and motivations, but so far there is no indication that the commercial viability of inventions is assessed in a rigorous manner.

In summary, this section has shown that learning in a NOP has led to incremental changes in *how* IP assessment activities are performed. The learning was initiated by members of a COP who agreed collectively that their previous ad-hoc approach lacked consistency. The assessment of academic invention has become more systematic. This empirical evidence supports my first theoretical proposition, suggesting that incremental changes in practice result from situated learning in NOPs initiated by COP members (e.g. Tagliaventi and Mattarelli, 2006).

#### *6.2.2.3 Learning to create and manage a brand*

In 2005 the university went through a major rebranding exercise. The university intended to replace the old logo with a new one, but after numerous student and staff protests both old and new logos are in use. The university and KTO senior management decided to create a new brand for entrepreneurial activities. The decision was taken to create a single brand for all entrepreneurial activities. This approach is quite different from the prevailing practice in Russell Group universities, where commercialisation activities tend to be marketed under the brand of the wholly-owned subsidiary companies (assuming that there is one) and non-profit generating entrepreneurial activities typically come under the university brand (e.g. contract and collaborative research). The Marketing Manager stressed: "in this university ... we see that business engagement is more than just the IP and licensing activities".

The Marketing Manager was put in charge of creating and managing a new "business brand". He explained that it is challenging to manage large brands, such as the university's "business brand", "because they are potentially made of many other brands, for example, if the colleges want to promote themselves separately" (Marketing



Manager). Brand management involves creating and managing a brand. The Marketing Manager worked on the design of the brand together with external design agencies and, in particular, the university Communications Department. (“I may go to the central communication team for advice on branding”). He had “kept in touch with a few people from the previous job who are in similar roles” and has contacted them informally for advice on brand management. That is, he engaged with the members of his NOP in order to understand better how branding works. The Marketing Manager cannot learn branding from his colleagues in the KTO since they have no experience in this area.

Once the brand was created, it was important to ensure that customers were aware of it. The Marketing Manager has worked on branding of newsletters, non-confidential marketing leaflets and posters to increase brand awareness among external audiences. He noted that previously “it wasn’t done in a consistently branded manner”. In pursuing these branding activities, he again sought advice from other KTOs and colleagues in the Communications Department. He also had to ensure that brand was consistent and remains distinctive “because otherwise the brand will be lost” (Marketing Manager).

In summary, this section has shown that learning from NOPs informed the development of brand management in KTO F. The learning was triggered by the directions set by the university and KTO top management and supported by resources allocated to developing the new activity. Since the brand was not actively managed previously, the addition of branding activity is an example of an radical change in what KTO F does to commercialise the university’s IP.

### ***6.2.3 Learning from other COPs in KTO F***

The purpose of this section is to explore whether other COPs are a source of knowledge for the commercialisation staff in KTO F and if so, what has been learnt in the KTO through interactions with other COPs and why this learning occurred.

#### ***6.2.3.1 Connections of commercialisation staff in KTO F to other COPs***

The IP managers, and to lesser extent the Licensing Manager, work together with external patent agents on patent applications and this gives them the opportunity to learn. The IP managers and the Licensing Manager learn from external consultants, who are sometimes brought in to advise on the commercialisation plan for a particular technology (e.g. about new structures for commercialisation deals). The Licensing Manager explained the kind of situations when they seek advice from external consultants: “the usual problem is that you have a lot of things you could potentially do

with the technology but you don't know quite what to do first, what is the best thing to do first, and to get that you need some very specialist knowledge". Thus, an external consultant is brought in when the IP and Licensing managers have a general understanding of a particular market, but want an expert opinion on the commercialisation plan. It is important that the IP managers and the Licensing Manager are able to contextualise the advice given by the consultants. What works for one commercialisation project may not work for another because the technology may be at a different stage of development, the industrial sector at which the technology is aimed may require compliance with specific regulations, the university may have a different attitude to commercialisation and/or there may be personal factors that make a particular solution unsuitable (e.g. willingness of academics to engage in commercialisation).

In cases where the IP and Licensing managers lack expertise in a particular market niche, the whole commercialisation process is outsourced. This type of outsourcing gives internal staff an opportunity to gain a better understanding of a particular market niche, which they can apply in the future "should the need ever arise" (Licensing Manager). While they work closely with the subcontractor, they learn who the big players are in a particular market, how the subcontractor contacts them, and how negotiations unfold.

The Spin-out Manager confirmed that he learns from the commercial team in spin-out companies. Being on the spin-out's board of directors during the company's merger was an important learning experience:

that is another great learning experience that I had because I have always seen it from one side of the table, so to speak, I did not see the mechanism and the things involved to make things happened. So having these very close relationships with companies is really good, and I think that is something that could be recycled back to the job and really improve things. (Spin-out Manager)

Working with the commercial managers of spin-outs provides the Spin-out Manager with a range of opportunities to understand better what is required for the spin-out to be successful, grow and/or exit.

The Marketing Manager reported learning from interactions with design agencies and engaging with colleagues in the university's Communications Department ("If I do a press release, then I will get advice from central communications" – Marketing Manager). Although colleagues in the Communications Department also undertake

marketing, their work is targeted at potential students and “their press releases are written in the style that the educated 17 year-old would understand.” (Marketing Manager). The KTO’s Marketing Manager can learn about style, use of logos and the role of branding, but these interactions do not improve understanding of commercial markets.

In summary, the members of the IP COP learn from patent agents, external consultants and commercial teams in spin-outs. The Marketing manager learns from external designers and internal colleagues in the Communications Department. Two interviewed BD managers claimed that they did not benefit from interactions with any specific group of external professionals.

As already discussed in 6.2.1.2, engagement with investors shaped the new approach to recruiting management for spin-outs developed by the Spin-out Manager. No other changes reported by the interviewees were related to learning across COPs.

#### **6.2.4 Summary of Case Study F**

As explained above, most activities in the commercialisation practice of KTO F were underpinned by the ‘science-push model of innovation’ at the end of 2010.

The analysis revealed that, in the period 2007/10, learning in KTO F took place through interaction within COPs, within NOPs and across COPs. KTO F learnt to assess the technology and inventors’ motivations in a systematic and rigorous manner. However, it continued to rely on desk-based market research, which arguably does not allow full understanding of the real commercial value of an invention. KTO F also learnt about branding commercialisation and other knowledge transfer activities which allowed it to standardise the visual appearance of marketing materials, focused on demonstrating technical strength and expertise. These changes in commercialisation practice were aimed at improving already existing IP-focused assessment and marketing activities. The arrival of the new Spin-out Manager was key to learning to recruit commercial management for spin-outs in a systematic and timely fashion – that is, to develop a systematic match-making approach to company formation activities in KTO F. In summary, the analysis revealed no radical changes in commercialisation practice and very few changes overall, which is consistent with the Licensing Manager’s comment that: “Our approach has been fairly consistent”. Table 6.2 summarises the findings from this case study.

Table 6.2 Summary of what KTO F has learnt, how and why

		How have KTO F learnt?		
		Learning in COPs	Learning in NOPs	Learning across COPs
Why has KTO F learnt?	Situated learning initiated by staff		<b>What?</b> assessing the technical aspects of inventions and the inventors' motivations (incremental change in 'the how'; see 6.2.2.2)	
	Situated learning instigated by management's strategic practices	<b>What?</b> recruiting commercial management for spin-outs (incremental change in 'the what'; see 6.2.1.2)	<b>What?</b> managing a business brand of the university (radical change in 'the what'; see 6.2.2.3)	<b>What?</b> recruiting commercial management for spin-outs (incremental change in 'the what'; see 6.2.1.2)

Source: Constructed by the author.

The observed changes in IP assessment activities show that *spontaneous learning in a NOP* results in *incremental changes in 'the how'*, supporting the first theoretical propositions. Moreover, the findings from this case study provide some new insights. Firstly, I find that that *radical changes in 'the what'* result from *learning in NOPs instigated and supported by management*. This is exemplified by the introduction of branding activity into commercialisation practice. Secondly, the observed changes in spin-out formation activity reveal that *incremental changes in 'the what'* come about through learning *in COPs* (as already shown in Case A) and *across COPs instigated and endorsed by management*.

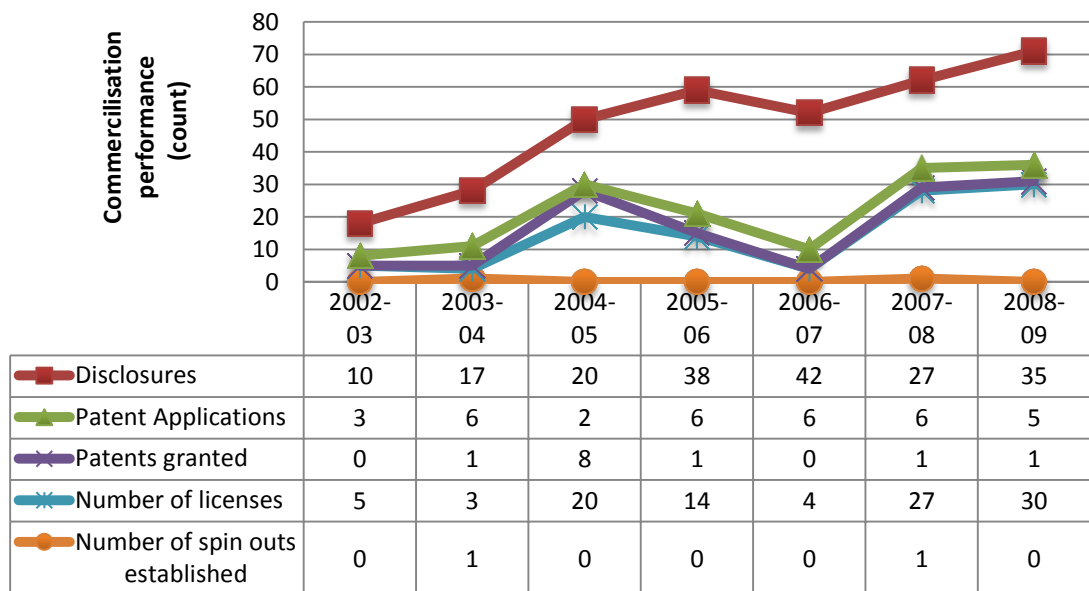
In summary, Chapter 6 presented case studies of two Russell Group university KTOs. The analysis showed that these KTOs have developed different approaches to commercialisation. I refer to these approaches as match-making commercialisation practice and IP-focused commercialisation practice, and have argued that each is associated with a different set of abilities. In Chapters 7 and 8 I show that the other four KTOs have developed one of these two approaches to commercialisation. In Chapter 7 I discuss two KTOs that developed match-making practice.

## 7 KTOs developing a match-making commercialisation practice

### 7.1 Case study B – background information

This case is about learning in a KTO in a research-intensive university. The university is a member of the 1994 Group and received a Royal Charter in the first quarter of the 20<sup>th</sup> century. The university was ranked in the top forty-five in the Times Higher Education's Table of Excellence (2008). Its commercialisation performance is depicted in Figure 7.1 which shows fairly steady performance growth in the period 2002/09. In 2009/10 commercialisation activities generated approximately £16.7 million. This included income of £124,000 from licensing and spin-out activities.

Figure 7.1 Commercialisation performance of University B.



Source: HEBCI surveys, 2006-2011

**Information on the KTO.** The KTO is an internal unit within the university structure and is responsible for enterprise activities and research support. The KTO provides support for research and enterprise activities in a wide range of disciplines, such as the physical and life sciences, medical research, social sciences, business, arts and the humanities. The first unit responsible for the exploitation of academic research was established in the late 1990s, about the time when the first wave of HEROBAC funding was set up. In the past the KTO was financially dependent on the HEIF. However, since January 2010 the KTO has been given the same “professional” status as Finance and Human Resources, and is now financed from the university’s central funds to which

HEIF contributes. At the time of the fieldwork (Dec 2010-Feb 2011) there were about 40 staff members (the number of staff had doubled in the previous five years) working in five teams of (1) Research Support Services, (2) Academic Legal Services, (3) the Knowledge Transfer Partnership Programme (KTP), (4) Strategic Programmes and (5) Science and Technology Incubator Centre. The commercialisation of academic research is currently carried out by three staff members in the Academic Legal Services – two IP managers and a Licensing Manager. They have different technical backgrounds (chemistry, biology, physics and electronic engineering) and some experience of working in industry. They work closely with their line manager – the head of Academic Legal Services, with the KTO Director and the university's Director of Innovation and Knowledge Exchange.<sup>28</sup>

***Information on commercialisation practice in KTO B.*** Following Orlikowski's (2002) approach, work activities (doing) are described below and inferences made from the observations about the 'knowing' required to perform these activities. As in the previous case studies, the 'doing' aspect of commercialisation practice comprises: (1) identification of commercialisation opportunities; (2) IP assessment activities; (3) marketing activities; (4) handling licensing agreements and other contracts; and (5) company formation activities.

***Identification of commercialisation opportunities*** is performed in a passive manner. The academics come to the KTO on the advice of colleagues, at the request of the head of school, or on their own initiative. The commercialisation staff should be passed information by the Research Support Team about research with the potential for commercialisable outputs, but such referrals are rare. The commercialisation staff do not proactively search for new commercialisation opportunities because they deal with a backlog of unexploited IP. The passive approach allows the KTO to identify commercialisable research outputs once they are produced, but it is not aware of on-going research with potential for commercialisable outputs.

***IP assessment activities*** are performed by the IP managers and the Licensing Manager. Their assessment of IP takes into account patentability of the technology, feedback from patent reviews done by a patent office, its commercial viability, and the researcher's motivation to develop the invention and his or her willingness to get

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<sup>28</sup> This post was created to support the Pro-Vice Chancellor for Research and Innovation in overseeing knowledge exchange activities in the university.

involved in commercialisation. Thus, they assess the legal aspects, the state of technical development and further development needs, and the commercial potential of academic inventions.

*Marketing activities* are performed predominantly by the Licensing Manager but also by the Consultancy manager. The IP manager explained briefly: “We do the non-confidential fliers which we use for sort of cold calling, and then we will have packs of more detailed information including specs but that’s under a Non-Disclosure Agreement” (IP Manager 1). So far the KTO has not marketed licensing opportunities on the university’s website. Identifying licensees is performed by the Licensing Manager using academic contacts and market research. The Licensing Manager “look[s] at selection” of companies and contacts a number of potential licensees to try to identify a long-term partner rather than a ‘buyer’ of a particular technology.

*Handling licensing agreements and other contracts* is performed by all commercialisation staff. Negotiations typically are done by the commercialisation managers and the IP managers prepare the contract. Licensing is seen “as a tool to improve links with companies and perhaps bring in research collaborations” (IP manager 1). In negotiating licensing contracts, the focus is on building a partnership with the licensee rather than maximising royalty rates by whatever means.

*Company formation activities* are performed by commercialisation staff. Licensing is preferred to spin-outs as an IP exploitation route in this university. Its academic inventions are rarely so-called ‘platform technologies’ suitable for a spin-out company. However, if formation of a spin-out is perceived as the most sensible exploitation route, then the commercialisation team provides support by writing a business plan, identifying funding opportunities and commercial management (e.g. a CEO), and making the necessary contractual arrangements.

Drawing together the insights into how commercialisation activities are performed, it seems that KTO B has the ability to (1) identify commercialisable research outputs, (2) assess the legal, technical and commercial aspects of inventions by combining information about the technology and the market, and managing two-way information flows between academia and industry, (3) identify partners for the academics, (4) build relationships and partnerships between the university and industry, and (5) secure human and financial resources for the exploitation of inventions in a spin-out company.

The KTO's ability to disseminate information about academic inventions to industry through marketing is somewhat limited.

In summary, KTO B takes a match-making approach to IP assessment, identifying licensees, and handling licensing agreements and other contracts related to IP exploitation and company formation activities. I argued earlier that match-making commercialisation practice is underpinned by the 'coupling model of innovation' (Rothwell, 1994). The next sections discuss how KTO B learnt its match-making commercialisation practice. In accordance with the theoretical framework, I explore what changes in practice resulted from learning in COPs, from interactions across COPs and from NOPs. I examine whether learning was triggered and shaped by commercialisation staff or by management's strategic practices.

### ***7.1.1 Learning in a COP in KTO B***

The purpose of this section is to explain what has been learnt through interactions within COPs in KTO B and why this learning occurred. First, I identify the COPs that emerged in KTO B, and discuss what was learned in these communities (changes in practice) and why (spontaneous or instigated by management).

#### ***7.1.1.1 COPs in KTO B***

On the basis of the information from the interviews with IP managers and the Licensing Manager, I identified a COP comprising two IP managers, the Licensing Manager and a lawyer. They share knowledge on an informal basis. They learn from each other and together, for example, about how to deal with academics, how to collaborate with other parts of the university, and what to do in a particular situation or if legislation changes. They discuss the strengths and weaknesses of internal processes and possible adjustments. When a problem is encountered by the commercialisation staff, they consult one another. As a group they display three characteristics of a COP.

First, they engage with one another daily in order to pursue commercialisation activities. The IP managers and the head of legal services were employed in this KTO in the five-year period under study (2005-2010). The Licensing Manager, who joined in 2009, has also integrated well, and all claimed to be aware of one another's strengths, weaknesses, professional expertise and personalities (e.g. "we made the effort to get to know people in a more social manner (...) because then you know whom to talk to and what type of character they have so how best to approach them" – Licensing Manager). They know where their expertise overlaps (e.g. ability to deal with academics) and



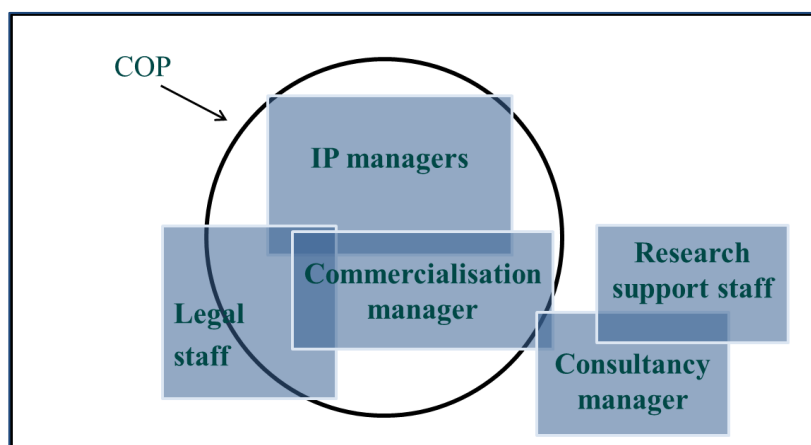
where it is complementary (e.g. technical backgrounds that complement one another in IP valuation). They know how to work with each other. Thus, there is evidence that these staff members learnt how to mutually engage to get the work done.

Second, they constantly negotiate their joint enterprise by discussing how things should be done, what is good enough, and what needs changing. One said that “we just work that closely together that things do tend to come up. We probably share views on things quite well. We occasionally have a battle” (Licensing Manager). Their responses to a question about ‘Dos’ and ‘Don’ts’ show they have some joint understanding of good practice and demonstrates socially negotiated understanding of what to do and how to perform commercialisation activities.

Third, they have developed a shared repertoire of practice. For example, they have disclosure, licensing agreement and shareholder agreement templates, the INTEUM database (more below), an IP code (a non-confidential agreement policy document), IP guidelines (a confidential document for academics), and a quantitative scoring system for IP valuation. They have a shared repertoire of stories, for example, about past deals and struggles to inspire unmotivated academics to consider commercialisation.

Thus, the three constitutive characteristics of a COP – mutual engagement, negotiation of a joint enterprise, and shared repertoire (Wenger 1998) – are all in place. The group is recognised as a COP. Figure 7.2 illustrates the overlapping practices of commercialisation staff (overlapping squares) and the community that emerged from the joint pursuit of commercialisation activities (the circle).

Figure 7.2 Community of practice in KTO B



Source: Constructed by the author.

The succeeding sections discuss what has been learnt through interactions within this COP and whether learning was spontaneous or instigated by management.

#### *7.1.1.2 Learning how to record information on IP development, IPR status and commercial development*

The commercialisation staff use the INTEUM database to keep a record of the technologies that they are trying to commercialise. This database is part of the community's repertoire of practice. The system is used to collect technical information on inventions, to track deadlines in the patenting process, and to record information about relations with external organisations (e.g. contact details of potential licensees). The commercialisation staff discuss "how to update that [INTEUM database], what information we need, what searches we can do" (IP Manager). Having joined KTO B in 2009, the Licensing Manager questioned the way that records were kept in INTEUM:

When I first joined it [INTEUM] was actually quite heavy on requiring information and I found it frustrating because we often put things in three times among ourselves. And if I have to put something in more than one time, I start being grumpy. One of the things we have done as things have relaxed is we said 'let's look again what do we use this piece of information for', and we've actually removed lots of information that we don't need that has been there historically but really we did not need it any longer, and we looked what information we do need to put in. So we have an agreement over what sort of information we do need to put in but we have a different opinion on what we would like to see in there but we agreed on what will be essential. (Licensing Manager)

This quote shows that members of this community engage in negotiations of what is important and what can be ignored and have developed a socially negotiated understanding of their joint enterprise. In particular, they agreed to be less strict about recording a large volume of information that had been recorded in the database for ANGLE – a venture management and consulting company that used to help KTO B to commercialise its IP through the provision of consultancy support and investment funding. ANGLE needed large amounts of up-to-date information about the commercialisation projects to fulfil its advisory role (e.g. "what stage a technology was at", whether it is "a licence or spin out", "whether it was active in commercial development" IP Manager 2). In mid 2007, the university terminated a 12 month

strategic partnership with ANGLE plc.<sup>29</sup> Interestingly, the record-keeping practice was not adjusted until 2010 on the initiative of the new Licensing Manager. This finding shows how COPs often continue a practice even when the initial rationale for it is no longer valid.

The Licensing Manager also identified more efficient ways of recording email communication with businesses in the database by using a “drag and drop function”. This technique was adopted by other members of the community. It helps to ensure that information from market research and marketing is recorded in the database.

In summary, as a result of spontaneous learning in a COP, the method of documenting commercialisation projects has been simplified and made more efficient. The interactions of a newcomer with incumbent members of this COP were crucial for the development of a new understanding. This is an example of an incremental change in ‘how’ information on IP development, IPR status and commercial development are recorded. The change is small but important. Given the small number of commercialisation staff and the large volume of work, each small improvement that saves time is important because it increases the efficiency of their work. This empirical example supports the first theoretical proposition which states that incremental changes in practice are brought about through learning in COPs on the initiative of staff. This incremental change in ‘the how’ occurred without any support of management.

#### *7.1.1.3 Learning how to assess the commercial potential of inventions in more rigorous way*

The management was concerned about the backlog of unexploited IP on KTO B’s books, which resulted from securing patent protection for inventions without having a clear commercialisation plan in place. This area of commercialisation practice was identified by management as problematic. The KTO director engaged with IP and Licensing managers to shape their understanding of commercialisation practice. He argued the following:

The other problem that we are having, that all universities have, in exploiting academic research, is the problem of publications. So the academic will do a piece of research and what they want to do is to publish it. So that leads the universities to file for IP protection early to protect publication. So that leads

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<sup>29</sup> The relationship was terminated because ANGLE’s business model was believed to be flawed since they “did not have enough money to fund both their expanding portfolio and support their collaborative relationships with the university” (KTO director). The KTO staff now manages the commercialisation projects and subcontracts work to a number of small organisations when necessary.

you into a whole vicious cycle – you file the patent, the patent is too early for commercial exploitation and you’re faced with a set of bills related to the patent. So universities approached that problem in different ways. Some universities have approached it like we were which is that you file a whole lot of patents and you see a mounting set of bills so you put more and more resources into the technology transfer. (...)What we are trying to do [now] is not file [a patent application]. What we are trying to do is we would try to work at much earlier stage with the academic to understand what their research is about (...) by understanding research and understanding what motivates academics we can start working at much earlier stage to identify collaborative research relationships. So that you have got invested interest from external partners in the research, so that they are looking at it and hopefully will come along and say “that looks very interesting, we would like to fund that, and by the way we will take the responsibility to file a patent”. (KTO Director)

The above quote indicates that the KTO director wanted the commercialisation staff to engage early into identifying commercial viability of invention and potential partners. The KTO Director also destabilised existing commercialisation practice by cutting the patenting budget and removing a formal procedure for assessment of IP, which was bureaucratic and cumbersome. This change to resources and controlling structures triggered learning and the direction set by the KTO director shaped learning in the COP comprising commercialisation staff. The IP manager explained:

We are less likely to patent, full stop, because we have less resources and less capacity so it [IP] has to be *stronger* (emphasis added) to get through, to overcome the hurdle. If we do put in the preliminary filing, we are more likely to withdraw than we used to. We would never have done that in the past; we would always go to PCT and then patent.(IP Manager 1, emphasis added)

Similarly, the Licensing Manager noted that they have become “more ruthless” (Licensing Manager), and (according to the IP Manager 2) “stricter” in their IP valuations. The IP manager explaining what being “stricter” meant said:

it is the commercial assessment, which we were not so interested in before. If it was interesting and we thought that there would be a commercial route for it, we would go for it.(IP Manager 2)

The commercialisation staff now have a better appreciation of the commercial value of IP. Over time commercial viability has become the most important factor in deciding whether to commercialise a particular invention or not. There have been adjustments to the methods used by the commercialisation staff for IP valuation. They perform more

market research and adjusted the formal scoring system to reflect changes in the understanding of which inventions “would be pass or fail”<sup>30</sup>. This shows that members of this COP have adjusted their repertoire of practice (here the scoring system) to embed their new understanding in practice.

In summary, the way in which the commercialisation staff assess academic inventions has changed as a result of learning in a COP that was triggered by changes in resource allocations. The old way of approaching IP assessment (focused predominantly on assessing patentability) is typical for an IP-focused commercialisation practice underpinned by a ‘science push model of innovation’. The new approach ensures that the information on the technology and the market is combined in the assessment of IP. This approach is typical of a match-making commercialisation practice based on the ‘coupling model of innovation’. The object of the IP assessing activity has changed – from aiming at assessing patentability to assessing commercial viability. This is an example of a radical change in ‘the how’. This empirical evidence suggests that the radical change in ‘the how’ is brought about through learning in COPs instigated by the direction set by the management and changes in resource allocation and controlling practices. The learning trajectory was also shaped by management who engaged with COP members in negotiations of meaning.

#### *7.1.1.4 Learning how to identify a partner-licensee*

Since his arrival in 2005, the KTO director has been propagating the view that “universities are about creating knowledge and companies are about exploiting knowledge”. This view emphasises that collaboration between academics and industry is the most appropriate approach to the exploitation/commercialisation of academic research. The KTO director explained:

the best way of approaching that [i.e. commercialisation] is you bring in a commercial mind-set and the commercial attitude that can see the intellectual outputs and can apply them [sic] to commercial problems. So we are trying to work much more with downstream partners who see beneficial outcomes from the research that we’ve done and are interested. So a win-win for us would be, for us to do some research and develop something that may be exploitable, and then to look for a relationship with a partner that would look to exploit that, and the partner will fund some R&D activities in the university to move it forward, and then we licence technology to that partner.(Director)

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<sup>30</sup> No details are available; the scoring tool for IP valuation is a confidential document.

‘Building relations’ and ‘developing partnerships’ are core principles in the Director’s view. By promoting this approach, management wanted to avoid “dealing with the [research] outputs” (Director) and thus to solve (1) the problem of the mounting bills for early patenting, (2) the problem of low commercial appeal of the patented embryonic technologies, (3) the funding gap for development work on patented inventions, and (4) the problem of insufficient expertise in the university to apply the intellectual outputs to business-related interests. The commercialisation staff referred to the director’s approach as ‘a new vision’, which sets new directions for the commercialisation practice. In accordance with the theoretical framework, the direction-setting activities of the management are expected to trigger and shape situated learning in the workplace.

In this case, management’s new vision encouraged the commercialisation staff to see a ‘licence deal’ as part of a complex and close relationship with a commercial partner (“use licensing as a tool to improve links with companies and perhaps bring in research collaborations” – IP Manager). Previously they had thought of ‘licence deal’ as a one-off sales transaction where commercialisation staff searched for a company to complete the transaction with, that is, they looked for a ‘buyer’. Under that old mind-set, licensing a technology to anyone happy to pay was acceptable, as long as the ‘client’ was to use the technology for a legitimate purpose. However, the new vision of the KTO director and the university senior management questions the old approach. The following quote illustrates the community’s new understanding of how to identify a licensee:

We always *used to go with the academics* (emphasis added). So (...) the academic said ‘oh, I think we can get good licence deal with this company’, and then we would only talk to that company. But actually you need to *have a little bigger picture than that* (emphasis added). Say ‘so you want a licence deal with that company, why do you want that? What it is you are trying to explore? .... There is also this company – is there any reason you would not want to talk to this company?’ and to *look at selection* (emphasis added) ... because if you talk just to one they will play a game with you. [...] This isn’t about a licence and selling it at any cost. This is about having a great idea and getting some benefit for the world and for the university out of it. So you shouldn’t just sell it for whatever you can sell it for. *You should find a real partnership* (emphasis added). There should be a real partnership with the licensee, not just ‘whoever catch’, which is how it always used to be. (Licensing Manager, all emphases added).

The new way of identifying a licensee includes performing market research to identify a range of potential licensees (other than those suggested by an academic) and contacting a number of potential licensees at the same time. The new approach aims at identifying ‘a partner’ for the commercialisation of academic inventions, whereas the old approach aimed at identifying ‘a buyer’. This represents a shift from an approach typical of an IP-focused commercialisation practice underpinned by a ‘science push model of innovation’ to an approach typical of match-making commercialisation practice underpinned by a ‘coupling model of innovation’. This is a radical change in ‘*how*’ licensees are identified as the object of the activity changed (from identifying ‘a buyer’ to identifying ‘a partner’). As in case of the radical change how IP is assessed, this radical change in ‘the how’ was brought about through learning in COPs instigated and shaped by the management’s direction-setting practice.

#### *7.1.1.5 Learning how to negotiate ‘win-win’ licensing deals*

The director’s new vision has also triggered learning in how to negotiate licence agreements. Since the new meaning of a ‘licence deal’ (as part of a wider collaborative relationship) was imposed on the commercialisation staff, they had to revise their way of negotiating with potential licensees. The members of this COP discuss “best situation, satisfactory situation, and walk-away situation” (IP Manager 2) before the Licensing Manager proceeds with the negotiations with the potential licensees. In the past, the main aim of licence negotiations was to secure the highest possible payments (e.g. up-front payment, royalty payments on sales, or mile-stone payments). However, this aim was often not compatible with ‘building partnerships’. The IP manager explains the new understanding:

you have to remember that the best deal for the university is a deal which will get done. (...) What you think it is worth is not necessary what it is worth. (...) You have to know when to walk away<sup>31</sup>... but you also have to know that... it is like selling a house... your house is worth the price you get for it, not what the estate agent tells you it is worth. And I think so many technology deals are like that. (...) This is something which came from [the director’s] new vision – it is better to get nothing for the licence in exchange for future collaborative work with that company.(IP Manager 2)

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<sup>31</sup> The words “you have to know when to walk away” reinforces the point made in the previous section that the commercialisation staff have learned to approach more than one company and to “walk away” when necessary.

The quote shows that the old profit-oriented approach to licensing gave way to a new partnership-oriented approach. They now try to find a win-win deal which satisfies the commercial partner (the metaphorical ‘buyer of the house’) and also is good for the university (the metaphorical ‘seller of the house’). As a result of learning, the commercialisation team has become more flexible and open-minded in licensing negotiations. Here I observed a shift from the approach typical of an IP-focused commercialisation practice to an approach typical of match-making commercialisation practice. The aim of maximising profits has been replaced by the aim of being good at developing collaborative relations with companies (change in the object of the activity). This is thus an example of a radical change in ‘how’ licence contracts are negotiated. As in case of changes to IP assessing and marking, this radical change in ‘the how’ was brought about through learning in COPs instigated and shaped by the management’s direction-setting practice.

#### *7.1.1.6 Failure in learning to identify research with potential for commercialisable outputs*

The cuts in the budget for the commercialisation of academic research after 2008 were particular severe. They involved redundancies and internal redeployment of staff which effectively reduced the number of commercialisation staff from six to three. This entailed the loss of all BD managers. One of the interviewees who used to work as a BD manager explained what they were doing:

We had a model of proactive engagement with businesses. So we would represent university, we would go out and proactively promote it, network. We would engage with particular companies that we had thought should be working with the university, should know about the profile of the university and our capabilities. And on the case-by-case basis we would support (...) high level academics who had a track record of delivering and working with companies. So we would help them to engage with companies, the former part of that remit being the greater part of the remit. (...) It was very much driven externally. (Former BD Manager)

In brief, BD managers used to (1) contact companies in order to understand their needs, (2) identify academics with knowledge and skills that would allow them to address the company’s needs, and (3) try to sell comprehensive services to the company. The ‘services’, which often involved academics from several departments, could include contract research, collaborative research, consultancy, CPD courses, student placements and on occasions licensing of the university’s inventions. The



activities of BD managers were often ineffective as on many occasions they “could not actually make that collaboration stick with the academics” (Director). As the need for savings in the KTO’s budget arose, the business development activities were essentially discontinued.

Management wanted to take a new approach to identifying commercialisable knowledge by “driving it out of the academic perspective” (Former BD Manager). This meant that the KTO staff would first identify academics interested in working with industry, and the academics could get help with developing the skills needed for working with industry and support with establishing the right contacts. The research support staff were given “responsibilities of helping academics think about businesses that want to participate in research and how you leverage that into money” (Director). The research support staff are also supposed to inform commercialisation staff about research with potential for commercialisable IP. This allows for the identification of commercialisable IP at an early stage in the research project and allows for timely assessment of the technical and commercial viability of research outputs and identification of commercial partners. This shows that the management wanted to instigate on-the-job (situated) learning of research support staff. One of the former BD managers was redeployed to the research support team to help with this agenda. She reported:

I do a lot of mentoring and teaching in this role [for academics] that I wasn’t involved in before. So teaching how to make contact, find the right companies to talk to, networking skills. (Former BD Manager)

However, she noted also that other research support staff are less involved in the identification of commercialisable IP and mentoring:

they have still got the remit that they had two years ago plus enterprise. So they have been charming and very welcoming but haven’t actually engaged in it because they are so busy doing the traditional research support role anyway (Former BD Manager).

The research support staff have apparently not yet learned to undertake the identification of research with potential for commercialisable IP. The commercialisation staff are hardly ever informed by the research support staff about commercialisation opportunities. The IP managers and the Licensing Manager also do not have time to look proactively for commercialisation opportunities. One of them noted: “we will need to increase our headcount (...) because for the sake of employing one person we will get

a lot more information and we can begin proactively seeking opportunities” (Licensing Manager).

This example shows that the management’s direction setting (i.e. the new approach to business development) and controlling activities (i.e. the change in job design of research support staff) have not been effective in triggering learning by the research support staff. The practice of the research support staff involves identification of funding opportunities announced by the Research Councils and other public institutions, costing of projects, and administration of project proposals. The identification of research with potential for commercialisable IP, and mentoring business-engagement skills seem to be ‘foreign’ to their work practice and thus has not been readily learnt by research support staff. This example allows a better understanding of when the strategic practice of the management is effective at bringing about radical changes to practice by triggering and shaping situated learning.

### ***7.1.2 Learning from other COPs***

The purpose of this section is to explain what has been learnt in the KTO through interactions of the commercialisation staff with other COPs and why this learning occurred. First, I explore what other COPs are a potential source of knowledge for commercialisation staff.

#### ***7.1.2.1 Connections of commercialisation staff in KTO B to other COPs***

All the commercialisation staff stated that they learn through interacting with commercial lawyers and patent agents to whom they subcontract some work. The IP manager explained that “working with patent agents, you learn what they are asking for, what they are looking for, and then next time you can give them more of that; you can get them quickly to the question you specifically need to answer”. In other words, the IP managers learn from patent agents to assess the patentability of inventions. At the same time, the Licensing Manager takes an even more overt approach to learning from legal experts:

As I said, I am a sponge. I tend to absorb information. If they say ‘we prepared this and this and it looks like this’, I will say ‘why?’ not because I necessarily need them to explain but because I like to understand why because I learn when I know why. So I learnt all sorts of bits of contract law and stuff to do with the spin-outs, vast quantities of what I know about the precise details of doing spin-outs I learnt through these type of contacts. I am learning all sort of things about the tax at the moment ... we have to have

some Intellectual Property valued and that interaction was fascinating – why have you done it that way, why have you not done that way? What was the reasoning behind your choice? That was really fascinating and it is all stored away [points at the head] for future use. (Licensing Manager)

This shows that the commercialisation staff treat the outsourcing situations as learning opportunities. It is most likely that stories from external consultants and lawyers are shared among the commercialisation staff; they admitted that they tend to “throw everything around the office” (Licensing Manager).

The Licensing Manager has developed close contacts with some business management consultants who are themselves serial entrepreneurs. The Licensing Manager does not reveal confidential details of projects she needs help with. She couches her questions in abstract terms, such as: “have you ever come across this sort of situation, and how have you handled it?” or “how does your IP code work in relation to copyright on a book?”, or “what would you do in a situation...?” or “have you got anybody who could give me any help?” (Licensing Manager). These informal interactions between commercialisation staff and members of other COPs seem to be a valuable source of knowledge for this KTO. The next section shows the change in practice that developed through interactions with other COPs.

#### *7.1.2.2 Learning how to identify funding for follow-on development of academic inventions*

Identification of funds for the follow-on development of commercialisation projects is an important part of commercialisation practice. The commercialisation staff help academics to estimate development needs and identify funding opportunities for proof-of-concept work. There used to be an internal pot of money dedicated to funding proof-of-concept work, but now external funding sources have to be found each time. In recent years the commercialisation staff have had to develop a better ability to identify external sources of funding for commercialisation projects. They realised that it was difficult to build an overview of all the available sources of funding for some projects. So they employed an external consultant, with whom they already had a relationship, to do a systematic review of the funding opportunities for some of the commercialisation projects undertaken by the KTO. While working with the consultants, they realised that these consultants could develop an online database of funding opportunities and keep it up-dated. As a result, the consultants created a company which runs an online portal covering a wide range of funding opportunities from public and private sector sources.

The Licensing Manager was content that: “They made it available to all the universities – so that’s great. (...) It was very good because we initiated it and now it is benefiting everybody”. The online portal has become a tool used by the KTO for identification of funding. Since 2009 the commercialisation staff have used the online portal regularly to identify funding for follow-on development of commercialisation projects. This portal has become a tool in their repertoire of practice.

In summary, learning through interactions across COPs led to changes in how funding opportunities are searched for. This is an example of incremental change in ‘the how’ initiated by spontaneous learning across COPs. It is worth noting that learning across COPs was possible thanks to resources allocated by management for hiring the consultants.

### ***7.1.3 Limited learning in NOPs in KTO B***

All interviewees in KTO B said they interact with KT professionals from other KTOs during formal events. Each has attended a few events organised by PraxisUnico and the Licensing Executive Society. They also follow the mailing lists of AURIL and the relevant discussion groups on LinkedIn. They attend European Patent Office’s events, training in using the INTEUM database and other relevant events. The interviewees asserted that these training and networking events are useful for sharing good practice for the commercialisation process and for understanding the policy environment regarding, for instance, budget cuts or government policy to foster commercialisation of academic research. They use their coffee breaks to discuss: “who has a problem with this?”, “how have you dealt with a...?”, “what do you do about government cuts?” or “how are you restructuring?” (IP Manager 2). Arguably these general discussions can advance know-what, but are less likely to advance the know-how of the commercialisation staff. I was told that following attendance at events newly developed contacts were rarely maintained.

The commercialisation staff in KTO B have not developed many close contacts with knowledge transfer professionals in other universities. Even colleagues from university KTOs in the same region are treated with an element of distrust. Although one of the commercialisation staff worked previously in a very vibrant university KTO, she has loosened the bonds with her former colleagues over time (because of lack of time and absence on maternity leave). All commercialisation staff at this KTO, however, are in

touch with the BD managers who left this KTO because of the restructuring, and sometimes call them up to get help or to tap into their networks of contacts.

Overall, the commercialisation staff at University B are not strongly embedded in wider NOPs. They have little time for networking (two of them are part-time) but more importantly they seem to have developed a particular view that is a barrier to developing close contact with individuals in other KTOs. The following excerpts from the interviews are illustrative:

we are all being at competition, we are competing for limited funds, so when there are funding opportunities that require working together, we can do so very well, but you always wonder what politically that university has got up their sleeve and if they are attempting to do something for them more than really something for everyone, and how does it benefit our university, or is it better being in or being out. (IP Officer)

and

If you are sharing what you are doing, you are worrying that you are giving away valuable information. So there is sort of professional caution in talking about your project. Whereas occasionally it would be great if you could sit down and have a long conversation with people about your particular project in a sort of confidential arena. (...) So it is just the fear of letting the cat out of the bag and spoiling your chances... because we don't trust one another, of course. (Licensing Manager)

Understanding other KT professionals as competitors who are perceived as less trustworthy certainly stops the commercialisation staff from developing close relations which could become a source of advice and which could help to improve their practices. Despite engagement in joint projects with other KTOs, commercialisation staff have not developed trusting relations with KT professionals from other KTOs. Lack of trust has been identified in the literature as a factor inhibiting knowledge sharing. It is thus unsurprising that none of the changes in practice, identified by staff in KTO B, resulted from learning in NOPs.

#### **7.1.4 Summary of Case Study B**

At the end of 2010 the IP assessment, marketing, licensing and company formation activities in KTO B had characteristics typical of a match-making commercialisation practice. I argue that such an approach to commercialisation activities is underpinned by a 'coupling model of innovation'.

The analysis revealed that the match-making commercialisation practice was developed through learning in a COP that was triggered and directed by the KTO's management. Previously, commercialisation staff performed IP assessment, identification of licensees and contract negotiations in a way typical of an IP-focused commercialisation practice underpinned by a 'science push model of innovation'. It should be noted that the KTO director who set the new direction had extensive experience of commercialising technologies in commercial businesses and thus was able to bring a new perspective on commercialisation practice.

Besides these radical changes, learning in a COP and across COPs also brought incremental changes in commercialisation practice in KTO B (in record keeping and funding sourcing, respectively). Learning from NOPs was limited, however, due to distrust driven by the competitive mind-set. The analysis showed that no significant change in work practices resulted from learning in NOPs. Table 7.1 summarises the findings from this case study.

Table 7.1 Summary of what KTO B has learnt, how and why

		How has KTO B learnt?	
		Learning in COPs	Learning across COPs
Why has KTO B learnt?	Situated learning initiated by staff	<b>What?</b> recording information on IP development, IPR status and commercial development (incremental change in 'the how', see 7.1.1.2)	<b>What?</b> identify funding for follow-on development of academic inventions (incremental change in 'the how', see 7.1.2.2)
	Situated learning instigated by management's strategic practices	<b>What?</b> identifying a partner-licensee (radical change in 'the how', see 7.1.1.3) negotiating win-win licensing deals (radical change in 'the how', see 7.1.1.5) assessing commercial potential of inventions in a more rigorous way (radical change in 'the how', see 7.1.1.3)	<b>What?</b> none

Source: Constructed by the author

The findings support the first theoretical propositions according to which *spontaneous learning in a COP* tends to result in *incremental changes*. In this case this is a change in 'the how' that occurred without management's support. The case study also corroborates new insights from case studies A and F; namely, that *spontaneous*

*learning across COPs* can result in *incremental changes in 'the how'*. However, the management allocated resources helped to make it happen.

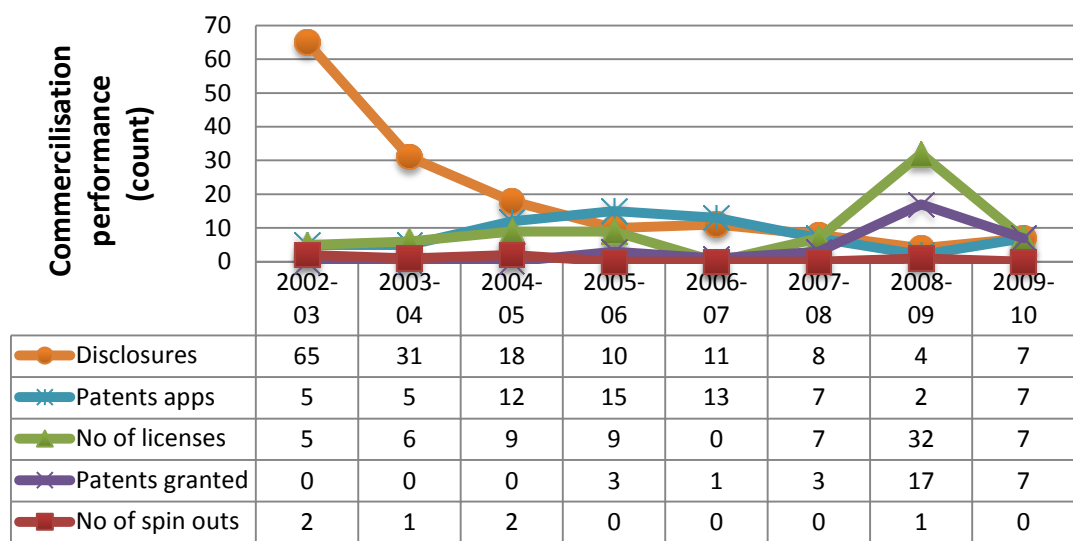
Furthermore, this case study provides new insights into how radical changes in work practices come about. Three empirical examples show that the need for a *radical change in 'the how'* is *identified by management*, who next *destabilise* the existing practice (by changing resources and controlling structures) and *shape* the situated *learning in the COP* (by direct engagement with COP members).

Finally, the example of unsuccessful management attempts to transform the practice of research support staff reveals that there are limits to management's power over its staff's situated learning. If staff are encouraged to learn to perform new activities that are very different to their current work practice, they may not respond to this encouragement in the way envisaged by management. This finding helps to clarify the conditions under which COPs are resistant to management ideas and the conditions under which they respond to the management's directions.

## 7.2 Case Study C – background information

This case study is about learning in a KTO belonging to a research-intensive university. The university is a member of the 1994 Group and was ranked in the top 30 in Times Higher Education's Table of Excellence (2008). Figure 7.3 illustrates the volume of commercialisation outputs at this university in 2002/10. It can be seen that the number of patent applications increased at a faster rate in between 2002 and 2007 than the number of licenses and spin-outs. After 2006-07 the trend reversed. This change in commercialisation outcomes seems to correspond to changes in the KTO, discussed below. In 2009/10 knowledge transfer activities supported by the KTO generated approximately £12m. This included income of £11,000 from licensing and spin-out activities.

Figure 7.3 Commercialisation performance of University C.



Source: HEBCI surveys, 2006-2011

**Information on the KTO.** The first KTO was set up in 2002 as a wholly-owned subsidiary of the university. The company engaged in IPR management, licensing and company formation, but support for other modes of knowledge transfer was not offered. The KTO “wasn’t properly integrated with the university” (KTO Director). There was also a Regional Office that worked predominantly on knowledge transfer to the local national health service and the city council. In 2008 support for research, knowledge transfer and commercialisation was restructured. A new research and enterprise office



was established consisting of five teams: (1) Research Development supporting applications for public research funding (advice on sources of funding and application process, help with costing and pricing, signing applications, negotiating terms and conditions of contracts, reviewing and accepting contracts; (2) Research Finance, in charge of accounting for the income and expenditure related to research activities; (3) Business and Enterprise (13 staff) provides similar support to the Research Development team, but for applications involving a commercial partner (e.g. it supports TSB applications, European Regional Development Fund (ERDF) projects, consultancy and KTP projects) and organises events raising awareness of entrepreneurial activities for staff and students, and events stimulating engagement with companies, charities and third sector non-governmental organisations, and is responsible for marketing and communication of the university's research and enterprise activities in conjunction with the university's Communications Department; (4) Contracts and IP (3 staff), responsible for provision of legal support to the other teams and to academics in preparation of contracts. The IP Manager, who is part of this team, is responsible for processing invention disclosures, managing IP protection, negotiations of licence agreements and contracts related to spin-outs; (5) Doctoral School, a unit supporting the engagement of doctoral and postdoctoral researchers from various disciplines. The KTO works closely with the Incubator, which has been a wholly-owned subsidiary company of the university since 2008. The KTO buys incubator services worth two people's time, in order to obtain help with the commercialisation of academic research.

***Information on the commercialisation practice.*** Below I describe the 'doing' aspect of the commercialisation practice comprising: (1) identification of commercialisation opportunities; (2) IP assessment activities; (3) marketing activities; (4) handling licensing agreements and other IP contracts; and (5) company formation activities.

***Identifying commercialisation opportunities*** is undertaken by the IP Manager. He organises talks and seminars "to improve IP awareness at the university", and informs academics about the support available for research commercialisation. So far, the seminars have proved effective at generating disclosures: "I've had three academics contact me as a result of a talk that I gave at the engineering and design away-day". Since 2008, the departmental research support staff have been charged with supporting enterprise activities in addition to their research support responsibility. They are meant to inform the IP Manager about research with potential for commercialisable outputs. At

the time of the data collection for this thesis, this arrangement was not functioning. It seems that KTO C experienced the same problem as KTO B. The task of identifying research with potential for commercialisable IP seems to be ‘foreign’ to the work practice of research support staff and thus has not been readily learnt by them. To sum up, the KTO’s approach allows the identification of commercialisable research outputs once they are produced, but the KTO is unlikely to be aware of on-going research with the potential for commercialisable outputs.

***IP assessment activities*** are organised around a formal process. The assessment of IP protection needs is performed by the IP Manager in liaison with external patent attorneys. The assessment of commercial viability is undertaken by Innovation Managers from the Incubator. The decisions on whether to proceed with commercialisation of an invention are taken by the Enterprise Panel comprising the PVC Research (Chair), the KTO Director, the Financial Director, the Head of Business and Enterprise, the CEO of the university Incubator, and two independent members of the university’s Council with extensive business experience. The Enterprise Panel meets monthly. Basic market research is undertaken before a patent application is filed. This includes assessing "what is the problem that the idea solves, understanding who else is in that market place, who is the competition, what that market place's dynamic is (...) what is the size of the market place, what are the key triggers within that market place, are we talking about the market that is saturated, or are we talking about early adopters, or innovators or anyone else?" (Innovation Manager). Besides market potential and patentability, the Enterprise Panel also assesses the motivations of academics and the resources necessary for moving forward (e.g. proof-of-concept funding or buy-out from teaching duties). Funds can be allocated to support projects. Should the Enterprise Panel decide to progress with commercialisation, further market research is conducted by innovation managers and the academics. They try to understand the “true value” of the technology. As noted by the Innovation Manager:

the only way you can do that is by engaging with that market place, getting feedback from that market place, getting relationships, partners, and feedback from the cold calling on what's going on out there, what really matters, what are your competitors doing. (...) You could do some of that through the databases but as I am sure you know, market research is sponsored by people who want to see a particular outcome. It is rarely that you can say ‘I got the information I need to make the business case’. It [desk-based market research] can help you to make some assumption but that is probably it.

Their approach involves extensive engagement with potential customers (of a potential spin-out) or potential licensees, as well as other actors operating in the market in which a technology will be commercialised. The process allows for ‘coupling’ of technical and market information while ensuring that academics are motivated and commercialisation projects are resourced appropriately.

**Marketing activities** are performed predominantly by the Innovation managers and academics. The Innovation managers help to prepare marketing materials which are “very much customer-focused” as they “try to get away from the technical language and make sure that a 10-year old is able to understand what it is” (Innovation Manager). There are a number of marketing activities including (1) online marketing on the university’s website, (2) marketing at conferences, road shows and other events, (3) regular newsletters about the progress of a particular commercialisation project to individuals who expressed some interest in the project (e.g. people met by academics during talks and seminars), and (4) press releases and other public relations activities prepared by the Innovation Manager in collaboration with the Communications Department of the university.

Identifying licensees is a joint effort of the Innovation Manager and the academics. A large number of companies that could be potential licensees are identified; then the relevant individuals within the companies are identified and contacted (“we are going to contact these 20 people” and “we drove lots of potential licence deals, and then we came out with one major licence deal” – Innovation Manager). They contact companies suggested by the academics as well as those identified by market research. BD managers are approached to make recommendations as to potential licensees since there may be “something we can learn from their sort of networks” (IP Manager). The licensees are perceived as partners, not ‘buyers’ (“we’re trying to identify partners as early as possible” – IP Manager).

**Handling of licensing agreements and other contracts** is performed by the IP, Contract and Innovation managers. Typically the Innovation managers are involved in negotiation of commercial terms, while the IP Manager takes care of IP issues. The IP and Contract managers also take care of other legal aspects. One of them noted that for licence negotiations “you need to be legally-minded, and there also needs to be commercial input to it as well; so it’s getting those together” (Contract Manager). They are “looking for a partner to commercialise an idea” (IP Manager). To achieve this aim, they negotiate “with several companies” (IP Manager) at the same time, trying to find a

deal that is satisfying for both parties. They focus on “things that are truly important” as they are aware that one could “argue about everything” (KTO Director). The comment made by the Innovation Manager illustrates well that licensing is seen as the beginning of a partnership: “We are not just happy to get the deal, but this is where the hard work really starts: How do you work together as two organisations to bring maximum value?”

*Company formation activities* are not yet well defined. At the time of the interviews, the KTO was setting up its first spin-out since the new commercialisation team was put in place. Innovation managers help with developing a business plan and with identifying potential clients for the services/products of the spin-out, whereas the IP Manager helps with securing funds for the further development of inventions (from public or private sector). So far, the KTO director has handled the legal aspects of forming a company with the help of external lawyers. The Contract Manager noted:

we haven’t really had an approach to spin-offs because we’re only in the process of doing our first one now. The first one since I joined; the first one since [KTO director] joined, okay? (...) There are some that happened before, but I’ve no idea what sort of way they decided to do that. (Contract Manager)

They appear to take care of a spin-out’s as well as the university’s interests. They want to ensure that the company can grow and achieve exit and that the university receives a research income if possible. They let the company own the IP so that it is a tradable asset, but they ensure that the university has the rights to get the IP back in case the IP has not been developed.

Drawing together the activities described, it becomes apparent that KTO C has the ability to (1) identify commercialisable research outputs, (2) perform a systematic assessment of the legal, technical and commercial aspects of inventions by combining information about the technology and the market, and by managing two-way information flows between academia and industry, (3) disseminate information about academic inventions into industry through marketing, (4) identify partners for the academics, and (5) build relationships and partnerships between the university and industry, but the ability to secure human and financial resources for the exploitation of an invention in a spin-out company is still somewhat limited.

In summary, the KTO’s approach to IP assessment was focused on coupling information about the technology and the market while the approach to identifying

licensees and handling contracts focuses on building partnerships. This suggests that KTO C has predominantly a match-making commercialisation practice underpinned by the ‘coupling model of innovation’ (Rothwell, 1994). As in KTO B, the passive approach to the identification of commercialisation opportunities is somewhat misaligned with the other activities constituting match-making commercialisation practice. The next sections explain how KTO C learnt its match-making commercialisation practice.

### ***7.2.1 Learning in COPs in KTO C***

This section presents COPs in KTO C and explains what has been learned through interactions within the COPs and whether learning has occurred spontaneously or was initiated by management’s strategic practices.

#### ***7.2.1.1 COPs in KTO C***

The evidence from interviews suggests that there are two established and one emerging COP in KTO C.

***COP comprising Innovation Managers.*** This community comprises Innovation managers working in the Business Incubator. The Incubator was established in 1996 jointly by University C and the City and County Councils. In 2008 it became a wholly-owned subsidiary of University C. The ‘joint enterprise’ of this COP is the provision of support for start-ups that are based in the Incubator. These start-ups typically are not formed on the basis of IP generated in academic research, but rather on the ideas of entrepreneurs who may or may not be related to the university. The practice of this COP encompasses activities related to new product or service development, such as market research, developing the customer base through marketing or managing relations with customers and suppliers. This community was not investigated in detail as start-ups are rarely a direct vehicle for the commercialisation of academic research.<sup>32</sup> Nonetheless, the interview with an Innovation manager indicated that they learn from one another while doing their everyday work. They have developed a shared repertoire of practice for supporting start-ups. The elements of the repertoire include, for example, “customer

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<sup>32</sup> Research outputs can be commercialised via a start-up if the university decides not to pursue the commercialisation of IP and assigns the rights to IP exploitation to academic(s) who then set up a start-up to exploit it.

discovery” routines, “customer validation” routines, and a database of commercial contacts.

***COP comprising IP and legal staff.*** This community comprises three contract managers and the IP Manager. They engage with one another in the pursuit of contract vetting (their ‘joint enterprise’) and this includes research contracts as well as contracts related to knowledge transfer and commercialisation. The IP Manager illustrated how everyday discussions (negotiations of the joint enterprise) with Contract managers provide opportunities for developing their understanding of what to do and how to do it:

For example, if you’re (...) dealing with a Non-Disclosure Agreement, for example (...). You’re negotiating with someone and they’ve amended the clause in some way. And you’re thinking, “Well is that acceptable or should I modify that in some way?” So you have a conversation with a colleague and you just talk about the issue and they may sort of describe something, you know, a similar issue that they had and how they dealt with it. So that’s something you’re going to take on board immediately and may adopt the same approach. (IP Manager)

Similarly, the Contract Manager noted: “it’s often the case that actually the three of us might sit down to resolve issues. So of course we’re learning from each other when we do that”. The quotes illustrate well the learning through interactions that takes place during negotiations of joint work activities. The shared repertoire of practice of this community includes, for example, standard terms for research contracts, template non-disclosure agreement, a template for shareholders agreement, and the INTEUM database. The development of some of these tools is discussed below.

***COP comprising staff involved in commercialisation.*** The members of this emerging COP include IP and Contract managers from KTO C and Innovation managers from the Business Incubator. This university and KTO management played an important role in enabling emergence of this COP. It is important to stress that management did not aim at constructing a new COP. They simply wanted to change commercialisation practice at KTO C. To this end, the university top management made all but one Technology Transfer Managers working for the old KTO (a university subsidiary company) redundant in 2007, brought a new KTO director, Contract and IP managers to the restructured KTO (a unit within the university) and bought time of Innovation managers from the Incubator. This approach gives support to the observation made by Roberts

(2006: 630) that “radical change may be very difficult to bring about within existing communities, and may be more easily introduced through the destruction of old communities and the emergence of new ones.” The new community emerged as a result of directions set by the new KTO director who insisted on closer collaboration between the KTO and the Incubator. The Contract Manager explained:

A lot of this has happened since we started, since [new KTO director] has given more direction. (...) I mean there was supposed to be a relationship [with the Incubator’s staff], but it wasn’t really working. They weren’t working well together, put it that way, whereas now it’s quite seamless. (...) There were personality clashes prior to that. (Contract Manager)

The new KTO director addressed the issue of “personality clashes” by replacing a person fulfilling the role of an IP Manager. In this way the last technology transfer manager who worked in the old KTO was made redundant. Moreover, the Contract Manager remarked that there is sharing of knowledge and expertise between the KTO and Incubator “because of the way it’s structured at the moment”. From that, one can infer that introduction of the Enterprise Panel ensured that the KTO and Incubator work together. In fact, the IP Manager noted that Innovation managers “are really part of the technology-transfer team” (IP Manager). This suggests that the direction-setting activities of the management and introduction of a new controlling structure (i.e., the Panel) played an important role in enabling the emergence of this COP.

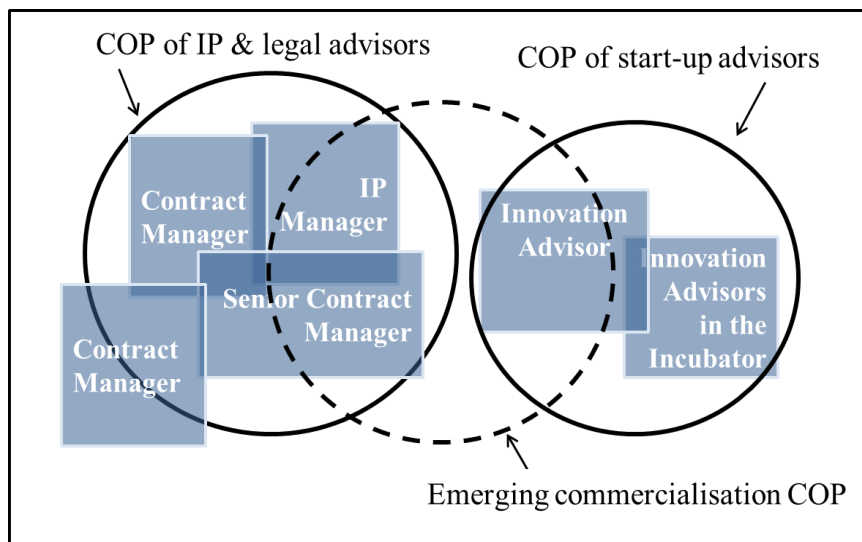
The community members have been working together for about three years (“When we started there were few [projects]. We have now probably around 25 projects at different stages” – Innovation Manager). So far, they have worked together on IP assessment, licence negotiations and company formation (mutual engagement). They discuss what to do and how to commercialise a particular idea (negotiation of joint enterprise). Their shared repertoire of practice includes, for example, the procedure for handling invention disclosures, the PAM database for project management, and standard Heads of Terms<sup>33</sup> for licence negotiations. Development of some of these is discussed below. Together they “learn through experience” (Innovation Manager). The IP Manager noted that learning takes place “through sort of some fairly small conversations you can have with people on something that can happen almost daily, but certainly weekly”.

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<sup>33</sup> Heads of Terms are short documents specifying the main agreed terms between the parties that are entering into a commercial transaction. This document is the basis for the full legal contract. Although the Heads of Terms are not binding, it may be difficult to change what has been agreed already.

In summary, the interviews allowed me to identify three informal learning groups which display characteristics of a COP – mutual engagement in work activities, negotiation of ‘joint enterprise’, and a shared repertoire of practice. Figure 7.4 illustrates the identified COPs.

Figure 7.4 Communities of practice in KTO C



Source: Constructed by the author

The next sections explore what has been learned in KTO C through interactions within these communities and whether learning was spontaneous or instigated by management.

#### *7.2.1.2 Learning how to assess the technical aspects and commercial potential of inventions in a systematic and rigorous way*

The Technology Transfer Managers in a wholly-owned subsidiary of University C, which was closed down in 2007, used to “take the technological IP from the academic, understand it, and patent it and the Technology Transfer Manager would try to market it and engage the commercial community more independently” (Innovation Manager). The academics were asked to sign an assignment of IP and revenue-sharing agreement after making an invention disclosure, and then commercial exploitation of IP would be led by the Technology Transfer Manager. This shows that patented IP was treated like a final product that can be sold. Since 2008, the new KTO director and university top management have expected the IP Manager and the Innovation managers to work together with the academics to assess the commercial value of an invention and its



patentability (if applicable). The new direction set by the Enterprise Panel shaped the development of the ‘joint enterprise’ of the emerging COP; namely, the assessment of academic invention.

Having worked together on a few inventions, IP and Contract managers and Innovation managers have learned what to do and how to work together and with the Enterprise Panel. They decided to capture what they had learned and formalise it. In particular, the IP Manager and the Innovations managers liaised to develop a formal “gateway process”:

at the moment we are designing an invention-disclosure process, which we haven’t really had. (...) So that an academic knows what is the route to follow to ultimately commercialise the idea. (IP Manager)

The new “gateway process” was explained by the IP Manager: “So an academic will complete the [disclosure] form. Submit that to myself. Then the next route would be for me to inform the Enterprise Panel.” This first meeting with the Enterprise Panel is a “gateway zero” and a decision about the idea’s viability is taken on the basis of the information collected in the disclosure form. If the Enterprise Panel decides to proceed, then the initial market research is conducted. The academic is asked to prepare a presentation about the invention and its market potential: “Normally the [Innovation managers from the Incubator] would assist the academic in putting together a presentation, if we feel he needs help in that area” (IP Manager). At the “gateway 1” meeting, the academic makes the presentation and:

the [Enterprise] Panel will have normally more questions at that stage that: ‘we need to investigate the IP position’, (...) ‘do we know what other competitors do in this area?’ The panel is really looking for ideas that have commercial potential.

If the Enterprise Panel decides to proceed with commercialisation, the patentability of an invention will be assessed further and more market research will be carried out:

[the Incubator] provides assistance on market research, on drawing up business plans. I would appoint one of our patent firms. We have probably sort of perhaps five or six patent firms that the University [F] works with. (IP Manager)

Provided that the assessment of patentability is positive, the application is filed with the UK IPO. KTO C has then 12 months before filing a PCT patent application:

then we have a 12-month window in which then to decide whether to continue with that first patent application. (...). Even if I've done an informal patent search, we'd request for the Patent Office, UK IPO, to conduct its own patent search. (...) There are other things we are trying to achieve in this 12-month window after we've filed the UK patent application. And that's really to identify companies or possible partners who may wish to commercialise the idea in some way. (...) So we're trying to *identify partners*\_(emphasis added) as early as possible. (...) And secondly, we need to make sure that the academic has funding to continue the research for that 12-month period and beyond. (IP Manager)

When a clear plan for the exploitation of academic inventions has been prepared (the so-called “business plan”), there is a “gateway 2” meeting at which the Enterprise Panel assesses the exploitation plan. The Enterprise Panel decides on the commercialisation route – licensing, assignment, or sale, to existing or newly formed entities. Alternatively, a “University Enterprise Unit” is formed. This is a structure within a university accounting system that operates on a self-supporting, full-cost basis. It allows for a commercial operation without the burden of company formation. The unit may eventually be transformed into a spin-out company. The Enterprise Panel meets monthly and at the same meeting the Enterprise Panel may look at different technologies, which are at different stages in the “gateway process”.

This is an example of how the direction-setting activities of management shaped learning in a COP. The members of the community worked together to develop a formal “gateway process”, which then became a part of the repertoire of practice. The process ensures that (1) the commercialisation-related decisions are based on information gathered through assessment of patentability, commercial viability and further development of inventions, (2) market potential is assessed before patenting, and (3) that the academics are closely involved in the assessment of their inventions. Previously the academics were involved very little and inventions were patented without much knowledge of the invention's commercial viability. This was a radical change in ‘how’ the assessment of academic inventions is done since the object of the IP assessing activity has changed – from aiming at assessing patentability to assessing commercial viability. Learning in the new COP was instrumental in making this change happen. The new controlling structure (i.e. the Enterprise Panel) allowed management to monitor the practice evolving through situated learning. This empirical example provides new insights into how radical changes in ‘the how’ come about.

### 7.2.1.3 *Learning how to exploit IP generated in industry-sponsored research in a business-friendly way*

Before 2008 KTO staff insisted on ownership of IP created in research, even if the research was sponsored by industry. The industry sponsor had the option of taking a licence from the university to use the IP (should they wish to do so at the end of the research contract) and royalty rates were negotiated before the research commenced. Increasing income from industry is a key objective of the university's top management in their strategic plan for 2009-2015 and the new KTO Director, appointed in 2008, initiated a change in the approach to negotiation of research contracts with industry. He wanted staff to develop an approach which can be summarised as not being so 'precious' about IP. The Director explained the change:

The previous start was if we do research we should own the IP, and we changed that to say that generally we expect the customer to own the IP, but we would like some return if they make use of the IP. We will negotiate that as it happens rather than try to predict at the negotiation stage for research what the outcomes are going to be. (...) That means you are not haggling on royalty rates on something which has not been produced yet. (...) So have a closure [in the contract] which says, 'If you don't do anything with this IP, we will have it back'. So there is some pressure on them [i.e. the industrial partner] to do something and hopefully they will be successful; you will get a return or you might get further research funding from them, which is of more interest to us than commercialisation income. (Director)

The only exception to this general rule is contracts in research areas that the university recognises as strategic. Strategic research areas are areas where considerable IP has been generated already and where relinquishing ownership of new IP in this area could "block over what we've already got and invested in" (Contract Manager). Thus the new approach can be summarised as (1) "trying to recognise which IP is valuable" to the University, (2) "taking a much more relaxed view about other areas of IP", and (3) recognising that "benefits of IP exploitation don't just come from licenses and spin-out, but we can get bigger benefits institutionally by giving away the IP as part of the research deal" (KTO Director). In order to formalise this new direction, the Director introduced a new IP policy – Contract Negotiation and Pricing Policy. The Director described his direction-setting activities as follows:

I had a strong view of what I wanted, but at various points I discussed it with [Contract Manager and IP Manager], to say 'This is where I am going; that's the draft; what's your reaction to it?' It was partly a way of helping me to

inform them about where I wanted to go so that everyone was trained in the same direction, and by giving them a chance to put into a process to ensure that I considered everything which ought to be considered, because it is quite possible that I overlooked something that would seem trivial to me perhaps, but would be absolutely essential in order to implement policy. The policy is not good if you cannot implement it. (Director)

The direction-setting activities of the KTO Director shaped learning in the COP comprising legal and IP Managers. Contract managers learned a new way of working and the IP Manager who joined in 2010 was unaware of anything but the new approach. The Contract Manager noted:

that was quite a change from what previously happened. (...) I think the way we negotiate research agreements is a lot different now.

IP is negotiated now in accordance with the new policy. The Contract Manager explained that now they tell industrial partners: “Well you can own it, but we’ll have appropriate licenses and revenue shares”, instead of saying “Well, we’ll give you a licence for what we produce and you can do whatever you like”. He highlighted that the new approach is “much more company-friendly”. The Contract managers and IP Manager ensure that the university has rights to publish and rights to continue research in a particular area.

In summary, KTO C changed its approach to the exploitation of industry-sponsored research. KTO C is putting less emphasis on owning IP and on the financial gains from licensing the IP rights to companies, and more emphasis on establishing a collaborative research relationship with companies. Thus, the object of the contract negotiation activity has changed. This is a shift from the approach typical of an IP-focused commercialisation practice to an approach typical of match-making commercialisation practice. Thus, this change in the way industry-sponsored research and related licenses are negotiated is an example of a radical change in ‘the how’. This change emerged from learning in a COP triggered and shaped by the management’s direction-setting practice.

#### *7.2.1.4 Learning to manage relationship with a partner-licensee*

At the end of 2010, KTO C was about to complete a licence deal for its most promising technology and there was a perception among staff members that they needed to find a better way to manage the relationship with the commercial partner. Until then, the KTO did not have a clear approach to managing relations after signing a licence

agreement. By saying “there are *perhaps* licence agreements in place”, the IP Manager revealed that these relations were not actively managed. He noted also that in the future he would be responsible for managing such relationships. Until then, the management of the relationship with a licensee was limited to administration of royalty or milestone payments and reviews of the contract if necessary.

The Innovation managers realised that “a specialist piece of software called ‘Partnering to Achieve More’ – PAM”, which was developed by a company that is based in the Incubator, could be used for sharing information with a commercial partner who licensed the university’s technology. The Innovation Manager explained the advantages of the software:

We now have to manage that as a relationship that is on-going, with key performance indicators for whether something is succeeding or failing, and we need to be aware of those. So the ability to take someone – from a customer if you like – from a commercial prospect into someone who then becomes a licensing partner with the university means that we still want to carry on dealing with them and perhaps expose different levels of detail in collaboration with them. And we can do that through this project software, where they go from being a customer to being an alliance.

Moreover, it was believed the software would improve communication between staff in the KTO and the Incubator, who are located in different buildings:

In terms of managing the outcomes of the Enterprise Panel, it [PAM] helps us to stay on top on what the outcomes are, what the tasks are, and to make sure that we can set the key performance indicators for the project so that we can see in a simple format – are we on target, are things done, how we can check projects. For example, if there is IP, we need to get things in the right order; otherwise we won’t be able to patent. (Innovation Manager)

At the time of data collection for this thesis, the KTO and the Incubator were “trying out” the PAM software. It was not clear whether it would become used widely for managing other commercialisation projects; that is, whether it would become a part of the repertoire of practice. Nonetheless, this example shows that the members of this COP spontaneously learned to share information with industry partners that licensed the university’s IP. This new action complemented already existing routines for managing formal aspects of the relationship with the licensees (i.e. payments and contracts). This is an example of incremental change in ‘what’ a KTO C does to manage the relationship with a licensee. This empirical evidence supports my first theoretical proposition,

suggesting that incremental changes in practice result from situated learning in COP on the initiative of COP members.

### ***7.2.2 Learning from NOPs in KTO C***

This section explains what was learned in KTO C through the interactions among the staff involved in commercialisation with members of their NOPs and why learning occurred. I first describe the NOPs of relevant staff.

#### ***7.2.2.1 NOPs of commercialisation staff in KTO C***

The Director of KTO C is well embedded in various NOPs. He has experience of working in two other KTOs in Russell Group universities, and had developed connections with his opposite numbers in other research-intensive universities. He maintains these contacts, partly through participation in the meetings of the Brunswick Group.<sup>34</sup> Since joining KTO C, he has attended 1994 Group meetings where he meets his counterparts from peer institutions. He is an active member of ARMA, PraxisUnico and AURIL. The Director acknowledged learning from his networks of practice:

When we have a situation which we have not dealt with before, I will use colleagues from outside the university. Either on a one-to-one approach or to one of the groups I am involved in. (Director)

Interviews with the Contract Manager and IP Manager revealed that they do not have many personal relations with members of other KTOs. The Contract Manager confessed:

There are a couple of contacts I've met on courses, but I'm not actually involved in anything, any external membership of that type. It needs to be developed. (Contract Manager)

The IP Manager started developing some personal contacts, but has not asked them for any informal advice:

Since I came here, I went up there for one day or half a day to have some training on an IP Management Software. So that was a useful experience to kind of meet the people up there. So I've met the people there and so I feel that I could contact them on something if I needed some advice or wanted to share, find out their experience. (IP Manager)

As the main job of the Innovation managers is to support start-ups located in the Incubator, it is not surprising that they have developed links with advisors in other

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<sup>34</sup> The group of top management from universities belonging to the Russell Group.

Business Incubators rather than in other university KTOs. The Innovation Manager said: "We have connection with a wide variety of innovation centres. There are around 300 in the UK. We are unusual in the sense that we have a support team. Most incubators are nice buildings" (Innovation Manager).

In summary, the interviews revealed that the KTO's Director learns from his NOPs while the staff members involved in commercialisation do not have close relations with knowledge transfer professionals in other KTOs. The Contract Manager explained that this is "because of the volume of work" (Contract Manager) that they have to handle.

#### *7.2.2.2 Learning to identify licensees for platform-technologies*

When structuring a licence deal, a KTO has to "carve up the fields that it [i.e. technology] is being used in" (Contract Manager). The technologies may have few or many applications and the KTO needs to decide what company gets the rights to use a technology in a particular field of application, whether the rights are exclusive and if so, for how long. The technologies that KTO C typically deals with have one main application in a particular market sector (e.g. software licences). When a technology with many potential applications in different market sectors (a so-called platform technology) was disclosed by an academic, there was a perception that

there was this risk originally envisaged in the technology that there would be probably between 10 to 20 licences to different market sectors for the technology. (Innovation Manager)

KTO C did not have the in-house experience to deal with platform technologies. The Enterprise Panel, comprising KTO and university top management, as described above, decided to hire a licensing expert from another KTO as a consultant. The licensing expert advised how to "commercialise it effectively and target the right applications" (IP Manager). The Innovation Manager explained how they worked with the consultant:

We brought in a guy from Imperial College who had experience of licensing technologies separately to different business sectors. (...) So we marketed and pushed the technology into 3-4 key business applications (...) and through doing ... we attracted interest from other key players and they saw it very much as a new (...) technology that they could be miniaturised to a circuit level and market in a different format. So it happened by pushing it out and testing this market place and going through that customer development and validation stage, we were able to drive very detailed commercial discussions with a wide variety of different people in different sectors and come to the conclusion 'right there is another opportunity here that no one has seen' and build on that. (Innovation Manager)

Through working with the licensing expert from another KTO, the members of the emerging COP learnt how to identify commercial applications of platform technologies that were not originally envisaged by the academic and the KTO and how to select a number of licensees for the rights to use a technology in different fields of application. These new actions were added to already existing ways for identifying a licensee (e.g. customer discovery and validation routines). This is thus an incremental change in ‘what’ is done to identify a licensee by KTO C. The licensing of platform technologies, which in the past would have been outsourced to external commercialisation companies, is now a part of the KTO’s commercialisation practice. Learning from NOPs was central in making this incremental change to practice and was enabled by management who allocated resources for hiring the licensing expert.

### ***7.2.3 Learning from other COPs in KTO C***

The purpose of this section is to explore whether interactions with other COPs are a source of knowledge for the staff involved in commercialisation and if so, what has been learnt in KTO C through interactions with other COPs and why this learning occurred.

#### ***7.2.3.1 Connections of commercialisation staff in KTO C to other COPs***

The KTO director, IP Manager and Contracts Manager highlighted that they learn through interactions with external lawyers and patent agents. An interviewee explained that “it’s not cost-effective for us to have people in-house doing that sort of thing when we’ve already got people that can be used elsewhere” (Contract Manager).

University C buys services from a few companies providing legal expertise and the KTO has developed a very close relationship with one of the firms. The Contract Manager noted: “It’s almost like, you know, like they work here. (...) It’s a bit like having somebody in the office really. It’s like a virtual lawyer”. The lawyers provide the first 30 minutes for free and only charge for more time-consuming advice. The Contract Manager explained that he just rings the lawyer up and talks things over. The KTO staff contact the lawyers to get advice, for example, on “high risk, medium risk, low risk issues” (IP Manager) in licensing agreements, other “quite complicated” issues in contracts, and on “grey areas” (Contract Manager). The KTO director also consults with external lawyers. For example, he sought advice while developing the IP policy and



“got some useful comments back saying ‘yes, this is robust’ or ‘replace it because it is not robust enough’, and it helped a lot to improve it” (KTO Director).

The IP Manager said he learned from patent firms who are “involved in advising on patentability of IP and drafting patent applications, filing patent applications and advising on all elements of patent prosecution to get patents granted” (IP Manager). Other KTO staff tend not to interact with the patent firms directly and thus do not learn from them.

The staff involved in commercialisation reported not learning from commercial partners. The IP Manager explained that: “You learn from each negotiation, I think, but not necessarily from perhaps the people you’re negotiating with” (IP Manager). On the contrary, the KTO director does learn from interactions with commercial partners. He said “The [deal] structures that they suggest may be quite interesting and therefore I can use them for the future deals” (Director).

I next discuss what has been learnt in KTO C through interactions with other COPs and whether this learning was spontaneous or instigated by management.

#### *7.2.3.2 Learning how to protect the university’s interests while licensing academic inventions*

While negotiating licensing agreements, the Contract Manager, IP Manager and Innovation managers have learnt how to protect the interests of the university. The key issues include, for example, ensuring that the university has the right to publish and the right to continue research in a particular area, avoiding giving any warranty for the results of the work and its uses, and ensuring that the university is indemnified for any loss, liability or damage, among other provisions. It is important to negotiate these provisions (so-called Heads of Terms) first and then translate them into a legal language. “The Heads of Terms [document] is 2, 3, 4, 5-pages long” whereas the “legal agreement is 20, 40, 50, 90 pages” (Director). The Contract Manager described how they learnt why Heads of Terms are important:

The way we structured the licence (...) it doesn’t quite work, you know the way we structured it. (...) Now the format that we would use to start as a basis for the Heads of Terms; we would probably alter that. (...) And to an extent we’ve already been doing that. That’s already been happening, on one of the deals we’re doing – this big deal that we’re doing at the moment – because the Heads of Terms there have been through several alterations and it’s largely come about as a result of the people that are involved. (Contract Manager)

The members of this COP perceived “the big licensing deal” as an opportunity to develop a standard Heads of Terms which could be used as a licensing template (“The reason we did the licence in this big one was that we wanted to have a good licence template” – Contract Manager). The standard Heads of Terms was initially developed collaboratively by all the individuals engaged in negotiating contracts – Contract managers, IP Manager and Innovation managers. Subsequently, they sought advice from external lawyers. “It’s quite important to get a second opinion”, noted the Contract Manager. The IP Manager explained:

We sent them actually the agreement and we wanted them to advise us on any high risk, medium risk, low risk issues in that agreement. (IP Manager)

The lawyers have the expertise to judge whether the provisions in the contract are clear and unambiguous, and whether they are legally binding or create obligations to negotiate. The KTO staff learned through interactions with the external lawyers how to protect the interests of the university.

The Contract Manager stressed: “we wanted to have a good licence template because since I’ve been here, we didn’t have a standard licence”. The standard Heads of Terms for a licence agreement are important as they make transparent what provisions are non-negotiable. The staff responsible for negotiations can be more confident that they represent the best interest of the university. Moreover, standard Heads of Terms help to ensure that all important provisions are included in the contract. It is apparently difficult to change the commitments made in negotiations of Heads of Terms and thus it is important to get them right from the beginning. The Contract Manager noted that “as far as licensing is concerned – the more complicated stuff – we’re still on a bit of a learning curve there ourselves” (Contract Manager). Over time, they may make further adjustments to the template to ensure that the lessons learnt from each licence negotiation are embedded in practice.

In summary, the interactions within the COP and the interactions with external lawyers (i.e. with other COPs) helped KTO C to develop a standard Heads of Terms that guide negotiations of licence agreements. This arguably made their approach to licence negotiations more systematised, more transparent and less likely to overlook important provisions protecting the university’s interests. This is an example of an incremental change in how KTO C protects the interests of the university in the exploitation of IP arising from publicly-funded research. It is worth noting that although the change was initiated within a COP, it is in line with KTO C’s new policy for the

negotiation of contracts, which states that “a distinction should be drawn between the negotiation of the shape of a deal, and the detailed discussion of contractual terms”.

#### **7.2.4 *Summary of Case Study C***

The analysis of KTO C found that at the end of 2010 its IP assessment, marketing and licensing and company formation activities had the characteristics typical of a match-making commercialisation practice, underpinned by the ‘coupling model of innovation’.

The analysis revealed that match-making commercialisation practice was developed under the new strategic direction of the university and KTO management between 2007 and 2010. A new KTO director, who came from one of the most successful UK KTOs, played an important role in directing the learning of KTO staff. The strategic practices of the management supported the emergence of a new COP and shaped its learning. Learning in a COP directed by the management resulted in KTO C learning how to assess the technical aspects and commercial potential of academic inventions. It also learnt in this way to exploit IP generated in industry-sponsored research in a business-friendly way rather than in a way focused on owning IP and profiting from licensing of this IP. This business-friendly approach is crucial for building research partnerships with industry. Furthermore, through spontaneous learning in the COP, KTO C learnt to share information more effectively with licensees after a licensing agreement is signed. This ability to manage a relationship with the licensee is also key to building partnerships with industry. Besides learning how to assess IP and handle contracts in a manner typical of a match-making practice, on the initiative of staff KTO C learnt, through interactions of staff with external lawyers, to protect the university’s interests when licensing academic inventions. Furthermore, through the interactions of the staff with their NOPs, and enabled by management, KTO C learnt how to identify licensees for different applications of platform-technologies. Table 7.2 summarises the findings from this case study.

Table 7.2 Summary of what KTO C has learnt, how and why.

Why has KTO C learnt?	How has KTO C learnt?		
	Learning in COPs	Learning in NOPs	Learning across COPs
	What?	What?	What?
Situating learning initiated by staff	managing relationship with a partner-licensee (incremental change in 'the what'; see 7.2.1.4)	None	protecting the university's interests while licensing academic inventions (incremental change in 'the how', see 7.2.3.2)
	protecting the university's interests while licensing academic inventions (incremental change in 'the how', see 7.2.3.2)		
Situating learning instigated by management's strategic practices	assessing the technical aspects and commercial potential of inventions in a systematic and rigorous way (radical change in 'the how'; see 7.2.1.2)	identifying licensees for platform-technologies (incremental change in 'the what'; see 7.2.2.2)	None
	exploiting IP generated in industry-sponsored research in a business-friendly way (radical change in 'the how'; see 7.2.1.3)		

Source: Constructed by the author

The findings support the theoretical propositions according to which spontaneous learning in a COP generally results in incremental changes to practice (here in managing the post-licence relationship with the licensee). This is the first case study illustrating that the *incremental changes in 'the what'* (rather than 'the how') come about through *learning in COP on the initiative of COP members*. Moreover, the findings from Case Study C corroborate insights gained from the previous case studies. As in Case study A, I found that in this case *learning in NOPs enabled by the management* results in *incremental change in 'the what'*. Case Study C supports insights from Case Study A and B showing that *spontaneous learning across COPs* informs *incremental change in 'the how'*. Finally, similar to the findings from Case Study B, this case study reveals that the need for *radical changes in how* activities are performed is identified by the management. The role of management and situated learning in COPs is very different, however, from that observed in Case Study B. Here the radical changes in 'the how' are triggered by the direction-setting practices of management, which destroy existing practice (staff redundancies), set direction and

constraints for new practice (e.g. new policies) and monitor the practice evolving through situated learning in the emerging COP (new controlling practices – the Enterprise Panel). While the approach seems to be effective in bringing about radical change in ‘the how’, it raises concerns about the loss of tacit knowledge.

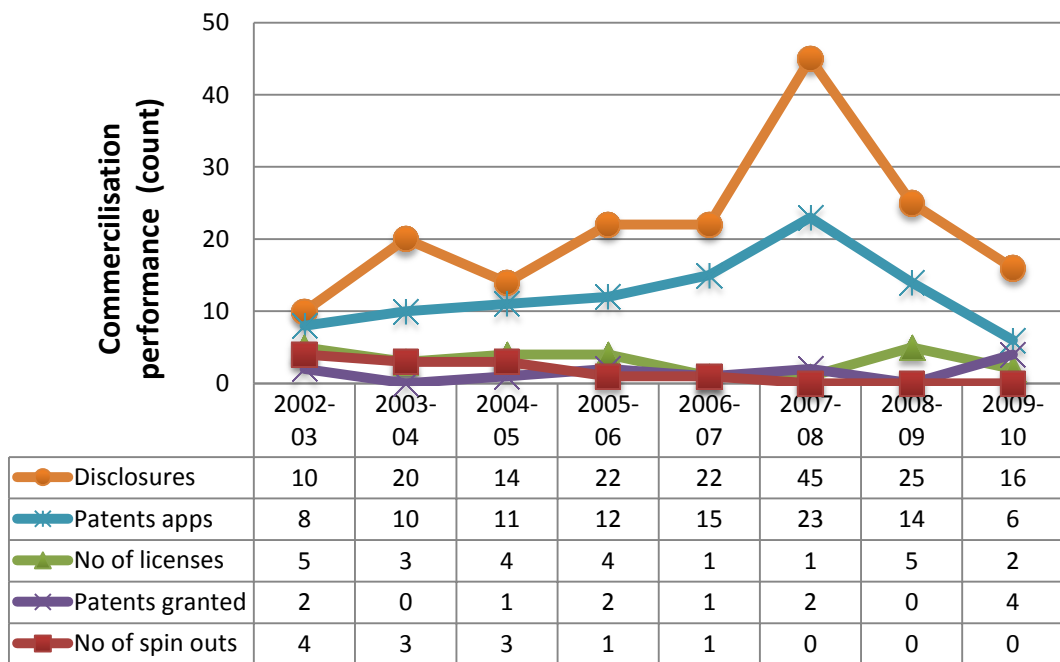
## 8 KTOs developing an IP-focused commercialisation practice

Chapter 6 showed that KTOs develop different approaches to commercialisation. This chapter discusses two more examples of KTOs that have been developing IP-focused commercialisation practice.

### 8.1 Case Study D - background information

This case study is about learning, in the KTO of a research-intensive university belonging to the 1994 Group which was ranked in the top ten in the Times Higher Education's Table of Research Excellence (2008), based on average RAE scores. Figure 8.1 illustrates the volume of commercialisation outputs in 2002/10. The number of disclosures and patent applications rose steeply in 2007/08 following an expansion in BD staff. In 2009/10 knowledge transfer activities supported by the KTO generated approximately £39 million. This included income of £727,000 from licensing and spin-out activities.

Figure 8.1 Commercialisation performance of University D



Source: HEBCI surveys, 2006-2011

**Information on the KTO.** The KTO is an internal department within the university structure and currently provides support for the development and administration of research projects, collaborative projects, CPD courses, KTPs, and commercialisation.

Consultancy activities are not managed centrally. The first centralised support for knowledge transfer dates back to 1989, when a biology professor was appointed as the first director of Industrial Development, and one additional person was employed to undertake business development activities and contractual support for collaborative research and commercialisation projects. The knowledge transfer staff was expanded after receiving HEROBAC funding (2000-2002) and then again after HEIF2 allocations (2004-2006), predominantly in the business development area. During the period 2006-2010, covered by this study, there were a further five new appointments in the existing areas (one FTE in business development, three FTEs in CPD support, and one FTE for contracts support). In 2008 the KTO was merged with the research support office.

At the end of 2010 there were about 30 staff members in this KTO. They were divided into four teams including (1) a team supporting research strategy implementation and preparing external and internal research reports (2 staff), (2) the research support team providing pre-award support (e.g. costing, assistance with submission) and post-award financial management of live projects (13 staff), (3) a team providing support for CPD courses, including assistance with new programme development, market research, promotion and marketing, and accreditation of CPD programmes (5 staff) and (4) a business development team providing support for the development of collaborative research relationships and exploitation of university IP (7 staff). There are also four staff members or “associates”, who work with research support colleagues and colleagues responsible for knowledge transfer. The associates comprise (1) an IP Manager and a Contract Manager who together provide help with legal aspects of research and knowledge transfer projects, (2) a Communications officer responsible for website content and all research-related communication, and (3) a Professional Development officer responsible for training of university staff, for example, courses for academics on making an impact. The KTO budget comes from the university’s central funds and the HEIF fund. Sixty per cent of posts in the research support teams are centrally funded, but only one in the KT support team (due to the length of employment). Most staff members have been working in the KTO for about five years. The commercialisation of academic research is carried out predominantly by six staff: four BD managers, the IP Manager and the Contract Manager.

**Information on commercialisation practice.** Following Orlikowski (2002), I discuss ‘the doing’ in KTO D at the turn of 2010/2011 and then draw inferences about ‘the knowing’ in this KTO.

**Identifying commercialisation opportunities** is undertaken by BD managers who are responsible for particular academic areas - physical sciences, medical sciences, bio-renewables and computer science. They mostly wait for academics to approach them with invention disclosures and occasionally organise seminars to raise awareness among academics of the support available for research commercialisation. One of the BD managers illustrated this approach by explaining what she had done in the most recent few years:

When I first started [in August 2009] I went out there and met with mostly academics. (...) And then six months ago [in the summer of 2010] I put out a flyer to make sure people remembered who I was. So now I rely more on academics coming to me with an idea. (BD Manager 1)

In summary, the BD managers have a generally passive approach to identifying commercialisable research outputs. There is no evidence that BD managers have developed close connections with academic departments in order to be aware of research with potential for generating commercialisable outputs.

**IP assessment activities** are undertaken by the IP Manager and BD managers. The IP Manager decides on patentability, but “the strategy of commercialisation is more the responsibility of the Business Development managers” (IP Manager). At the start of a commercialisation project, the focus is on assessment of novelty and inventiveness to justify patenting while market demand is not systematically assessed. The IP Manager explained the approach to assessing IP:

we’re often patenting without having as much examination of the market opportunity and even the patentability (...) if we think that something is novel and there’s no obvious prior art that is going to cause us a big problem, our presumption would be that we would at least file a GB patent application (...) At the PCT stage, after 12 months, obviously we have to think a bit longer and harder whether it’s really worth patenting. But normally we do [file a PCT application] because even by that stage, you haven’t necessarily got a great deal more market information, because these technologies are very, very early stage. (IP Manager)

From the above quote, it can be inferred that KTO D does some assessment of patentability. The BD managers “are supposed to do the market research to establish whether or not it’s worth patenting”, but they apparently do not do much of that because



“usually, there’s a bit of an imperative to get patents in place, because there’s going to be a publication or a talk at a conference or whatever” (IP Manager). Arguably the lack of rigorous assessment is partly attributable to the fact that BD managers do not learn about the invention early enough, as a result of their fairly passive approach to identifying commercialisation opportunities.

Once the patent application is filed, the BD managers focus on assessing and securing the resources necessary for the development of inventions. Some inventions are supported by an internal proof-of-concept fund. After a PCT patent application is filed, the BD managers “sometimes” (IP Manager) subcontract some market research to an external consultant in order to assess market size and identify potential licensees. The IP Manager showed awareness that the potential licensees are in a position to know the ‘true’ commercial value of technology (“The licensee is always in a better position than us to know what its true value is. But they’re clearly not going to divulge what they think the true value is as much as they can” – IP Manager). However, there is no indication that BD managers actively seek feedback from potential licensees and other companies in the relevant sector. This is illustrated by their approach to patent reviews, which typically are undertaken by the IP Manager in collaboration with an external patent attorney:

Well, then we’d normally meet with the inventors and see what arguments we can marshal to respond to the examiners’ objections. And sometimes the Business Development managers would get involved. Quite often they don’t. It would quite often just be me and the patent attorney. It sort of depends. (...) I don’t think they have a great appetite for getting involved in patents. (IP Manager)

The implications of the fact that the BD managers do not get involved in the review of patent claims are that (however minimal) market intelligence gathered by the BD managers is not incorporated in the patent applications. The IP Manager noted that some patent applications are dropped at the end of PCT examination (“we drop them after we’ve tried to licence them and come up against a brick wall. And, you know, that often happens” – IP Manager). More importantly, she said: “There’s a lot of wastage. And that’s because, you know, *this is technology push*, not demand pull. So I think you would expect it” (emphasis added).

In summary, IP assessment activities give weight to the technical aspects of inventions (patentability criteria). This approach to IP assessment does not ensure that

the information from the technical assessment of an invention and the information from the assessment of its commercial appeal are combined in a systematic manner.

**Marketing activities** are undertaken by the BD managers and the Communications manager. Information about the technologies available for licensing are placed on the KTO's website and other IP portals, such as IP.net. The Communications officer is responsible for online marketing. The BD managers did not report having any templates for marketing leaflets or frequent marketing routines.

Identification of potential licensees is undertaken by BD managers after filing a PCT patent application (i.e. 12 or more months after the priority filing). The BD managers rely, first of all, on the contacts of academics and previous contacts of the KTO. They seem to rely on "rubrics of convenience" (i.e. available contacts) and "faculty inventor desires" (i.e. their preferred licensees) (Powers and McDougall, 2005: 1030). If these do not suffice, market research is commissioned to identify new companies, which are then contacted by "cold calling". They do not look for licensees early "because these technologies are very, very early stage" (IP Manager). If the BD managers were looking for commercial partners to work jointly with the academics on the invention, they would approach potential licensees as early as possible rather than doing it at the last minute and would always make contact with a broad range of potential licensees. As this is not the case, I conclude that BD managers do not look for a partner for the development of early-stage technologies, but wait for the academics to do more work on the invention so that it is more ready for 'sale'.

**Handling of licensing agreements and other contracts.** Typically BD managers start negotiation of the commercial terms of a licensing contract and subsequently the IP Manager and the Contract Manager take over the licence negotiations. The Contract Manager explained: "What Business Development managers would be involved with are very much commercial terms – so basic issues of, you know, how much are we getting paid for this licence and what is the royalty structure" (Contract Manager). The BD managers work to income targets and maximising royalty payments is high on their agendas. The BD managers think it important to have sales-related skills for "selling an idea to an external party" (BD Manager 1). These observations suggest that licensing is perceived as a sales transaction rather than as a part of partnership building.

On occasions, BD managers do not get involved at all in negotiations of licensing deals. The contracts are prepared by the IP Manager and the Contract Manager. They ensure that no promises are made in the contract that would put undesirable liabilities

on the university (e.g. “we are not promising it [technology] works, we are not promising you don’t need other IP. We are not promising the safety of a product you make from it. We don’t want to promise that if you use this you won’t be infringing some third party” – Contract Manager) and that the university gets the rights to receive royalty reports, audit licensee’s records and terminate the contract if there is not sufficient progress. The default legal position of the KTO is captured in the template agreements that were developed by the IP Manager with the help of external lawyers, and adapted for each licence deal. Since the new Contract Manager joined the KTO in 2010, he has redrafted contracts for each specific deal using his legal knowledge. In summary, the focus on licence negotiations is on ensuring high financial returns and protecting the interests of the university.

***Company formation activities.*** None of the internal staff is responsible for company formation activities. A decision was taken in 2006 to enter a long-term exclusive contract with IP Group plc. – an external IP commercialisation company – who obtained the rights to identify and facilitate the formation of spin-out companies from inventions coming out of all academic departments. The reasons were first, lack of internal expertise, and second lack of internal financial resources to support technology maturation and company formation. The partnership is to be in place for 25 years, and during this period the IP Group is entitled to 25% of the equity in any university spin-out company at the time that the company is established (i.e., before further investments), if they invest their own funds in the spin-out company. If the IP Group does not invest in the spin-out, but helps to form it, it receives 15% of the equity. The IP Group will receive 10% of any income received by the university from licensing over the 25 year period.

Since the beginning of the partnership in 2006, IP Group has not invested in a university spin-out. In fact, only one spin-out company was formed between 2005 and 2010 (HEBCI data) and this occurred before the partnership with IP Group was established. The IP Manager commented on outsourcing of company formation activities:

We’ve had lots of different ways of getting spin-offs off the stocks. And over the years, I’ve been quite deeply involved. We’re trying to outsource more of it and therefore take some of the burden off the staff of the [KTO]. I think the jury’s out on how well that’s working. (IP Manager)

I concluded that there are no recurrent activities involving company formation.

Drawing together the activities described above, it is apparent that KTO D has (1) the ability to identify commercialisable research outputs, (2) somewhat limited ability to assess the appropriability of IP, (3) somewhat limited ability to manage the dissemination of information about academic inventions, (4) the ability to identify ‘buyers’ of academic inventions, and (5) the ability to make one-off licence transactions.

Its approach to identifying commercialisation opportunities, assessing IP, identifying licensees and handling contracts is arguably based on the implicit assumption that the outputs of research can be passed on to industry, which will turn them into innovations. There is no need, therefore, to identify commercialisation opportunities early on. In conclusion, at the end of 2010, KTO D had an IP-focused commercialisation practice underpinned by a science-push model of innovation (Godin, 2006). The next section outlines a picture of learning in KTO D between 2005 and 2010.

### ***8.1.1 Learning in COPs in KTO D***

The purpose of this section is first to explore whether there are COPs in KTO D, and then to explain what has been learnt in the KTO through interactions within these COPs and why this learning occurred.

#### ***8.1.1.1 COPs in KTO D***

The evidence suggests that there is a COP comprising four BD managers who carry out business development for science and engineering departments.

***COP comprising BD managers.*** The joint enterprise (or work activities) of BD managers is generating research income and securing funds for the commercialisation of academic inventions. Other aspects of commercialisation are not perceived as a key part of their role. One of them explained:

If I need for advice from a more experienced Business Development manager, I talk to [person X]. If I need advice on a technical issue outside my area, it would depend on the BD manager. So if it was to do with Computer Science, for example, which could interact with my area, it would be [person Y], if it was to do with Health Science, that would be [person Z].  
(BD Manager 2)

They help each other get these work activities done (“We all work together” – BD Manager 1), which shows that there is mutual engagement. They manage the internal

Strategic Initiative Fund, the use of which they negotiate among themselves (e.g. what kind of knowledge transfer projects can be supported by the fund, how to define what knowledge transfer is and is not). Their repertoire of practice includes, for example, the disclosure form for collection of information about an invention, the funding process for the allocation and monitoring of grants from the Strategic Initiative Fund, and spreadsheets for recording research income generated by business development activities.

In summary, the group of four BD managers display three characteristics of a COP – mutual engagement, negotiation of joint enterprise, and a shared repertoire of practice.

***Why are the IP Manager and the Contract Managers not members of the COP?*** The main activities requiring mutual engagement between BD managers and IP and Contract managers are IP assessment, and negotiation of licensing agreements and other contracts. As KTO D is not very selective before filing a patent application, there is little need for mutual engagement and negotiation over whether or not to patent. Moreover, as already explained, BD managers do not always get involved in licence negotiations. The IP Manager said that negotiation of the legal terms of a contract is sometimes difficult “because BD managers have gone in and actually agreed something before I get my hands on it” (IP Manager). This indicates that there is little cooperation or mutual understanding about how to approach licence negotiations. Thus, mutual engagement is minimal.

The IP Manager noted also that: “I don’t think they have a great appetite for getting involved in patents”. Her feeling was confirmed in a comment from a BD manager who said: “Project management will involve [IP Manager] when it’s to do with the protection not to do with the resourcing element. Planning funding that would be me”. It seems that BD managers have developed a view that the activities of IP Manager and Contract Manager are complementary, but there is no need for joint work. Given the lack of “joint enterprise” and low levels of mutual engagement, they do not seem to belong to the same COP.

This situation arguably resulted from the strategic decision of the KTO management to downplay commercialisation. Before 2005, the KTO was focused on commercialisation (licensing, spin-outs) after 2005 there was a stronger emphasis on increasing the volume of research projects funded by sources other than the Research Councils (e.g. development of collaborative research, contract research) as well as other

knowledge transfer activities (KTP, CPD). The BD managers were employed to work on the implementation of the above strategic goals. Their business development activities aimed at increasing the engagement of academics in the above-mentioned knowledge transfer activities. Commercialisation of academic research via licensing and spin-outs was treated as a less important activity. One of the BD managers commented: “How much time we spend on each role, on each project, isn’t determined – we choose” (BD Manager 1). All of them, however, tend to downplay commercialisation and spend more time on other aspects of their role (“The priority is generating research business. And everybody sees that as number one priority” – IP Manager). This situation is clearly unfavourable to the development of commercialisation practice.

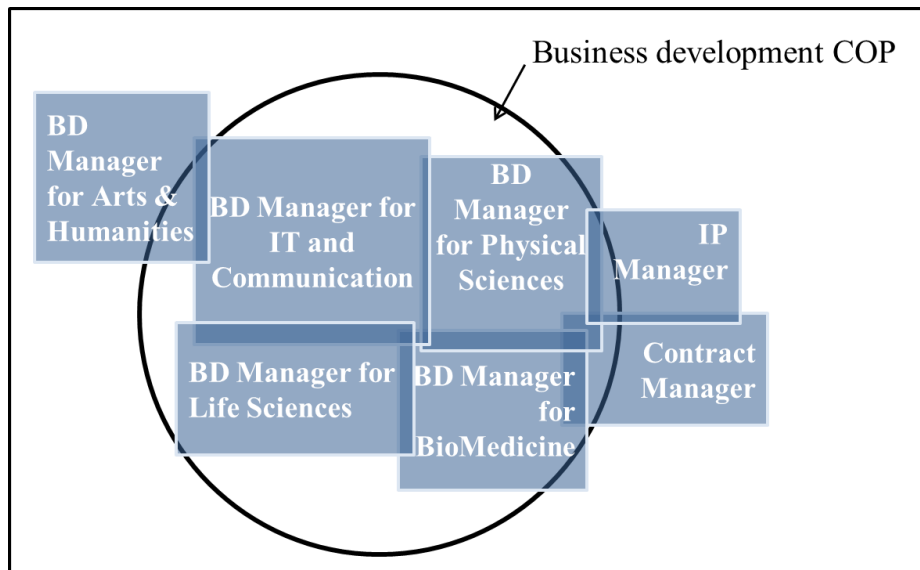
***Why is the BD manager for Arts and Humanities not a member of a COP?*** This BD manager explained: “if a biologist is talking about protein or something, I haven’t a clue what he’s talking about. And I’m sure he hasn’t a clue when I’m talking about medieval history. So there was a problem about understanding what each other’s thing” (BD Manager 2). Similarly the BD manager for Physical Sciences stressed that: “He covers Humanities and spends a lot of the time on the ERDF<sup>35</sup>- funded expansion projects. There’s less of a natural overlap because he doesn’t cover sciences” (BD Manager 1). The four BD managers who belong to the COP work on securing funding for “commercialisation activities”, whereas the BD manager for Arts and Humanities looks at developing ways of identifying new funding streams for “knowledge transfer” to the private and public sector. They do not have a “joint enterprise” and thus it is unlikely that they will seek mutual engagement in the pursuit of their daily work.

In summary, the interviews revealed that there is one COP. Figure 8.2 illustrates the members of this community.

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<sup>35</sup> European Regional Development Fund allocated by the European Union

Figure 8.2 Community of practice in KTO D



Source: Constructed by the author

Below I discuss what was learnt through interactions within this COP and whether learning was spontaneous or instigated by management.

#### *8.1.1.2 Learning how systematically to assess the patentability of academic inventions and inventors' motivations*

Until 2010 the BD managers used to “just meet, greet and talk about the disclosure” with the academics (BD Manager 1). This situation was problematic because BD managers sometimes lacked key information on the invention, which was necessary for the assessment and marketing of inventions. The BD manager noted that they “had a procedure, but it wasn’t often followed” (BD Manager 1). At the beginning of 2010, a disclosure form was developed by the BD manager heading the team. The other BD managers reviewed and commented on the form. The development of the new disclosure form forced the BD managers to discuss how disclosures of inventions should be handled. One of them pointed out that the form “is forcing us to evaluate all these areas” (BD Manager 1). The form makes a thorough assessment of the technology by requiring information on (1) the ownership of IP (i.e. how the research was funded, collaborators), (2) novelty of the invention (i.e. significant advantages over current solutions), (3) IP status (i.e. whether it is patented or is patentable), (4) prior art that would render the invention non-patentable, and (5) publications and other public

disclosures that likewise would render the invention non-patentable. This information allows KTO staff to assess the patentability of an invention. The form also makes a thorough assessment of the resource requirements for further development of an invention and the aspirations of the academics in taking their inventions to the market. The form requires academics to assess the commercial potential of invention, in particular, to suggest potential applications and competitors. As mentioned earlier, the market research is typically not conducted until a year after filing a first patent application (when filing a PCT patent application). Thus, although BD managers ask academics to assess market potential, they do not have routines for systematic and thorough assessment of the commercial value of invention.

The introduction of the form into the repertoire of practice gave some coherence to the work of BD managers since the same aspects are evaluated and the same kind of information is collected on each invention. The form arguably has helped to introduce timely assessment of patentability and the inventor's abilities and motivations. This solved part of the problem as noted by the IP Manager – “we're often patenting without having as much examination of the market opportunity and even the patentability”. Introduction of the disclosure form is an incremental change in ‘how’ inventions are assessed and apparently resulted from spontaneous learning in the COP.

### ***8.1.2 Learning in NOPs in KTO D***

The purpose of this section is to explain what has been learnt in KTO D through interactions within its NOPs, and why this learning occurred. First, I explore whether other KTOs are a source of knowledge for KTO D's staff involved in commercialisation.

#### ***8.1.2.1 NOPs of commercialisation staff in KTO D***

Some staff members have developed external networks which are a source of professional knowledge. The KTO director and the BD manager leading the BD team have developed close contacts with their counterparts in other KTOs. Other BD managers participated in PraxisUnico courses, AURIL conferences and other events, but have not developed close external contacts with staff members in other KTOs. The BD managers tend to rely on the Head of BD team to gather insights from other KTOs. The IP manger used to be an active member of AURIL, but she now no longer has time for external liaison. When contacts are not maintained, social capital erodes and the opportunities and possibilities to learn from NOPs decrease. This situation suggests that



the KTO management does not recognise the importance of the informal NOPs of its staff.

The IP and Contract managers, however, do have contacts with staff from other KTOs in the region. The academics from different regional universities work on ERDF-funded projects and this creates opportunities for KTO staff to interact and develop personal relations. Having joined KTO D, the Contract Manager was introduced to his counterparts in KTOs belonging to a regional consortium. He noted that these interactions have become a source of knowledge on how contract-related work is organised in other universities.

#### *8.1.2.2 Learning how to keep a record of formal contracts with external parties*

After joining KTO D, the Contract Manager developed the view that information about contracts with external parties had to be made more easily accessible. He explained why the lack of a contract database is problematic:

We have so many confidentiality agreements, [research] partnership agreements; it is difficult to keep track of what we have signed. Ideally, a BD manager should be able to come and say, 'OK, we have worked with this partner before, we know what that relationship is with them, I know who to contact within that company,' and that sort of thing. Or, 'You know what the IP was from this project' and now I know that we can advance it to the next stage. But if there is no tracking of new IP, then it is very difficult to be able to know when to explore it. (Contract Manager)

Transparency of IP ownership is very important. In fact, assessment of IP ownership is the first step after an invention is disclosed by academics. The commercialisation of co-owned IP requires a different approach from commercialisation of IP owned by the university as the interests of all co-owners must be coordinated.

The Contract Manager received support from the IP Manager and the Head of BD team to work on a contract database. He discussed with counterparts from other KTOs, belonging to a regional consortium of three universities, how they keep records of contracts. The Contract Manager described his interactions with other KTOs as follows:

It's not very structured; it's just very ad-hoc, very informal. (...) I'm discussing with them to see what they have done, so I can learn from what they have done. They have given some helpful information about how they track documents and key documents, and [I'm] getting some interesting ideas from them.

Through these interactions, the Contract Manager found out what systems other KTOs were using and their advantages and disadvantages. These interactions within his network of practice informed the record-keeping activities introduced by the Contract manager. He explained what he had done up till then:

So far, I have made a database for all of the contracts that I am currently working on, because it is difficult to keep track because there is a large number of them. Previously it wasn't very rigorous. (...) What I want to do next year, hopefully, if we can have some agreement on it, I want to work with other units within [the KTO] so that we can develop a slightly larger database. (Contract Manager)

The Contract Manager wanted to introduce a contract database for all types of contracts, which could be shared by the Contract Manager, research support staff, BD managers and the IP Manager. He noted that it would be important to get research support staff on board since they deal with research contracts. Then “the BD managers could access those [research contracts] when they want to know what the project is about or want to take it to commercialisation stage” (Contract Manager). Information on IP ownership, which is necessary to perform the IP assessment, would become easily accessible to BD managers.

Systematising the way of keeping records of contracts represents an incremental change in how record keeping is handled in KTO D. This change was shaped by learning in a NOP initiated by staff. Should the Contract Manager succeed in getting Research Support staff to use the database, assessment of IP ownership will become easier.

#### *8.1.2.3 Learning how to document IPR-related and financial data in a systematic manner*

Fusion IP, the exploitation company for Sheffield and Cardiff Universities, was hired as consultants by KTO D. It was asked for advice on the exploitation route for certain academic inventions, and it was hoped that it might take over some inventions and commercialise them. The Head of BD team worked closely with Fusion IP and observed that “they put twelve, sixteen – however many opportunities they were looking at – into *My IP* because that was what they used” (IP Manager). The Head of BD learned from interactions with Fusion IP (i.e., from interactions within his NOP) about the benefits of *My IP* and became “the front man” pioneering the introduction of *My IP* database in KTO D. He was supported by the KTO director, and other KTOs

were consulted to get a better understanding of the benefits of *My IP* (Director). The IP and BD managers discussed the possibility of purchasing *My IP* database:

We had a sort of team meeting and decided it looked quite useful, and we got the company to come and give us a presentation, and agreed that we were going to use it. Best laid plans and all that. (IP Manager)

Subsequently, *My IP* was purchased and installed on staff computers, and relevant staff received training in how to use it. The information about patents is stored in the database by the IP Manager. The BD managers, however, do not populate the database with the contact details of potential licensees and information about marketing attempts. The IP Manager lamented that:

It was meant to be a way of really tracking projects as well, you know, from disclosure through all of the, sort of, marketing and right through to successful deals. But because nobody uses it apart from me, it doesn't really get used for a lot of that. (...) It was meant to be a tool for, sort of, team working, I suppose – sort of team working. (IP Manager)

and the Contract Manager confirmed:

It's mainly [IP Manager] who is accessing it and updating it to record the process of patent application and to record [each] patent's licence revenue. There is a section on there for BDMs to enter details about opportunities and possible business deals, but I don't think any BDM currently does that. (Contract Manager)

The BD managers reported that they have not been using the database because it does not allow them to record most of their work activities. *My IP* is good for keeping records of the commercialisation of patented IP, but this is not what BD managers spend most of their time on. They focus on bringing in research funding (e.g. from public and private funders) and generating income from business engagement (e.g. ERDF projects, KTPs, CPD, or consultancies) projects and thus need a database that allows the recording of these activities. BD managers have introduced a spreadsheet that fulfils this purpose and is widely used by all BD managers. One of them explained why the spreadsheet was introduced:

One of the things that we will have to do, for example, is to justify why the university should continue to pay us. So we need some clear and precise way of capturing and articulating what benefits we think we are providing to the university. (BD Manager2)

There was “a lot of discussion about what this spreadsheet should look like” (BD Manager 2), and the BD managers ensured that it fitted their needs. The new spreadsheet has become a part of the repertoire of practice of BD managers.

This example shows how spontaneous learning in NOPs shaped changes in how records of patents are kept. It shows the difficulties of embedding knowledge gained through interactions within these networks into the organisation. The *My IP* tool was supposed to be used by staff members in different COPs. As explained earlier, the IP Manager and BD managers work in parallel, but not jointly. The lack of “joint enterprise” creates no real need for a shared repertoire of practice, such as a shared database. At the same time, this example showed that tools developed within a COP (e.g. a spreadsheet for recording income generated by business development activities) are more easily adopted if community members already have joint work activities. The KTO learnt to systematically record information about IPR status (granting of IP rights, licensing of IP rights), income from the commercialisation of patented IP, and income generated by business development activities, but not the results of market research and marketing activities. This is an example of an incremental change in ‘how’ records of IPR-related and financial information are kept.

### **8.1.3 *Limited learning across COPs***

Staff reported learning personally from interactions with other communities of practice. For example, a BD manager explained that “Through interactions with academics and commercial companies, you learn what works – (...) obviously some skills you develop which are to do with sales, either selling an idea to an academic or selling an idea to an external party” (BD Manager 1). They IP, BD and Contract managers also reported learning from patent attorneys.

However, none of the changes in commercialisation practice was reported to be related to learning from other COPs. This case corroborates the findings from Case Study C, which also showed that when there is no strong internal COP around commercialisation practice, then interactions within NOPs may shape changes in organisational practice, but interactions with other communities do not have an appreciable effect on organisational practice.

### **8.1.4 *Summary of Case Study D***

At the end of 2010 KTO D had an IP-focused commercialisation practice, underpinned by the ‘science-push model of innovation’. The analysis revealed that in

the period 2005-2010, KTO D learnt through the initiative of staff and their interactions within a COP and within NOPs. Table 8.1 summarises the findings from this case study.

Table 8.1 Summary of what KTO D has learnt, how and why

Why has KTO D learnt?	How has KTO D learnt?	
	Learning in COPs	Learning in NOPs
	What?	What?
Situating learning initiated by staff	<p>assessing systematically the patentability of academic inventions and inventors' motivations (incremental change in 'the how'; see 8.1.1.2)</p> <p>keeping records of income-generating business development activities (incremental change in 'the how', see 8.1.2.3)</p>	<p>keeping records of formal contracts with external parties (incremental change in 'the how'; see 8.1.2.2)</p> <p>documenting IPR-related and financial aspects of projects in a systematic manner (incremental change in 'the how'; see 8.1.2.3)</p>
	<p>none</p> <p>What?</p>	<p>none</p> <p>What?</p>
Situating learning instigated by management's strategic practices		

Source: Constructed by the author

Firstly, KTO D evolved its ability to record of information on IP, IPR status and income from knowledge transfer activities. In particular, the practice of keeping records of income raised through business development activities was systematised on the basis of knowledge generated through interactions within a COP. The practice of keeping records of formal contracts with external parties was systematised by the Contract Manager, who looked for insights from his NOP. Similarly, the insights gained through interactions in NOPs shaped changes made in documenting IPR-related and financial aspects of commercialisation projects. All changes in record keeping were initiated by KTO staff members and were incremental. Secondly, KTO D developed the ability to assess the appropriability of academic inventions. Specifically, learning within COPs led to incremental changes in the way data were gathered about inventions on which the assessment was based.

This case study provides interesting insights into how commercialisation practice in KTOs evolves when there is *no* community of commercialisation practice. In other

words, it reveals how commercialisation practice evolves when staff members performing commercialisation do not perceive it as one of their core work activities. First, we observe that only two kinds of activities evolved – IP assessment and record-keeping. The ability to assess the appropriability of inventions developed through learning within the community of BD managers arguably helped KTO D to minimise the number of patent applications that subsequently were rejected or had to be withdrawn. It helped avoid mistakes, but did not help directly to increase the success of knowledge flows between academia and industry (such as the ability to identify potential licensees). The ability to keep systematic records helps to monitor the obligations of the university to external parties, and vice versa, and helps also to make the due diligence process more efficient. Arguably, this ability helps to avoid mistakes, but does not help directly to increase the success of knowledge flows between academia and industry. In conclusion, when there is no community of commercialisation practice, changes in practice were marginal, showing that the knowing embedded in practice, that is, abilities, also changed only marginally.

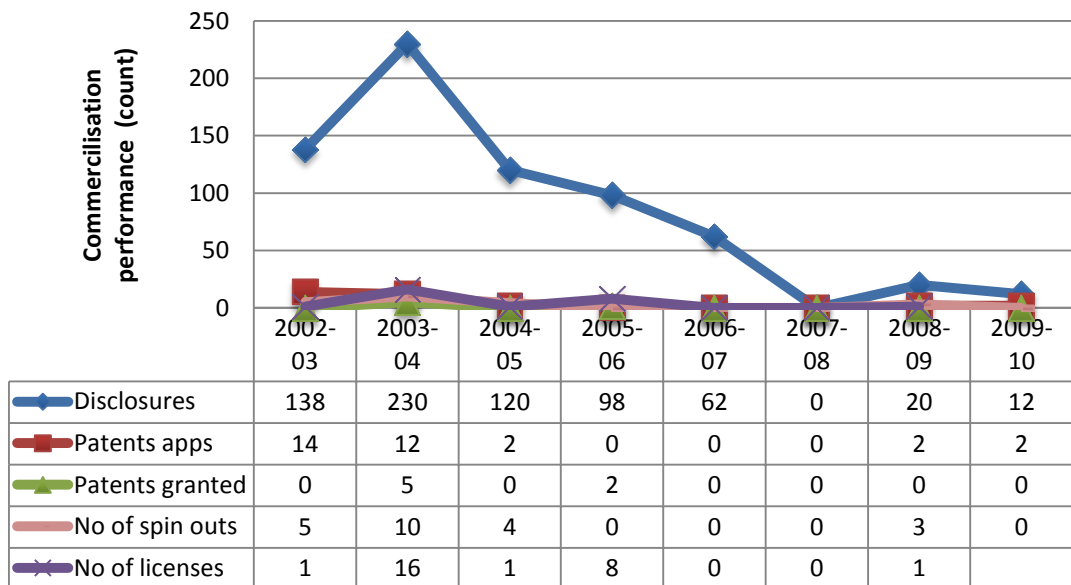
With regard to the theorised effects of situated learning, this case study provides support for the first propositions presented in Chapter 3. Specifically, I find that spontaneous learning in COPs and in NOP can result in incremental changes in ‘the how’. One of the examples (introduction of *My IP* database) shows that management’s support may be required for some incremental change in ‘the how’ to come about.

## 8.2 Case Study E - background information

This case is about learning in the KTO of a teaching-oriented university. The university is a former polytechnic which received the Royal Charter in 1992. It is a member of Million+, formerly known as the Campaign for Mainstream Universities. The university was ranked in the top 125 in the Times Higher Education's Table of Research Excellence (2008), based on average RAE scores. In 2009/10 knowledge transfer activities generated approximately £8.6 million. This included income of £2,000 from licensing and spin-out activities.

The volume of commercialisation activities is quite low as illustrated in Figure 8.3.

Figure 8.3 Commercialisation activities in University E



Source: HEBCI surveys, 2006-2011

**Information on the KTO.** The KTO is an internal unit within the university structure and is responsible for enterprise activities and research support. A unit responsible for the exploitation of the university's research outputs was formed in the late 1990s as the "regional office", and focused on working with local authorities and businesses for the employability of the university's graduates. The emphasis on income-generating entrepreneurial activities, however, began to increase gradually with the start of the HEIF funding scheme in 2002. KTO staff posts are financed by HEIF and some regional regeneration programmes as well as by the university's central funds (roughly 50% of posts). There are 16 staff working in five teams: (1) an administrative support team (finance, IT), (2) a knowledge transfer team comprising BD managers, (3) a

commercialisation team including the Senior BD Manager who heads the knowledge transfer team and the Senior Administrator who heads the administrative team and two law academics seconded to the KTO, (4) a team providing support for multidisciplinary research centres, and (5) a research support team. In the past the KTO has been responsible for student enterprise, but this activity moved to the business school in 2007. Team boundaries are very fluid and people span several roles across teams. This is most visible in the case of the commercialisation team, where as noted above, there are two academics seconded temporarily from the Law School to the KTO.

The Knowledge Transfer Team is the largest and is focused on the identification and delivery of “business support” projects. The BD managers network with regional organisations (e.g. the Regional Development Agency, Business Link, the Regional KTP Group, the local Chamber of Commerce) in order to identify companies that could benefit from working with the university. They diagnose firms’ needs and identify academics with the knowledge and skills required to address them. The “services” provided to companies can involve contract research, collaborative research, consultancy, CPD courses for the workforce and student placements. The costs of the services provided to companies are covered in part by public funding schemes, such as the ERDF, the Economic Challenge Investment Fund, the Knowledge Transfer Partnerships scheme, and the innovation vouchers scheme, among others. Since this thesis focuses on commercialisation practice, changes to how “business support” projects are identified and managed by the KTO are not discussed here.

***Information on commercialisation practice.*** As in the previous cases studies, I discuss ‘the doing’ in KTO E at the turn of 2010/2011 and draw inferences about ‘the knowing’ in this KTO. ***Identification of commercialisation opportunities*** is performed predominantly by the Senior BD Manager. He organises calls for projects, which help to identify commercialisable research outputs, among other knowledge transfer opportunities. ***IP assessment activities*** are performed by the Senior BD Manager in collaboration with the KTO director. The assessment of patentability is subcontracted to external patent agents. The commercial potential of inventions is not assessed by the KTO since the Senior BD Manager does not engage purposefully with relevant commercial organisations to assess the ‘true’ commercial value of inventions. Market research can be commissioned after a PCT patent application is filed in order to identify licensees or customers for a spin-out. ***Marketing activities*** are performed generally by



academics with some support from a BD manager who may accompany them to exhibitions or trade shows to showcase the new technology. They have not done any on-line licensing so far. “I would prefer direct contact, but there are things like an internet-based repository for IP”, the Senior BD Manager told me. Identifying potential licensees is the responsibility of the Senior BD Manager, but he has not made any attempts to gauge the interest of companies in inventions at the PCT stage of the patenting process. The current team has yet to handle licensing agreements. *The company formation activities* are performed by the Senior BD Manager, the Senior Administrator and two law academics seconded to the KTO. They have a routine for helping academics realise what it means to work in a spin-out company and they also help to secure funds from venture capitalists.

Drawing together the activities described, it becomes apparent that KTO E has developed some ability (1) to identify commercialisable research outputs, (2) to assess the appropriability of intellectual property, and (3) to secure the resources for the formation of spin-out companies. Its ability to disseminate information about academic inventions to industry and to identify licensees is rather limited as indicated by the presence of very few activities in this direction. KTO E has yet to develop the ability to negotiate licensing and shareholder agreements. The approach to identifying commercialisation opportunities and assessing IP developed in this KTO seems to be based on a ‘science-push model of innovation’. This model, as explained earlier, assumes that inventions produced by scientists, once identified and patented, will be taken up by industry. The next sections describe how and why KTO E has learnt to perform the aforementioned commercialisation activities.

### **8.2.1 Learning in COPs in KTO E**

The main purpose of this section is to explain what aspects of the KTO’s commercialisation practices have been learnt through interactions within COPs in the KTO and why this learning occurred (spontaneous or instigated by management). I first identify the COP.

#### **8.2.1.1 COPs in KTO E**

The interviews revealed two COPs in KTO E – one well established COP comprising staff undertaking business development activities, and one recently emerged COP comprising staff doing commercialisation. The focus of this thesis is on changes in

commercialisation practice. As none of the changes in the commercialisation practice resulted from learning in the established COP, consequently this COP is not discussed in detail.

***Community of practice comprising commercialisation staff.*** The emergence of this community followed a calculated approach to commercialisation activities developed by the KTO and university top management in their HEIF4 strategy:

Over time, there were different approaches through our HEIF strategy. We then really just now focus on those [research outputs] that are commercialisable and exploitable. (Director)

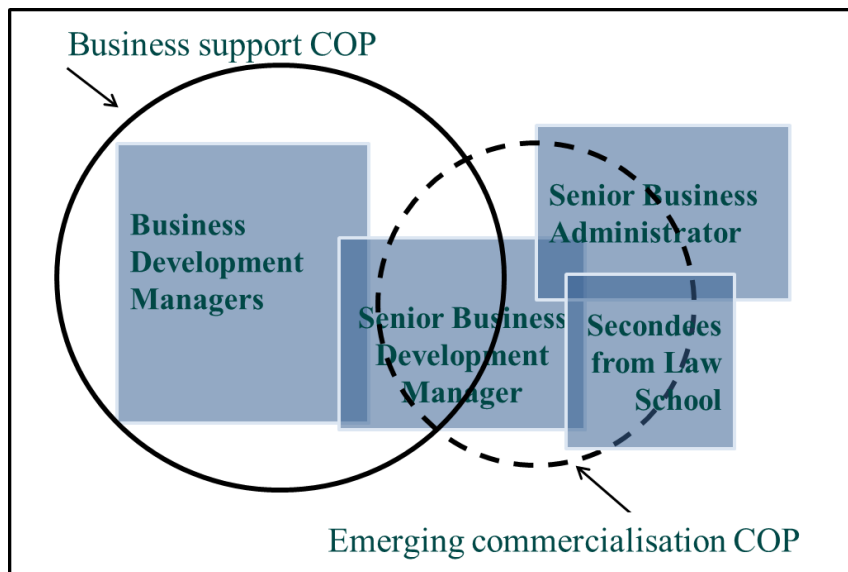
The deliberate intent to develop commercialisation activities in this university, as laid down in the university's HEIF4 strategy, has led to an increase in human resources dedicated to commercialisation. In 2002/07, commercialisation was handled externally through the Mercia Spinner programme funded by the Regional Development Agency, and previous to that by individual academics. In 2007 the KTO management employed a Senior BD Manager who now dedicates part of his time to commercialisation activities. He manages commercialisation projects from start to finish. Subsequently, the KTO director secured the secondment of two law academics from the Law School to help develop a legal framework for commercialisation activities. In 2010 a Senior Administrator was hired by the KTO who, in addition to taking care of financial aspects of KTO's activities, also spends a small fraction of his time on support for spin-out creation.

The Senior BD Manager, the Senior Administrator and two law secondees mutually engage with one another in the pursuit of commercialisation activities. They know each other well, both professionally and socially. They discuss how commercialisation activities should be pursued and what approach is suitable for the kind of institution in which they are based. They negotiate the performance of their joint enterprise – commercialisation. For example, the Senior Administrator explained how the pursuit of commercialisation activities is negotiated: “In the mock board meetings and in discussions with [BD manager, law secondees], we will bounce ideas off, [discuss] particular projects, which way we might think is best” (Senior Administrator). The joint enterprise is negotiated in informal interactions as well as in the team meetings, which have an explicit learning element on the agenda. They have jointly developed a shared

repertoire of practice, including the routine for creation of spin-outs, *My IP* patent database, and templates for licence and shareholder agreements.

Therefore, three constitutive characteristics of a COP – mutual engagement, negotiation of a joint enterprise, shared repertoire – are present in this group. However, the commercialisation staff members have not been working together for long. They have not completed any commercialisation projects together, which suggests that there are still many aspects of commercialisation that remain to be developed. Moreover, the way in which commercialisation projects are handled is evolving continually. One respondent said “that’s a fairly new process so it is changing every time” (Senior Administrator) and another respondent confirmed this, saying “for the IP and commercialisation side that’s always changing at the minute, we’re always learning new things, new methods of doing things and building structures and procedures. So that’s evolving into something that will be fairly systematic” (Senior BD Manager).

Figure 8.4 Communities of practice in KTO E



Source: constructed by the author

In summary, the interviews revealed that there are two COPs in KTO E. Figure 8.4 illustrates these communities. The Senior BD manger is a member of both COPs. I discuss below what changes in commercialisation practices were learnt through interactions within the emerging COP and whether that learning was spontaneous or instigated by management.

In accordance with my operational definition, the addition of new activities is considered a radical change in ‘the what’. Some changes in commercialisation practice in KTO E are likely to be radical because there were no pre-existing in-house activities. The Senior BD Manager portrayed the past situation:

Before I came here, there was a project which [the director] will probably tell you about called ‘Mercia Spinner’. So IP was handled through that project at that time. But there was no long-lasting legacy of how IP was handled here. So I’m starting from scratch with that and [I’m] building all those processes. (Senior BD Manager)

Thus, this case study allows gain insights into how learning in an emerging COP helps to develop ‘systematic’ and recurrent IP management, licensing and spin-out formation activities that form commercialisation practice.

#### *8.2.1.2 Learning to identify commercialisable IP*

In 2008, the KTO Director dedicated a part of the HEIF4 funds to establish an internal fund to support knowledge transfer projects. The allocation of resources triggered learning on how to identify projects that could be supported by HEIF money. The Senior BD Manager periodically issues calls for projects:

HEIF4 was a three-year programme so what we’ve done over those three years has been fairly consistent. We’ve put calls out for academics to bid into those funds and always responded in the same manner. (Senior BD Manager)

The project proposals can suggest knowledge transfer projects (e.g. development of CPD courses) as well as commercialisation projects (development of a technology for licensing or a spin-out company). Among the approximately 50 KT projects that have been financed this way, there are nine potential spin-outs and two potential licences. Previous to this procedure being put in place, there was no systematic way of identifying commercialisation opportunities. This represents a radical change in what KTO E does. The KTO director is involved in decisions on allocation of internal funds. This allows the director to control and monitor staff’s evolving approach to identifying commercialisable IP.

Subsequently, the Senior BD Manager learnt through interactions with other KTOs about how to organise drop-in sessions and seminars in academic departments to identify commercialisation opportunities. He organised the first drop-in session in 2010. This first session was quite successful and a number of academics attended to discuss

their work. The Senior BD Manager intends to run periodic drop-in sessions. If this materialises, the drop-in sessions will become a new routine in the repertoire of commercialisation practice (an incremental change in ‘the what’).

This example showed that learning in a COP instigated by management triggered the development of a new activity for the identification of commercialisation opportunities – ‘a call for projects’. I have argued that identifying research outputs (as opposed to identifying research projects with potential for commercialisable outputs) is a typical characteristic of a commercialisation practice underpinned by the ‘science-push innovation model’.

#### *8.2.1.3 Learning to assess the patentability of academic inventions and inventors’ motivations*

Before 2007, the assessment of commercialisable IP was performed via the Mercia Spinner Programme as KTO E lacked internal capacity. Management’s decision to handle the commercialisation of academic inventions in-house entailed a need to start assessing academic inventions.

The proposals sent by academics in response to ‘calls for projects’ (discussed in the previous section) are assessed by the Senior BD Manager and the Director. So far they have supported all “interesting” projects regardless of their commercial potential. The approach to assessing IP that is to be commercialised via the licensing or spin-out route was revealed in the Senior BD Manager’s story about handling a technology that is to be licensed. The technology has been patented in the UK IPO and subsequently a PCT patent application was filed, but potential licensees had yet to be contacted:

We’re just going through a new sort of round of some prototype development. And then once we’ve got the results from that, because that may open up the scope of things a little bit more, then we’ll be looking for licenses for that one. (Senior BD Manager)

They believe that if they “fully understand the economics of the new product and the scalability of it”, then they will be “able to give them [potential licensees] a fuller picture so they have fewer questions to ask and fewer reasons to say no” (Senior BD Manager). This approach shows that assessment is focused on the technical aspects of invention. The patentability of inventions has been assessed (with the help of external patent agents), but its commercial viability has been explored only through “some desk-based research” (Senior BD Manager). A dialogue with potential licensees that could provide more accurate information about the real commercial value of an invention has

not been initiated. The Senior BD Manager argued – “we’ve not approached them yet because we’d like to get our story right before we go and speak to them” (Senior BD Manager). Although the Senior BD Manager is aware that “you have to evaluate the commercial potential”, his practice does not seem to reflect this principle.

Learning in the emerging COP, which was instigated by management, allowed the development of this approach to assessing IP. This change in commercialisation practice entails the addition of activities assessing academics’ interests in commercialisation and patentability (a radical change to ‘the what’), as earlier IP assessment was handled through the Mercia Spinner Programme. I have argued that the approach to IP assessment that is focused on technology and inventor’s motivations rather than on ‘coupling’ technical and market information is typical of an IP-focused commercialisation practice.

#### *8.2.1.4 Learning to protect the university’s interest while commercialising academic inventions*

The management’s strategic intent to develop in-house commercialisation activities required the creation of a clear legal framework for licensing and spin-out activities. The Senior BD Manager and the Senior Administrator said that they had learnt much from the law secondees about IPRs, IP law, and contractual issues in licensing and spin-out creation.

For example, with regard to licensing, the members of the emerging COP have developed an understanding of what terms must, or cannot, be accepted in licence agreements. The key issues included warranties, liabilities and indemnities, provisions governing confidentiality and publications, the scope of any granted licences, provisions for which party is responsible for patenting expenditure, payments terms, duration of a contract and conditions for its termination. In other words, they have been learning *how* to protect the interest of the university in licensing activities. This has resulted in the development of a suite of legal documents, including templates for licence agreements, memorandum agreements, confidentiality agreements, and shareholder agreements. These templates have become part of the repertoire of practice and will be used in negotiations of contracts with established companies and spin-outs. They will shape the way in which the negotiations of licence and shareholding contracts will be performed.

This example shows how interactions within a COP allowed the individuals to learn how to protect the university’s interests and to develop jointly a community repertoire

of practice. Learning was instigated by the management's resource allocation activities to fund secondments from the Law School. Since the learning was taking place during the data collection period, it is not possible to say what has been its impact on commercialisation practice (e.g. licence negotiations). This example shows that individual learning of members of a COP and changes in the repertoire of practice precede changes in work practices.

#### *8.2.1.5 Learning to prepare academics for working in a spin-out*

Before 2007, the formation of spin-outs was handled via the Mercia Spinner Programme run by the Regional Development Agency. However, some commercialisation opportunities were done by the academics. The Senior Administrator summarised the previous ad-hoc approach:

(...) an exec was collared in the car park and said "Oh will you put some money in for us?" because academics are like that... and a previous employer, you know, who is Director of the Department, said "Oh, that's a good idea". But then there's been no structure to it. So the university has put money in and that's it. (...) They've been flying by the seat of their pants, you know, that's what has happened. (Senior Administrator)

Since 2007 KTO E has tried to develop a systematic approach to spin-out formation. In 2010 the Senior Administrator and the Senior BD Manager came to the conclusion that "there was a gap in the skill base of academics that might want to spin-out" (Senior Administrator). They decided "to help the training of [academic] staff" and introduced a new routine, which they refer to as "mock boards". This routine involves meetings of some stakeholders in the spin-out (academics, the faculty's administrative representative, KTO staff, the spin-out's employees) in a 'dummy board meeting'. The Senior Administrator explained that "everybody is assigned a role, so you might be Finance Director, Managing Director, you know, Commercial Director, and we might switch those as the year progresses". The Senior BD Manager and the Senior Administrator take on the roles of non-executive directors of the spin-out because they are treating themselves "as the venture capitalists putting this HEIF funding in" (Senior Administrator). The law secondees lead discussions on "licensing agreements, royalty agreements, touching on IP issues" (Senior Administrator). The meetings of a mock board may be monthly or bio-monthly, depending on the project. The routine was introduced in autumn 2010 – just a few months after the Senior Administrator joined the commercialisation team. He is responsible for, among other things, the training of

academics<sup>36</sup> and this focus has driven the creation of the mock-boards, which essentially try to ensure that academics get “on the job training ... [and] those experiences necessary to run the company” (Senior Administrator). This example clearly shows that the experience and interests of members of a COP shape changes in practice. The new routine also allows to review the progress of company formation projects in a structured manner.

In summary, interactions between the new member of the COP (the Senior Administrator) and the incumbent members shaped changes in their approach to company formation. Learning was triggered by “a gap in the skill base of academics” that members of this COP found was a problem for commercialisation. A new action (i.e. reviews/training meetings) was introduced to execute company formation activity. This example shows that members of emerging COPs can trigger and shape learning that leads to incremental change in ‘the what’.

#### *8.2.1.6 Learning how to document IPR-related and financial aspects of commercialisation projects in a systematic manner*

The members of the emerging COP realised that they needed to start systematising the way that they documented their commercialisation activities, which previously was done ad-hoc. The KTO Director was approached in order to secure resources for the purchase of a new database. The *My IP* database for documenting commercialisation projects was scrutinised and then purchased in 2010. One of the BD managers explained that

[Senior BD manager] was the one who has initiated it. He has populated a lot of it, now it has been put on to all the KT team and also rolled out to all [KTO]. (BD Manager 1)

The Senior Administrator noted that the database helps them in their work and in the creation of reports on commercialisation activities which are required by government:

That’s really improving the way that we work. (...) It keeps things ordered, but it also enables you to easily forecast when there are deadlines coming up for patents, expiry or maintenance or anything like that. (...) one aim is to be able to print out the reports that are needed for HEBCI/HEFCE and that data will come straight out of this database. (Senior BD Manager)

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<sup>36</sup> The Senior Administrator is responsible for managing the university’s training programme, which includes courses to develop the entrepreneurial skills of academics. He also trains entrepreneurial students in his spare time, using his experience of running a company.



The quote indicates that the main purpose of the database is to record information about IP status (patented or not), IPR exploitation status (e.g. licensed or not) and income from IP exploitation, data required by the HEBCI survey. There is less emphasis on recording the outcomes of marketing and market research (e.g. contact details). In fact, at the time of data collection for this thesis, the KTO was in the process of introducing a Customer Relations Management system, which could be used by all professional services and academic departments in the university for recording information on companies and public sector organisations working with the university (through research collaborations, CPD courses, KTPs and licensing).

This example shows that spontaneous learning in the COP systematised the way that records of IPR-related and financial aspects of commercialisation projects were kept. This example shows that management's endorsement may be instrumental in bringing about incremental change in 'the how'.

### **8.2.2 *Learning in NOPs in KTO E***

This section explains what was learned in KTO E through the interactions of commercialisation staff with members of their NOPs and why learning occurred. I first describe the NOPs of key KTO staff.

#### **8.2.2.1 *NOPs of commercialisation staff in KTO E***

The KTO Director is well embedded in national professional networks such as the Association of Research managers and Administrators, AURIL, a university grouping (Million +) and the online GINNN network. All BD managers and the Senior Administrator are very well embedded in various regional networks:

People in these sorts of roles in the West Midlands share information quite a bit. Through various things that have gone in the past, we've built quite a bit of a network. There's 13 HEIs in the West Midlands and we talk to each other and through different events and networks, we share information.  
(Senior BD Manager)

They work collaboratively with other KTOs, they participate in formal regional gatherings (e.g. events and training organised by the RDA, the regional KTP network) and interact informally with their counterparts in other KTOs. The regional NOPs are particularly useful for gathering information on funding opportunities, and views and reactions to funding cuts:

It's usually around opportunities to bid for funds for something. Yes, money's often a driver, I guess. But it might be on ideas for projects for

business support, it might be on who to contact in different organisations and what's happening with the regional growth fund. Because there are so many changes at the minute, we do share a lot of information on what we know they might not know and what they know we might not know. So we tend to share any snippets of information that we can. (Senior BD Manager)

This quote hints that working together in joint projects has played an important role in enabling the development of connections across the various KTOs in the region. One can infer that the RDA, which funds many joint business support projects, has stimulated the development of inter-organisational NOPs. The need for “*transformation of traditional industries*” in the West Midlands has promoted joint applications for EU-funded regional regeneration projects. The BD managers clearly learn from their NOPs how to maintain and increase the volume of business support activities – that is, they learn how to perform business development. The respondents were less forthcoming about the value of their regional networks for learning how to perform commercialisation activities. KTO E has had a business support practice for many years whereas commercialisation practice had developed only in the last three years. This explains why the NOPs of the BD managers were more willing to share information on business support practice than commercialisation practice.

The staff members involved in commercialisation activities have made some attempts to develop contacts with commercialisation staff at other KTOs. In particular, the Senior BD Manager has attended courses organised by PraxisUnico where he learnt some techniques and tips and has developed contacts that he can exploit. The Senior Administrator planned to attend PraxisUnico courses in the future. The Senior BD Manager attends meetings of the Mercia Fund attended by commercialisation experts from other KTOs and from industry. He said “we also learn from each other about how do they handle the business of creating a spin-out or managing IP or whatever” (Senior BD Manager).

The next two sections explain changes to commercialisation practice that resulted from learning in NOPs and explains whether learning was spontaneous or instigated by management.

#### 8.2.2.2 *Learning to create IP policy*

The Senior BD Manager explained that the lack of a clear policy on IP was perceived as problematic as it was difficult to “manage people's expectations from the beginning”. He explained further that:

if an academic came to me today and said “Right, I want to take this to market,” I couldn’t refer him to a policy and say “This is what happens, this is what you get as an academic, these are your rights, this is the process”. So I’m creating that part of it from scratch. (Senior BD Manager)

The Senior BD Manager was the key person working on IP policy. He described how the policy document was developed:

We’ve not got a formal working group for it, but me and a couple of colleagues do talk about different things at different times. But I try to find out what are the best bits of other universities’ policies and have a look at what seems to work for them and think about how that might work for us, because I don’t think transferring a policy from one university straight to another and just using it necessarily works for that university. So it’s been a case of reviewing lots of IP policies that I’ve downloaded from the internet that are publicly available, talking to people, going to conferences and starting to patch together what is going to work as a policy for us, and then discussing that with colleagues. We have some secondees from the Law School working in our department to advise on legal issues so they’re very useful on those sort of things as well, and obviously discuss things with my line manager and other people from across the university. (Senior BD Manager)

This suggests that the new element in the repertoire of practice – this IP policy – is being developed through learning within the COP (interactions with law secondees) and learning through interaction with members of the NOPs (interactions with other KT professionals at conferences, accessing policies used by other KTOs). The learning was spontaneous and was triggered by problems managing expectations without a clear IP policy. Since the learning was taking place at the time of the fieldwork, it is not possible to assess the impact of IP policy on commercialisation practice. However, it could be expected that, once the IP policy is finalised, it will shape the way that income from royalties is shared among the academic, the faculty and the university, and will simplify the procedure for disclosure of academic inventions, among other commercialisation activities.

### ***8.2.3 Limited learning from other COPs in KTO E***

All of the commercialisation staff said they had learned from interactions with patent agents who are a source of knowledge on IP. The KTO subcontracts searches of prior art and filing of patent applications to external patent agents, which creates opportunities for learning about the patent process and what is patentable. The Senior

BD Manager explained “they don’t divulge details, but you can learn from their experiences different things as well as the legal sort of formal processes”. The commercialisation staff also reported learning from academics about the technologies.

None of the changes in commercialisation practice was highlighted as being shaped by interactions with patent agents, academics or other professionals. In summary, learning through interactions of commercialisation staff with other COPs does not explain any of the changes in commercialisation practice in KTO E.

#### 8.2.4 Summary of Case Study E

The analysis shows that at the end of 2010 the emerging commercialisation practice in KTO E had the characteristics of IP-focused commercialisation practice, underpinned by the ‘science-push model of innovation’. The analysis has revealed that in the period 2005-2010, KTO E learnt through interactions of staff within a COP at the initiative of staff or management as well as through spontaneously initiated interactions of staff within NOPs. Table 8.2 summarises the findings from this case study.

Table 8.2 Summary of what KTO E has learnt, how and why

	How has KTO E learnt?	
	Learning in COPs	Learning across COPs
	What?	What?
Why has KTO E learnt?	<b>Situated learning initiated by staff</b>  training academics for working in a spin-out (incremental change in ‘the what’, see 8.2.1.5)  documenting IPR-related and financial aspects of commercialisation projects in a systematic manner (incremental change in ‘the how’, see 8.2.1.6)  creating IP policy (no changes in practice were observable yet; see 8.2.2.2)	creating IP policy (no changes in practice were observable yet; see 8.2.2.2)  organising drop-in session for identifying commercialisable research outputs (no change observed yet; see 8.2.1.2)
	<b>Situated learning instigated by management’s strategic practices</b>  identifying commercialisable research outputs through calls for projects (radical change in ‘the what’, see 8.2.1.2)  assessing patentability of academic inventions and inventors’ motivations (radical change in ‘the what’, see 8.2.1.3)  creating template licence and shareholder agreements (no changes in practice were observable yet; see 8.2.1.4)	<b>What?</b>

Source: Constructed by the author.

First, KTO E developed some ability to identify commercialisable research outputs. Specifically, after management allocated resources for an internal fund, staff within a COP learnt to issue calls for projects in order to identify commercialisable research outputs. Subsequently, staff learnt on their own initiative how to organise drop-in sessions through interactions with NOPs, to identify commercialisable research outputs. Second, KTO E developed some ability to assess the appropriability of academic inventions. In particular, having been prompted by management, staff members learnt through interactions within the COP about how to assess the patentability of academic inventions. Third, KTO E evolved its ability to secure appropriate (human) resources for the exploitation of academic inventions. This is exemplified by learning within a COP to develop routines to prepare academics for work in spin-out companies. The learning was initiated by staff members. Fourth, KTO E evolved its ability to keep records of information on IP, IPR status and income from commercialisation activities through the initiative of staff members and their interactions within a COP. Finally, KTO E had started developing the ability to handle contracts for IP exploitation, such as licensing or shareholder agreements. Specifically, they have been learning through interactions within a COP what provisions to include in contracts by producing a suite of standard contracts, and about how the benefits should be shared between the university and inventors by creating an IP policy. The latter has been informed by insights gained by staff through interaction within NOPs.

With regard to the theorised effects of situated learning, the findings from this case study support the first theoretical proposition that spontaneous learning in COPs results in incremental changes. Precisely, I found evidence that spontaneous learning in COPs brings about incremental changes in ‘the how’ and in ‘the what’. The incremental change in ‘the what’ resulting from spontaneous learning in COPs was observed also in Case Study C, but not any other case study. I conclude that incremental changes in ‘the what’ are most likely to occur in an emerging COP, such as those observed in KTO E and KTO C. Finally, this case study provides support for the third theoretical proposition suggesting that radical changes in ‘the what’ result from learning in a COP instigated by management. Case Study E reveals that management identifies the areas of practice that need to be developed and brokers connections among staff stimulating emergence of a new COP. Next, practice evolves through situated learning but is monitored by the management.

## 9 Discussion – insights from the six case studies

This chapter discusses the findings from the six case studies. Section 9.1 highlights new insights about the abilities of KTOs revealed by a relatively novel conceptualisation of knowledge in KTOs. Sections 9.1 and 9.2 discuss my findings in the context of previous studies on the commercialisation of academic research. Section 9.1 addresses the research questions: *What do university KTOs learn?* and Section 9.2: *How do university KTOs learn?* and *Why do university KTOs learn?* Next, the findings are discussed in relation to the situated learning theory in section 9.3. In order to ensure robustness of the analysis, alternative explanations of changes in practice are explored in section 9.4.

### 9.1 Insights into the abilities of university KTOs

Chapter 2 discussed the limitations to our understanding of the knowledge and abilities of KTOs and the tendency for previous studies to investigate KTO abilities in isolation. This thesis research has looked at all the commercialisation activities performed by KTOs, using a relatively novel approach to conceptualise KTO knowledge. It adopts a practice-based view of organisational knowledge.

According to this conceptual framework, knowledge – referred to as knowing – is embedded in practice. Knowing and doing are inseparable elements of practice and observations of ‘doing’ in a particular organisation allow inferences about ‘knowing’ in that organisation (Orlikowski, 2002). This practice-based approach involves in-depth analysis of work activities. In order to understand the abilities of KTOs, I examined the activities constituting commercialisation practice, including identifying commercialisation opportunities, assessing IP, marketing activities, licensing activities, company formation and record-keeping. A practice-based view of knowledge provides a more nuanced understanding of KTO abilities than the approaches in the literature on the commercialisation of academic research.

***Two archetypal sets of abilities.*** Analysis of commercialisation practice in six KTOs shows that some commercialisation activities can be conducted in alternative ways. Different ‘doing’ (i.e. ways of performing activities) is associated with different knowing (abilities) in KTOs. The differences in ways of performing activities allowed

me to distinguish two types of commercialisation practice. Table 9.1 summarises the similarities and differences between them.

I describe the first type of KTO commercialisation practice as *IP-focused commercialisation practice*. Based on how some commercialisation activities are performed, I concluded that KTOs that adopt this practice have the ability to (1) identify commercialisable IP, (2) assess the appropriability of IP, (3) identify “buyers” for IP, (4) make one-off transactions with commercial organisations, and (5) record information about IP and related IPRs. I argued that the IP-focused commercialisation practice is underpinned by implicit assumptions that the innovation process is linear and that the outputs of academic research can be passed on to industry, which will turn them into innovation without the need for feedback loops and long-term relations.

The second type of KTO commercialisation practice is *match-making commercialisation practice*. KTOs that adopt this practice perform commercialisation activities that show the ability to (1) identify research with potentially commercialisable outputs, (2) assess the commercial viability of academic inventions, (3) identify partners for the academics, (4) build partnerships between the university and commercial organisations, and (5) record information on IP, IPR status and commercial development. I argued that match-making commercialisation practice is underpinned by implicit assumptions that the innovation process is not linear and that science-based innovations require some matching between scientific discovery and industry needs and capabilities, two-way communication between academia and industry, and the collaboration of market and R&D experts.

However, these two types of commercialisation practice also have some common features. KTOs that are both IP-focused and match-making commercialisation type, display an ability to disseminate information about academic invention to industry through on-line and off-line marketing activities, and some ability to secure financial and human resources for exploitation. Depending on the availability of internal financial resources, the KTOs do more or less marketing and expend more or less effort on finding external funds for the further development of inventions.

The conceptual framework adopted for this thesis suggests that staff members belonging to the same COP have shared assumptions about what to do and how to do their work activities. Thus, the commercialisation activities performed by KTO staff belonging to the same COP are likely to follow one of the two alternative approaches to commercialisation. This was observed in all the KTOs studied. At the end of 2010,

KTO A (2 overlapping COPs), KTO B and KTO C (1 one COP in each) had in place a match-making commercialisation practice; KTO F (2 COPs), KTO D and KTO E (1 COP in each) had an IP-focused commercialisation practice in place. It should be noted that in KTO B and KTO C, all commercialisation activities except the identification of commercialisation opportunities were performed according to the match-making approach to commercialisation. This was because identification of commercialisation opportunities was the responsibility of the research support staff who were not part of the COP that included staff performing other commercialisation activities.

In summary, the analysis of KTO knowledge through a practice-based conceptual lens revealed sets of interlinked abilities embedded in the shared practice of COP members who share assumptions about the process of generating science-based innovation. Thus, the practice-based view of organisational knowledge, and the concepts of ‘practice’ and COP in particular, explain why KTOs develop certain abilities.

***Particularising previously identified KTO abilities.*** The conceptual framework adopted for this thesis allowed a more detailed understanding of the KTO abilities discussed in the literature. Firstly, the ability to identify licensees (Markman et al., 2005a) was demonstrated as an ability to identify ‘buyers’ or ‘partners’. Markman et al. argue that KTOs better able to identify licensees contact fewer companies before completing a deal. My findings suggest that the lower or higher number of companies contacted may reflect different rather than better or worse abilities. The KTOs with the ability to identify buyers tend to rely on the contacts of academics and restrict their search only to what is necessary to identify a buyer. KTOs with the ability to identify partners purposefully approach a large number of companies. Secondly, I found the ability to assess inventions (Ndonzuau et al., 2002) consisted either of an ability to assess the appropriability of inventions or an ability to engage with industry and to assess the commercial viability of an invention and its ‘true’ commercial value. Ndonzuau et al. (2002) overlook the fact that KTOs may take different approaches to assessing the commercial potential of inventions. My findings suggest that KTOs with the ability to assess appropriability tend to limit their commercial assessment to identifying potential applications (required for a patent application) and estimating the size of the potential market (to justify the university’s initial expenditure on the commercialisation of the invention). However, there is no detailed assessment of



commercial viability from the perspective of business. In summary, the practice-based view of knowledge highlights that studies of KTO abilities should explore in depth what KTOs do and how they do it.

Previous studies suggest that the commercialisation practice of KTOs can make technology transfer more effective or if dysfunctional practices are developed, can reduce the efficiency of technology transfer (Siegel et al., 2003). Although the analysis of the effects of practice on commercialisation performance was not the aim of my research, it should be noted that all three KTOs with match-making practice in place exhibited higher growth in the number of licence deals executed between 2002/03 and 2008/09 than KTOs with IP-focused commercialisation practices (for details see case study selection in Chapter 4). It is plausible that match-making commercialisation practice “mitigate[s] conflict caused by palpable differences in the motives, incentives, and organizational cultures of scientists, firms, and administrators” (Siegel et al., 2003: 36) and for this reason is associated with superior commercialisation performance compared to IP-focused commercialisation practice.

To summarise, my investigation of knowing in KTOs (i.e., the abilities of KTOs) based on the case studies reveals that KTOs tend to develop either IP-focused or match-making commercialisation practice. These practices are based on different implicit assumptions about the generation of science-based innovation and associated with a distinctive set of abilities. Section 9.2 discusses what the six KTOs learnt in developing their IP-focused or match-making commercialisation practice, how they learnt it and why.



Table 9.1 Summary of differences and similarities between IP-focused and match-making commercialisation practices

IP-focused commercialisation practice		Activity	Match-making commercialisation practice	
Knowing aspect of practice	Doing aspect of practice		Doing aspect of practice	Knowing aspect of practice
Ability to identify commercialisable Intellectual Property	Waiting to be informed by academics; raising awareness among academics of support for research commercialisation	1. Identification of commercialisation opportunities	KTO staff develops close relations with academics to keep on top of progress in academic research	Ability to identify research with potential for commercialisable outputs
Ability to assess appropriability of Intellectual Property	Assessment of legal aspects (ownership of IP, patentability), and technical development (progress and resource needs for further development); desk-based market research to speculate about potential applications and financial returns	2. Assessment of Intellectual Property	Assessment of legal aspects and technical development; early desk-based market research to identify the players in the relevant industry; Early interactions with companies that launched products based on similar technologies in order to estimate the value that the university's technology can add to a product	Ability to assess commercial viability of academic inventions
Ability to identify "buyers" for university's Intellectual Property	Reliance on contacts of academics whenever possible; 'First come, first served' approach One-way communication	3. Identifying licensees	Identification of potential licensees through the use of an academic's contacts and by means of market research Talks with a number of potential licensees Two-way communication	Ability to identify partners for the academics
Ability to make one-off transactions with commercial organisations	Maximising financial gains from commercialisation; protecting interests of the University; retaining IP ownership whenever possible	4. Licensing agreements and other contracts for IP exploitation	Maximising opportunities for research collaborations; Securing a win-win deal while protecting interests of the University	Ability to build partnerships between university and commercial organisations
Ability to record IP and IPR-related information	Keeping records of contracts, IP, IPR-related information and financial information	5. Record keeping	Keeping records of contracts, IP, IPR-related information and financial information and information about market engagement	Ability to record IP, IPR-related and market-related information
Ability to disseminate information about academic invention into industry	Online and off-line distribution of marketing materials	6. Marketing	Online and off-line distribution of marketing materials	Ability to disseminate information about academic invention into industry
Ability to secure financial and human resources for exploitation	Help with identify funding for further development of inventions (e.g. proof-of-concept work, seed funding); identifying commercial teams for spin-outs; mentoring academics during commercialisation process	7. Securing resources for IP exploitation	Help with identifying funding for further development of inventions (e.g. proof-of-concept work, seed funding); identifying commercial teams for spin-outs; mentoring academics during commercialisation process	Ability to help secure financial and human resources for exploitation

Note. The differences between two types of commercialisation practice are related to activities 1-5; the similarities are related to activities 6-7

Source: Constructed by the author

## 9.2 Insights into learning in university KTO

According to the conceptual framework adopted in this thesis, work practice evolves through situated learning that takes place through interactions of staff within COPs, within NOPs and across COPs. Learning can be initiated spontaneously by staff members in response to problems or opportunities, or instigated by management's strategic practices. Changes in KTO practice demonstrate what they learnt. I found some radical changes to practice – change in *what activities are performed* as part of practice (removal or addition of an ability) and *how the activities are performed* (transformation of one ability into another) and incremental changes to practice – change in *what actions are performed* to complete a certain activity and changes to *how these actions are performed* (refinement of abilities).

### 9.2.1 What university KTOs learn

This section discusses what was learnt in each of the six KTOs. KTO A, KTO B and KTO C were found to have in place match-making practice at the end of 2010. Table 9.2 provides a summary of changes in doing and related changes in knowing between 2005 and 2010, that is, it presents what was learnt in these three KTOs.

**KTO A** refined its ability (1) to assess the commercial viability of academic inventions (systematised assessment), (2) to build partnerships between the university and commercial organisations (improved at negotiating 'win-win' deals with spin-outs). The nature of these changes to practice suggests that KTO A learned to improve its match-making commercialisation practice. It also showed improvement in some activities that are not distinctive features of match-making commercialisation practice. Specifically, it (1) refined the ability to disseminate to industry information about academic invention to industry (added business-friendly ways of marketing on-line and demonstrating the commercial value of inventions in marketing materials) and (2) was developing the ability to manage university equity in spin-outs (it created an investment fund and learnt how to make contractual arrangements for investment in spin-outs).

**KTO B** (1) transformed its ability to assess appropriability into an ability to assess the commercial viability of inventions (changed its approach to commercial assessment), (2) transformed its ability to identify buyers into the ability to identify partners (broadened its market research), (3) transformed its ability for one-off transactions into an ability to build partnerships between university and commercial organisations (changed the approach to licence negotiations) and (4) refined its ability to

record IP, IPR-related and market-related information (simplified record keeping). The nature of these changes in practice, which resulted from learning, suggests that KTO B learned to transform its IP-focused practice into match-making commercialisation practice. KTO B also refined its ability to secure financial resources for exploitation (developed new ways to search for external funds).

**KTO C** has been re-developing its commercialisation practice with help of new staff following the closure of a subsidiary company that was responsible for IP commercialisation. KTO C (1) replaced its ability to assess appropriability by an ability to assess the commercial viability of inventions (started integrated assessment of the legal, technical and commercial aspects of inventions), (2) replaced its ability to make one-off transactions by an ability to build partnerships between university and commercial organisations (started handling contracts for industry-sponsored research in a business-friendly way) which it has refined (systematised its approach to protecting the university's interests in licensing contracts by introducing standard 'Heads of Terms' and new ways of sharing data with licensees), and (3) refined its ability to identify partner-licensees (developed an approach to marketing platform technologies). The nature of these changes in practice resulting from learning suggest that KTO C learned how to transform its IP-focused practice into match-making commercialisation practice.

Table 9.2 Summary of what has been learnt in KTO A, KTO B and KTO C

What ‘doing’ has changed?			What ‘knowing’ has changed?
KTO A	KTO B	KTO C	
	Failure to start identifying research with potential for commercialisable outputs	Failure to start identifying research with potential for commercialisable outputs	None
<b>Incremental in ‘the how’:</b> KTO A - assessing legal aspects, technical development and commercial viability of inventions in a systematic and rigorous way	<b>Radical in ‘the how’:</b> KTO B - assessing commercial potential of inventions in more rigorous way	<b>Radical in ‘the how’:</b> KTO C – assessing legal aspects, technical development and commercial potential of inventions in a systematic and rigorous way	Ability to assess commercial viability of academic inventions
	<b>Radical in ‘the how’:</b> KTO B - identifying a partner-licensee	<b>Incremental change in ‘the what’:</b> KTO C- identifying licensees for platform-technologies	Ability to identify partners for the academics
<b>Incremental in ‘the how’:</b> KTO A - negotiating “win-win deals” with spin-outs	<b>Radical in ‘the how’:</b> KTO B - negotiating win-win licensing deals	<b>Radical in ‘the how’:</b> KTO C - exploiting IP generated in industry-sponsored research in a business-friendly way <b>Incremental in ‘the how’:</b> KTO C - protecting university’s interests while licensing academic inventions <b>Incremental change in ‘the what’:</b> KTO C- managing relationship with a partner-licensee (sharing information)	Ability to build partnership between university and commercial organisations
	<b>Incremental in ‘the how’:</b> KTO B - recording information on IP, IPR status and commercial development		Ability to record IP-related and market-related information
<b>Incremental in ‘the what’:</b> KTO A - demonstrating commercial value of inventions in marketing flyers <b>Incremental in ‘the what’:</b> KTO A - marketing inventions online jointly with other KTOs			Ability to disseminate information about academic invention into industry
	<b>Incremental in ‘the how’:</b> KTO B - identifying funding for follow-on development of academic inventions		Ability to help secure resources for exploitation
<b>Radical in ‘the what’:</b> KTO A - managing contractual arrangements for an investment in a spin-out KTO A - setting up a fund for investments in spin-outs			Ability to manage equity in spin-outs

*Note.* <sup>1</sup> The first five abilities are distinctive features of match-making practice, the last two are observed in both match-making and IP-focused commercialisation practice.  
Source: Constructed by the author.

KTO D, KTO E and KTO F had mainly IP-focused practices at the end of 2010. Table 9.3 summarises what these three KTOs learnt between 2005 and 2010 by illustrating the changes in doing and corresponding changes in knowing.

**KTO D** refined its ability (1) to assess the appropriability of invention (introduced a standard invention disclosure form) and (2) to record IP, IPR-related and financial information (introduced new electronic databases). These were incremental changes in an IP-focused approach to IP assessment and record keeping. The nature of these changes to practice resulting from learning suggests that KTO D learned to improve its IP-focused commercialisation practice.

**KTO E** developed its commercialisation practice (before 2007 commercialisation of academic research was fully outsourced). KTO E (1) developed the ability to identify commercialisable IP (launched calls for projects, held clinic sessions), (2) developed the ability to assess the appropriability of IP (started assessing the patentability of academic inventions) and (3) refined its ability to record IP, IPR-related and financial information (introduced new electronic database). Thus, KTO E learnt how to identify commercialisation opportunities, conduct IP assessment and keep records in a way typical of IP-focused commercialisation practice. It has yet to learn how to market academic inventions and to handle IP contracts. It also made improvements to some activities that are not distinctive features of IP-focused commercialisation practice. Specifically, KTO E refined its ability to secure human resources for exploitation (mentoring academics preparing to exploit their inventions via spin-outs).

**KTO F** improved its IP-focused commercialisation practice by refining the ability to assess the appropriability of IP (systematised assessment of the legal aspects and technological development of inventions and inventors' motivations). It learnt to make changes to other activities that are not distinctive features of IP-focused practice. Specifically, it refined its ability to secure human resources for exploitation (new approach to recruiting commercial management for spin-outs) and started developing an ability to manage a brand (creating and managing the university's business brand).

Table 9.3 Summary of what has been learnt in KTO D, KTO E and KTO F

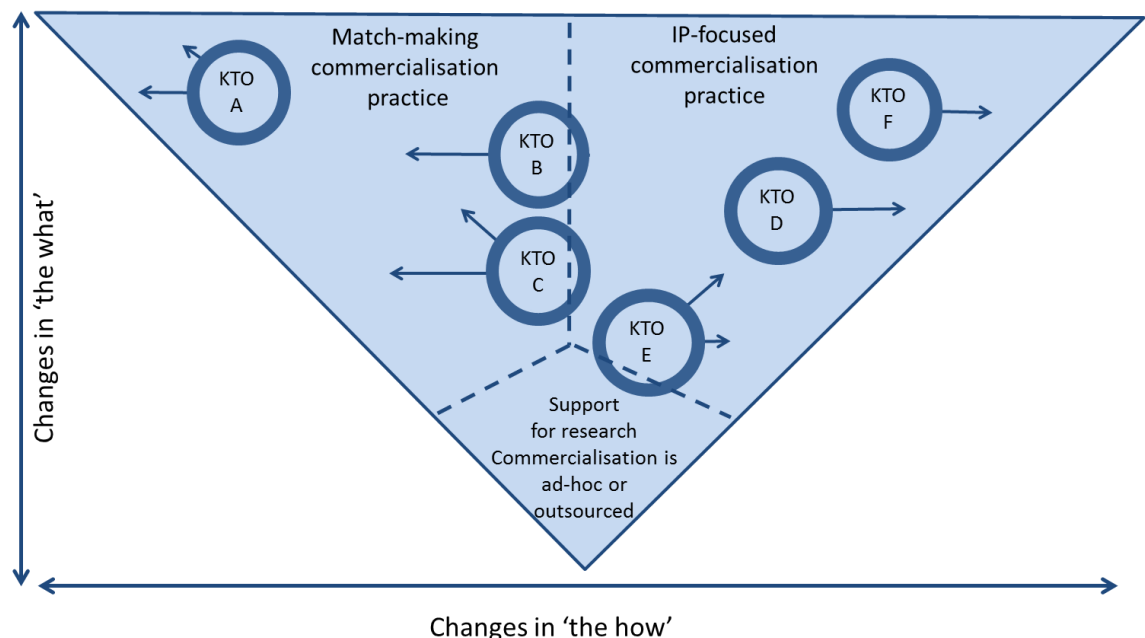
What 'doing' has changed?			What 'knowing' has changed?
KTO D	KTO E	KTO F	
	<b>Radical change in 'the what':</b> KTO E - identifying commercialisable research outputs		Ability to identify commercialisable research outputs
<b>Incremental change in 'the how':</b> KTO D - assessing systematically the patentability of academic inventions and inventors' motivations	<b>Radical change in 'the what':</b> KTO E - assessing patentability of academic inventions and inventor's motivations	<b>Incremental change in 'the how':</b> KTO F - assessing the legal aspects, technical development and the inventors' motivations in a systematic and rigorous manner	Ability to assess appropriability of academic inventions
<b>Incremental change in 'the how':</b> KTO D -keeping records of income-generating business development activities KTO D - keeping a record of formal contracts with external parties KTO D - documenting IPR-related and financial aspects of commercialisation projects in a systematic manner	<b>Incremental change in 'the how':</b> KTO E - documenting IPR-related and financial information on commercialisation projects in a systematic manner		Ability to record IP-related information
		<b>Radical change in 'the what':</b> KTO F - managing a business brand of the University	Ability to manage a brand
	<b>Incremental change in 'the what':</b> KTO E - training academics for working in a spin-out	<b>Incremental change in 'the what':</b> KTO F - recruiting commercial management for spin-outs	Ability to help secure financial and human resources for exploitation

*Note.* The first five abilities are distinctive features of KTOs with match-making practice, the last two are observed in both match-making and IP-focused commercialisation practice. Source: Constructed by the author.



*In summary*, the study revealed that one KTO learned to improve its match-making commercialisation practice (KTO A); two KTOs learned to replace their IP-focused commercialisation practice by match-making commercialisation practice (KTO B and KTO C); two KTOs learned to improve their IP-focused commercialisation practices (KTO D and KTO F) and one KTO learned to develop IP-focused commercialisation practice (KTO E). I conclude that KTOs learn to perform commercialisation typical of IP-focused practice or match-making practice. Figure 9.1 provides a graphical summary of these findings.

Figure 9.1 Learning in six KTOs



Note. Learning to perform an additional new activity or action in a manner typical of match-making practice is illustrated by a movement upwards to the left. Learning to perform an additional new activity or action in a manner typical of IP-focused commercialisation practice is illustrated by an upwards to the right movement. Learning how to perform an existing activity or action in their commercialisation practice in a way typical of match-making commercialisation practice is illustrated by a movement to the left. Learning how to perform an existing activity or action in their commercialisation practice in a way typical of IP-focused practice is illustrated by a movement to the right. Learning to perform activities that are not a distinctive feature of either type of practice are not displayed.

Source: Constructed by the author

The case studies showed that, over time, KTOs develop different practices and different abilities. Each type of commercialisation practice occurs in young and old KTOs. This finding explains why previous studies investigating the effect of KTO experience (as years of operating) on commercialisation performance have been inconclusive. Specifically, some studies show a positive relation between the number of years of operation of a KTO and its commercialisation performance (Link and Siegel,

2005b; Siegel et al., 2003; Siegel et al., 2008); others find no relation (Lockett and Wright, 2005; Markman et al., 2005a) or even a negative relation (Chapple et al., 2005). The findings from my research show that the assumption underpinning previous studies, namely, that older KTOs have better abilities, is questionable, and suggest instead that it is *what* activities KTOs perform and *how* that matter, not their age.

### 9.2.2 *How KTO learn and why*

I argued in Chapter 2 that KTO learning has been ‘black-boxed’ in previous studies on the commercialisation of academic research. The literature review shows that there are very few if any studies that explicitly and systematically explore the learning process in KTOs. This thesis research addresses this apparent gap in the literature.

I introduced the concept of situated learning to explain how the KTOs’ abilities are developed. Specifically, I suggested that situated learning takes place through interactions within COPs and NOPs and across COPs. My conceptual framework distinguishes between bottom-up triggers of learning (i.e. problems and opportunities identified by staff) and top-down triggers of learning (i.e. management’s strategic practices, such as direction-setting practice, controlling practice, resource allocation practice) to enrich our understanding of why learning occurs in KTOs.

The analysis provided the following insights into KTO learning (see Table 9.4):

- Identification of commercialisable IP was learnt through interactions within a COP instigated by the direction-setting practice of management (KTO E).
- Identification of research with potentially commercialisable outputs was learnt through interactions within a COP (comprising research support staff) following direction-setting activities of management (KTO B and KTO C). In both cases management did not succeed in stimulating learning. I argued that this was because the other activities performed by research support staff are unrelated to commercialisation and the research support staff did not perceive this new activity as core to their work practice.
- Assessment of appropriability of academic inventions was learnt through the interactions of staff within a COP (KTO E, KTO D) and through interactions within NOPs (KTO F). Learning in KTOs that had established IP-focused commercialisation practice was initiated spontaneously by staff (KTO D and KTO F), whereas learning in KTO E, which was just developing a commercialisation practice, was instigated by the direction-setting practice of management.

- Assessment of the commercial viability of academic inventions was learnt through interactions within a COP. Learning in a KTO that had an established match-making commercialisation practice was spontaneous (KTO A); learning in KTOs that were transforming from an IP-focused to match-making commercialisation practice was instigated by management's direction-setting practice (KTO C and KTO B).
- Identifying partners for academics to commercialise their inventions was instigated by the direction-setting activities of management and learnt through interactions within a COP (KTO B) or interactions within a NOP (KTO C). It was observed only in KTOs transforming from IP-focused to match-making practice.
- Building partnerships between the university and commercial organisations was learnt in a KTO with an established match-making commercialisation practice, through the interactions of staff with other COPs – specifically with the commercial management of spin-out companies and lawyers (KTO A) on the initiative of staff. Learning to build partnerships in KTOs that were transforming from an IP-focused practice to match-making commercialisation practice took place in COPs and was triggered by management's direction setting practice (KTO B and KTO C). Staff in these KTOs learnt spontaneously how to build partnerships through interactions within a COP (KTO C) and through interactions with other COPs; namely with commercial lawyers (KTO C).
- Recording IP-related information was learnt on the initiative of staff through interactions within a COP (KTO D and KTO E) and through interactions within a NOP (KTO D).
- Recording IP-related and market-related information was learnt on the initiative of staff through interactions within a COP (KTO B).
- Disseminating information about academic inventions into industry was learnt through interactions in COPs (KTO A) and NOPs (KTO A). This learning was instigated by management's direction setting practice.
- Securing resources necessary for research commercialisation was learnt through interactions in COPs (KTO E and KTO F) and across COPs (KTO B, KTO F) on the initiative of staff (KTO E and KTO B) or in response to directions set by management (KTO F)

- Managing university's equity in spin-outs was learnt through interactions in NOPs and across COPs (KTO A) on the initiative of staff (but endorsed and monitored by management).
- Managing University's brand was learnt through interactions in NOPs (KTO F). The learning was instigated and endorsed by management.
- None of the case studies provided examples of developing the ability to identify 'buyers' for academic inventions, or expertise in and ability to make one-off transactions with commercial organisations. I argue that these abilities result from a reliance on "rubrics of convenience"<sup>37</sup> (Powers and McDougall, 2005: 1030) rather than proactive learning.

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<sup>37</sup> Signing a licence agreement with companies that have already expressed interest in the technology and/or are conveniently available to contact and/or are preferred by the academic faculty

Table 9.4 Summary of how and why KTOs learn

What 'doing' has changed?	What 'knowing' that has changed?	Learning trigger: problem or opportunity perceived by staff			Learning trigger: Strategic practices of management		
		Learning in COPs	Learning in NOPs	Learning across COPs	Learning in COPs	Learning in NOPs	Learning across COPs
Identifying commercial- isation opportunities	Ability to identify commercialisable IP				KTO E (r-what)		
	Ability to identify research with potentially commercialisable IP				KTO B – Failed KTO C – Failed		
Assessing of IP	Ability to assess appropriability of academic inventions	KTO D (i-how)	KTO F (i-how)		KTO E (r-what)		
	Ability to assess commercial viability of academic inventions	KTO A (i-how)			KTO B (r-how) KTO C (r-how)		
Identifying licensees	Ability to identify “buyers”						
	Ability to identify partners for the academics				KTO B (r-how)	KTO C (i-what)	
Licensing and other IP contracts	Ability to make one-off transactions						
	Ability to build partnerships	KTO C (i -what) KTO C (i-how)		KTO A (i-how) KTO C (i-how)	KTO B (r-how) KTO C (r-how)		
Keeping records	Ability to record IP-related information	KTO D (i-how) KTO E (i-how)	KTO D (i-how) KTO D (i-how)				
	Ability to record IP-related and market-related information	KTO B (i-how)					
Marketing	Ability to disseminate information into industry				KTO A (i-what)	KTO A (i-what)	
Securing resources	Ability to secure financial and human resources for exploitation	KTO E (i-what)		KTO B (i-how)	KTO F (i-what)		KTO F (i-how)
Equity management			KTO A (r-what)	KTO A (r-what)			
Brand management						KTO F (r-what)	

Note. i-how = incremental change in ‘the how’; r-how = radical change in ‘the how’; i-what = incremental change in ‘the what’, r-what = radical change in ‘the what’, Failed – unsuccessful attempt to learn. Source: Constructed by the author.

In summary, this thesis introduces the concept of situated learning to the literature on the commercialisation of academic research and shows that situated learning theory explains how KTOs learn. The findings provide support for suggestions in previous studies that KTOs learn “through experimentation” (Debackere and Veugelers, 2005) or “by doing” (Mowery et al., 2002), but provides a more fine-grained understanding of the learning process. In particular, this research found that KTOs learn (1) through interactions within COPs – that is, among the staff members engaged in commercialisation, (2) through interactions within NOPs – that is, with commercialisation staff in other KTOs, and (3) through interaction with other COPs – that is, with commercial law experts, patent agents, entrepreneurs and venture capitalists.

Learning in KTOs was found to be initiated spontaneously by KTO staff engaged in commercialisation, or instigated by management’s direction setting practice. In particular, the direction-setting practice of KTO management was found important for stimulating the development of commercialisation practice in KTOs with no experience of commercialisation, and for stimulating transition from IP-focused commercialisation practice to match-making commercialisation practice. Management’s direction-setting was also found to be necessary to refine the ability to market academic inventions in KTOs with an established commercialisation practice. Marketing activities were not learnt on the initiative of the staff engaged in commercialisation. Finally, some changes to the way that KTOs secure resources for the exploitation of IP resulted from learning instigated by management.

### **9.3 Insights into the effects of situated learning**

Chapter 3 argued that studies inspired by situated learning theory are preoccupied with the passing the community’s knowledge on to a new generation, rather than refining COP’s existing abilities and developing new ones. This limits our understanding of how COPs transform their work practices and innovate (a similar argument can be found in Fenwick, 2008; Fox, 2000; Swan et al., 2002). Previous studies argue that changes to practice can result from situated learning through interactions *in COP* (Anand et al., 2007; Brown and Duguid, 1991; Meeuwesen, 2007; Orr, 1990; Wenger, 1998), *in NOP* (Tagliaventi and Mattarelli, 2006) and *across COP* (Mørk et al., 2008; Wenger and Snyder, 2000; Nooteboom, 2008; Amin and Roberts, 2008c). However, few of these studies pay attention to what kinds of change result from

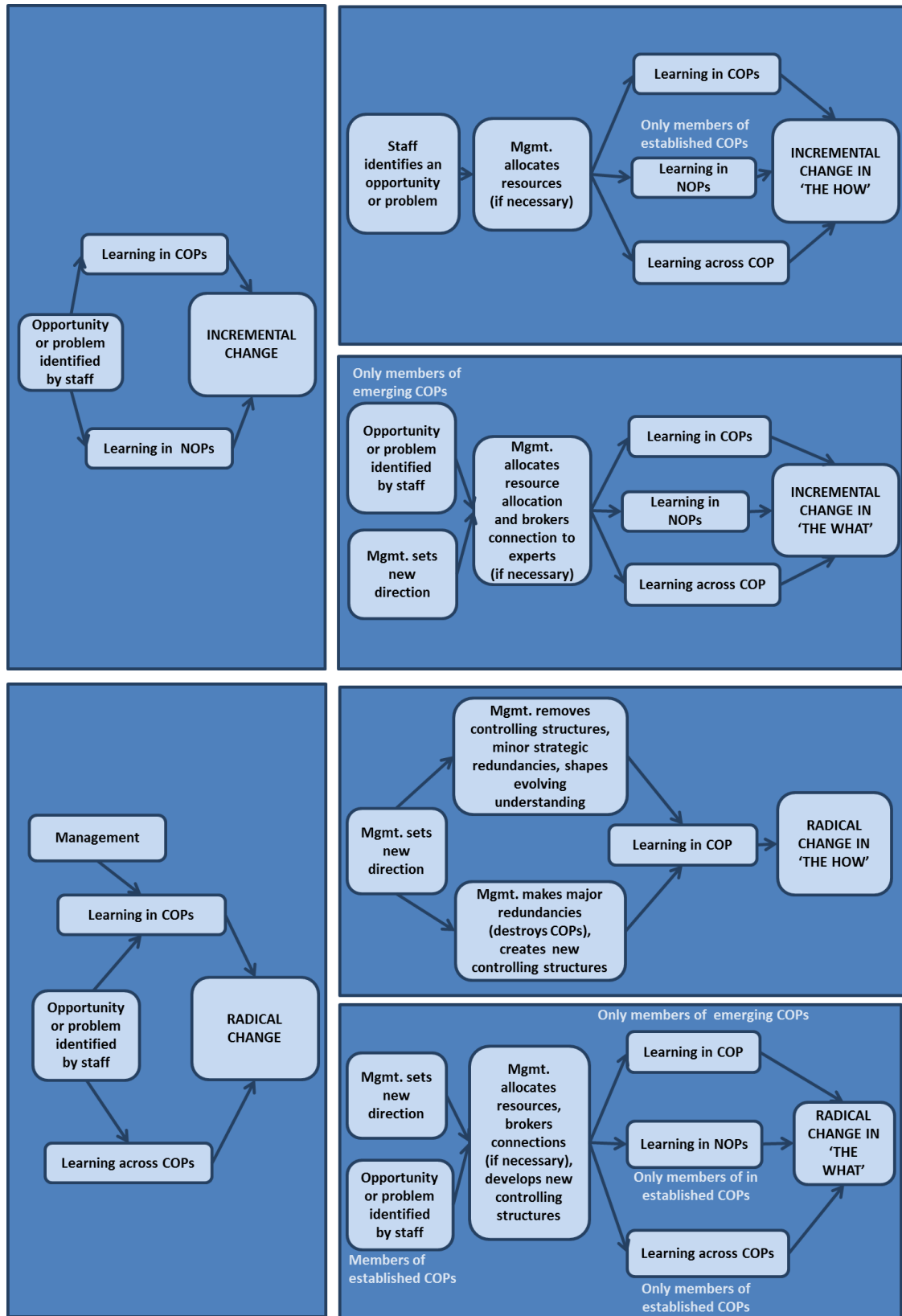
this learning and why the learning occurred. Previous work tends also to look at only one form of learning at a time (e.g. only learning in a COP). I argue that our understanding of how situated learning transforms work practices would be enhanced by (1) distinguishing different kinds of change (incremental and radical changes in ‘what’ is done and ‘how’ it is done); (2) exploring what form of situated learning leads to each kind of change (learning in COPs, in NOPs or across COPs); and (3) exploring the role of management in triggering situated learning and sharing its trajectory.

The aim was to develop a theory of situated learning through simultaneous examination of the triggers and consequences of situated learning. Huff (2009) suggests that research aimed at theory development can benefit from before-and-after models representing the theoretical arguments in the literature and the theoretical insights arising from the current research. Figure 9.2 presents before-and-after models. The models portraying how situated learning transforms work practices that were developed on the basis of findings from previous studies are on the left-hand side, the improved models portraying how situated learning transforms work practices developed on the basis of findings from the six case studies are on the right-hand side. Each final learning outcome is discussed separately. The next two sections discuss how the findings from the six case studies relate to the literature. Some of my findings corroborate existing theoretical propositions and some extend our understanding.

Figure 9.2 Comparison of my empirical findings with those of previous studies

## FINDINGS FROM PREVIOUS STUDIES

## FINDINGS FROM SIX CASE STUDIES



Source: Constructed by the author.



***Incremental changes.*** I distinguish (1) incremental change in ‘the what’ – change in what actions are performed in order to complete a particular activities within the practice and (2) incremental change in ‘the how’ – change in how actions are performed to complete some activities within the practice. Previous studies show that incremental changes to activities constituting work practices result from situated learning in COPs initiated by community members (Wenger, 1998; Brown and Duguid, 1991). Five case studies corroborated this finding, showing that incremental changes in ‘the how’ (KTO A, KTO B, KTO C, KTO D, KTO E) and incremental changes in ‘the what’ (KTO C and KTO E) result from spontaneous learning in COPs. Previous studies show also that incremental changes arise through learning in NOPs instigated by staff (Tagliaventi and Mattarelli, 2006). Two case studies (KTO D and KTO F) confirm this finding. This thesis provides new insights into how incremental changes to practice come about. Four case studies showed that members of a COP can learn through interactions with other communities about how to make incremental changes to the way they perform their work activities. This applies to both emerging and established COPs (KTO A, KTO B, KTO C and KTO F). My research also shows the interplay between the strategic practices of management and situated learning in the process through which incremental changes emerge.

I show that the mechanism described in the literature (Brown and Duguid, 1991; Tagliaventi and Mattarelli, 2006), showing that members of COPs identify problems or opportunities and learn within a COP or NOPs to make incremental changes to practice without the support of management, relates only some incremental changes in ‘the how’ (KTO A, B, C, D, F). When incremental changes in ‘the how’ entail the introduction of expensive tools, the management’s endorsement is necessary (found in KTO E, C, D). Moreover, COP members also learn to make incremental changes in ‘the how’ through interactions across COPs (found in KTO A, B, C). In the context of KTO, some interactions across COPs were possible thanks to resources allocated by management for bringing in external experts. This mechanism (no 1) is presented in Table 9.5.

The findings reveal two more mechanisms promoting incremental changes to practice. Specifically, members of COPs may identify new ways of doing things and seek endorsement from management. In these cases, incremental changes to ‘the what’ come about through learning in a COP and the role of management is limited to providing necessary resources. This mechanism (no 2 in Table 9.5) was observed in KTO C and E. Alternatively, management identifies a need for new ways of doing

things and communicates them to COP members through direction setting practice. Once the learning is triggered by management, staff learn through interactions within the COP or NOPs or across COPs how to execute a new action. The role of management is to provide the necessary resources and sometimes to create the opportunity for learning in NOPs or across COPs by brokering a connection to external experts. This mechanism (no 3 in Table 9.5) was observed in KTO A, C, and F.

***Radical changes to practice.*** I distinguish (1) radical change in ‘the what’ – change in the activities that are performed as part of the practice and (2) radical change to ‘the how’ – changes to the object of an activity in the practice that requires transformations to the way the activity is performed. Previous studies provide some evidence that radical changes to practice are informed by learning in COPs (Anand et al., 2007; Swan et al., 2002) and learning across COPs (Amin and Roberts, 2008c; Nooteboom, 2008). My findings corroborate the results of these studies. The case studies show that learning in a COP underpins radical changes to ‘the how’ (KTO B and C) and radical changes to ‘the what’ (KTO E). These latter may be informed also by learning across COPs (KTO A). This thesis provides new insights into how radical changes in practice come about. Firstly, I found that radical changes in ‘the what’ may be shaped also by learning in NOPs (KTO A and F). Secondly, the findings shed light on the interplay between the strategic practices of management and situated learning, in the emergence of radical changes to practice. I identified four mechanisms.

Mechanism no 4 in Table 9.5 is based on the process where opportunities for the addition of a new activity to existing practice (radical change in ‘the what’) is identified by COP members who seek its endorsement from management. This dynamic was observed by Anand et al. (2007). I found also that COP members seek new insights from NOPs and from interactions across COPs to inform their emerging approaches to performing the new activity. Management provides resources and connects staff to external experts (if required) and subsequently develops new controlling structures to monitor the development of the practice and keep it aligned with organisational goals. This mechanism was observed in KTO A, which introduced equity management activity into its commercialisation practice. This is the only example of radical change being triggered by COP members.

Mechanism no 5 in Table 9.5 also describes the emergence of radical change in ‘the what’. However, in this case the opportunity for development of new activities is identified by management which sets a new direction, promotes interactions among staff members, and allocates organisational resources (people, time, money) for the development of new activities. This facilitates the emergence of a new COP in which members interact to learn how to perform the new activities. This dynamic was observed by Swan et al. (2002). I found also that management continues to monitor the trajectory of situated learning through new controlling structures that help to ensure that the emerging practice is aligned with organisational goals. This mechanism was observed in KTO E, which has started to develop commercialisation practice and in KTO F, which started branding activities.

Roberts (2006: 630) notes that “radical change may be very difficult to bring about within existing communities, and may be more easily introduced through the destruction of old communities and the emergence of new ones”. Indeed one of the case studies (KTO C) illustrates that this is the route that some organisations followed – as illustrated by another mechanism (no 6 in Table 9.5). This mechanism shows that radical changes in ‘the how’ are triggered by the direction-setting practices of management, which destroy existing practice, set direction and constraints for new practice and monitor situated learning in the emerging COP. Here COP members learn to perform activities aligned with organisational goals.

It is difficult but not impossible to bring about a radical change within existing COP, (see case study of KTO B). Mechanism no 7 in Table 9.5 shows that radical change in ‘the how’ may come about through close engagement of management with COP members. The learning is triggered by management and takes place in a COP. The role of management is to destabilise the COP’s practice and shape COP members’ evolving understanding of their practice.

Table 9.5 The interplay between strategising and situated learning in developing and refining abilities

Learning outcome	Refinement of existing ability			Addition of an ability		Transformation of an ability into another one	
	Incremental changes in 'the how'	Incremental changes in 'the what'		Radical changes in 'the what'		Radical changes in 'the how'	
Mechanism	1	2	3	4	5	6	7
What triggers learning?	Staff identifies problems and opportunities	Staff identifies problems and opportunities	Strategic practices of mgmt.	Staff identifies problems and opportunities	Strategic practices of mgmt.	Strategic practices of mgmt.	Strategic practices of mgmt.
How is new knowledge created?	in a COP in a NOP across COPs	in a COP	in a COP in a NOP across COPs	in a NOP across COPs	in a COP	in a COP	in a COP
What role does management take up?	<i>None or Endorse</i> - mgmt. allocates resources for purchase of new tools	<i>Endorse</i> - mgmt. allocates resources for development of new actions	<i>Set direction</i> – mgmt. identifies practice area that need improvement  <i>Endorse</i> – mgmt. allocates resources for performance of new actions, brokers connections to knowledgeable individuals, if necessary	<i>Endorse</i> – mgmt. allocates resources, brokers connections to knowledgeable individuals, if necessary  <i>Monitor learning trajectory</i> : mgmt. develops new controlling structures to monitor whether developing practice is aligned with organisational goals.	<i>Set direction</i> –mgmt. identifies practice area that need improvement  <i>Endorse</i> – mgmt. allocates resources, brokers connections to knowledgeable individuals, if necessary  <i>Monitor learning trajectory</i> : mgmt. develops new controlling structures to monitor whether practice evolving through situated learning in the emerging COP is aligned with organisational goals.	<i>Set direction</i> –mgmt. identifies practice area that need improvement  <i>Destroy</i> - mgmt. destroys previous practices by making most staff redundant  <i>Set directions/ constraints</i> – mgmt. creates rules and policies  <i>Monitor learning trajectory</i> : mgmt. develops new controlling structures to monitor whether practice evolving through situated learning in the emerging COP is aligned with organisational goals.	<i>Set direction</i> –mgmt. identifies practice area that need improvement  <i>Destabilise practice</i> – mgmt. removes sources of inertia in practice (formal procedures, staff who are resistant to changes, cut resources)  <i>Shape learning trajectory</i> – mgmt. engages with COP members to shape their evolving understanding of the shared practice

Source: Constructed by the author.

In summary, the insights gained from the six case studies point to seven mechanisms illustrating the dynamic between strategic management and situated learning in the process of making changes to organisational practice. While previous work suggests that managers play an important role in nurturing and shaping situated learning by COP members, there is little evidence to support these claims (Swan et al., 2002). This thesis enriches our understanding of this dynamic by specifying seven mechanisms – six of which are partly identified or alluded to in previous studies (mechanisms number 1, 2, 3, 4, 5, 6) and one that provides a new insight (mechanism number 7).

This section has discussed the findings in the light of previous studies of situated learning and outlined the contributions of this thesis to situated learning theory. In order to ensure the internal validity of these inferences, the next section explores whether other theories could explain the observed changes in practice

#### **9.4 Alternative explanations of changes in practice**

It has been shown that empirically observed changes in practice can be explained by the concepts of situated learning and strategising. The findings in this thesis support the propositions made on the basis of previous studies and allow new theoretical propositions about how situated learning can transform work practices. In order to avoid a confirmation bias in the analysis, it is important to investigate whether the empirical observations can be explained by other theories. This ensures theory triangulation (Stake, 1995) and increases internal validity of the study. Two alternative explanations of changes in commercialisation practice in the KTOs are discussed (discussed already in Chapter 4, Section 4.3.3).

***Organisational culture.*** I explored whether organisational culture could offer a more compelling explanation of the changes to commercialisation practices. The selected cases included KTOs operating within different organisational cultures. Five are in research-oriented universities (KTO A and KTO F in Russell Group universities, and KTO B, KTO C and KTO E in 1994 Group universities) and one is in a university with a teaching-oriented culture (KTO E). The changes observed in KTO B and KTO C were broadly similar. Both KTOs were transforming from IP-focused practice to match-making practice. However, the observed changes in the KTO A and KTO F were different. KTO A had introduced a number of changes aimed at improving its match-making commercialisation practice (e.g. systematising the assessment of commercial

viability, making contracts with spin-outs ‘friendlier’ for next-round investors, and ensuring that marketing materials were written in business-friendly language); KTO F had introduced changes aimed at improving its IP-focused practice (e.g. systematising the assessment of appropriability). The changes in KTO F were similar to those observed in KTO E, which belongs to a teaching-oriented university in the Million+ Group. KTO E was developing an IP-focused practice (e.g. it had started identifying commercialisable research outputs, and assessing the appropriability of academic inventions). Thus, the observed changes in commercialisation practice differed across some KTOs belonging to universities with a similar organisational culture and were similar across KTOs belonging to universities with different organisational cultures. These observations suggest that the concept of organisational culture cannot explain similarities and differences in changes to practice observed across the six KTOs.

***National institutional context.*** I explored whether institutional context might offer a more compelling explanation of changes in commercialisation practices than the proposed conceptual framework. Institutional context has been shown to shape work practices in organisations (Gherardi and Perrotta, 2011). Also, the institutional context, for example, national policies and laws, has been shown to affect the commercialisation of academic research (Sampat et al., 2003; Adamsone-Fiskovica et al., 2009; Grady and Pratt, 2000). As already argued (see Chapter 5), if national policies were the dominant determinant of changes in commercialisation practice in university KTOs, then we would expect to observe similar changes in practice and subsequently convergence in commercialisation practice across all KTOs operating within the same policy framework. The review of UK national policy for university-industry links revealed that, in the period 2005-2010 covered by this study, the policies encouraged more collaborative relations between universities and business rather than simple technology transfer transactions. Given this national institutional context, one could expect that all KTOs would make their practices more collaborative. In other words, they could be expected to adopt or to improve a match-making commercialisation practice. The empirical evidence does not support this prediction. Three KTOs were developing match-making practices, but three KTOs were refining or developing IP-focused practices. Thus, institutional context does not explain changes in commercialisation practice in the latter three KTOs.

In summary, the two rival theories do not offer more compelling explanations of changes in practice than the explanations proposed by the theoretical framework combining the concepts of situated learning and strategising. I conclude that situated learning and strategic practices of management offer a robust explanation of changes in KTO's commercialisation practices.

## 10 Conclusions

This thesis has analysed the process of learning in university KTOs in order to improve our understanding of how KTOs develop abilities for the commercialisation of academic research. It analysed six cases (Chapters 5, 6, 7) and discussed theoretical implications (Chapter 9). Chapter 10 provides the conclusions and highlights the contribution of this thesis research to the academic literature. It presents some implications of the findings for policy and practice, outlines the limitations of this research and offers suggestions for future work.

### 10.1 Thesis contributions

Anne Huff (2009) distinguishes between (1) contributions to scholarly conversation that enrich the understanding of a phenomenon that is the focus of such conversation and (2) contributions that aim to change the course of the scholarly conversation. This thesis arguably makes both kinds of contributions.

Firstly, this thesis contributes to the scholarly conversation on the knowledge and abilities of KTOs by showing that KTOs tend to develop either IP-focused commercialisation practice or match-making commercialisation practice. Each type of practice is based on different implicit assumptions about generating science-based innovation and each is associated with a different set of abilities. This finding offers more fine-grained understanding of KTO abilities than is provided in previous studies. This contribution is based on a practice-based understanding of organisational knowledge novel in the literature on commercialisation of academic research.

Secondly, this thesis argues that there is a need for a better understanding of how the abilities of KTOs, shown in the literature to affect commercialisation performance, are developed. I suggest a change in focus of scholarly conversation from explaining the effects of KTOs abilities to explaining their antecedents. This thesis introduces the concept of situated learning to the literature on commercialisation of academic research and shows that situated learning contributes to explaining how KTOs learn.

Lastly, this thesis contributes to developing situated learning theory. In particular, it contributes to the scholarly conversation on the consequences of situated learning by illustrating the roles of COP members and managers in the introduction of different type of change to organisational practice. It suggests seven mechanisms that demonstrate the interplay between situated learning and management's strategic practices, highlighting



how learning is triggered and nurtured, and how the trajectory of situated learning aligns with organisational goals.

## **10.2 Recommendations for policy and practice**

The findings in this thesis offer insights that may be of interest to a number of stakeholders concerned about the effectiveness of university-industry knowledge transfer.

An important implication of my research findings is related to how to tackle the problem of inadequate abilities of university KTOs. In the past the UK Government supported organisations providing training courses for knowledge transfer professionals, and university and KTO management actively encourage their knowledge transfer professionals to participate in these courses. While class-based learning is a positive mechanism, it may not be sufficient. My research found that KTO's commercialisation practices are transformed predominantly through learning based on informal knowledge sharing within KTOs, across KTOs and through interactions with other professionals such as patent agents or venture capitalists. It shows also that such informal social learning may need to be triggered and nurtured. Governments and university management could do more to support these forms of learning.

### ***Suggestions for government***

- Government could provide funds for programmes to support knowledge sharing across university KTOs. In the UK, the Fast Forward competition (explained in footnote 15, page 94) run by the UK IPO is a step in this direction, but is not explicitly directed at stimulating collaboration among KTOs. The competition supports projects run jointly by consortia of KTOs as well as projects proposed by single KTOs. Government could create a programme for university KTOs similar to the Beacon Scheme for local government in the UK. The Beacon Scheme, introduced in 1999, identifies good practice and innovative services in local government and supports peer to peer learning across local councils. Such a scheme could help KTOs with less advanced commercialisation practice to catch-up and could diffuse the most innovative practices across the sector.

***Suggestions for university and KTO management***

- University and KTO management should encourage staff to develop and maintain networks of contacts with their peers in other KTOs (e.g. to encourage staff to engage in closer collaboration with KTOs within a region). This may be particularly beneficial for staff whose work practice does not overlap much with practice of their colleagues allowing fewer opportunities to learn through interactions. My research suggests that marketing managers in larger KTOs and IP managers in KTOs in teaching-oriented universities in particular, could benefit from collaboration with opposite numbers in other KTOs.
- University and KTO management should create environments conducive to the emergence of COPs. This includes space and time for social interactions (e.g. by co-locating staff involved in commercialisation), ensuring continuity of relations (e.g. by reducing staff turn-over) and allowing staff to make decisions about work practices on the basis of their learning.
- University and KTO management should try to strike a balance between providing autonomy and space for informal learning, and directing the development of practice. Informal learning initiated spontaneously by KTO staff helps to refine the abilities in KTOs and occasionally can result in radical changes and new abilities. A systematic approach to the development of new abilities and transformation of existing ones requires some management input. Specifically, KTO management needs to set new directions, provide resources and ensure that evolving practice is aligned with organisational goals while allowing staff to develop new abilities based on informal learning.

In addition to insights into learning processes, the findings in this thesis show that some university KTOs operate on the assumption that the innovation process is linear, that scientific discovery is followed by technological development in companies. There is a lack of awareness in some KTOs that feedback from companies and long-term relationships between universities and industry contribute to effective commercialisation practice. This is somehow worrying as there is robust evidence that the linear model of innovation is inadequate for understanding how research feeds into economic growth, among other things. My research shows that KTOs that assume a linear innovation process develop different practice and different sets of abilities to those KTOs with a more nuanced view of the innovation process which show higher

growth rates of licensing and spin-out activity. The evidence in this thesis suggests that the practices of KTOs with a non-linear view of innovation are more effective at generating licences.

***Suggestions to organisation providing training for knowledge transfer professionals***

- Training organisations, such as PraxisUnico in the UK, should ensure that knowledge transfer professionals are trained in specific skills and understanding of IP law and have a broad understanding of the innovation process and the role of universities in the national and regional innovation systems.

**10.3 Limitations and avenues for future research**

Section 9.4 ruled out the possibility of alternative explanations for the observed changes in practice and confirms that situated learning and management's strategic practices are valid explanations of the observed changes to practice. However, the findings of this thesis research and implications should be considered in light of its limitations.

***Breadth and depth of data collection.*** The multiple case study research design provides the breadth of data necessary to address the research questions and draw meaningful conclusions about learning in university KTOs. However, this breadth comes at the cost of fine detailed data, which cannot be collected via interviews. For example, only changes reported by the interviewees could be explored. It is possible that some changes were overlooked or intentionally not mentioned by the interviewees. In order to address the first concern, interviews were conducted with a number of employees in each KTO, including senior and junior staff. Interviews with junior staff were particularly helpful in this context, because their responses generally were less strategic. While multiple interviews in each KTO reduce the problem of missing information to some extent, I cannot rule out the possibility that information about certain changes to practice were intentionally suppressed. Moreover, a multiple case study design made it impossible to interview all employees in every KTO. While the interviews with the key actors, in my view, provided a fairly comprehensive picture of learning in the KTOs, I recognise that interviews with all the staff members in a KTO, combined with a mapping of all their networks would provide stronger evidence of mutual engagement underpinning learning. In order to avoid these shortcomings, future

studies could employ an ethnographic method of participant observation combined with interviews and network analysis method.

***Data collection at one point in time.*** A longitudinal study involving data collection at multiple points in time would have been more appropriate for the type of questions posed by this thesis. Unfortunately, given the limited time-frame for the completion of a PhD thesis, this kind of longitudinal research design was not feasible. Revisiting the six KTOs to collect more recent data could bring interesting insights, for example, showing whether learning experience reported by the KTO staff at the time of the fieldwork for this thesis research subsequently was embedded in practice.

***Effects of two types of commercialisation practice on performance.*** This thesis identified two types of commercialisation practice – IP-focused and match-making. All three KTOs with match-making practice in place exhibited higher growth in the number of licence deals executed between 2002/03 and 2008/09 than KTOs with IP-focused commercialisation practices. While this would suggest that match-making commercialisation practice is more likely to lead to superior performance in the exploitation of academic inventions via licensing compared to IP-focused commercialisation practice, a study based on a bigger number of KTOs would provide more robust evidence. Future studies could establish a method for diagnosing the type of commercialisation practice in a KTO on the basis of the insights provided by this thesis. A larger number of KTOs could be surveyed and the relationship between the two types of practice and commercialisation performance could be explored systematically and rigorously.

***Understanding the learning process.*** This study investigated only successful attempts to learn to make changes in ‘the what’ and ‘the how’. Although there were some examples of failed learning, they were not systematically explored. In order to shed more light on why learning occurs in KTOs, it would be helpful to investigate in detail the barriers to and facilitators of informal social learning in KTOs and also the factors facilitating and hindering the process of embedding experience gained through interaction with others, into work practices (e.g. power relations). For, example, my findings show that interactions within NOPs may be an important source of knowledge for KTOs but some KTOs learned more than others from their NOPs. Future studies could explain this finding by analysing in-depth the factors facilitating and hindering learning through interaction within NOPs, in a larger sample of KTOs in different types

of universities. Future research along these lines would provide further valuable insights into the development of KTO's abilities.

***The propinquity between business development practice and IP-focused commercialisation practice.*** Business development practice is focused on sales of academic expertise through various mechanisms, such as contract research, consultancy projects, or CPD courses for external clients. Interestingly, the presence of a vibrant business development practice seems to coincide with IP-focused commercialisation practice (as in KTO D, KTO E and KTO F). There could be several reasons for this phenomenon, which are not explored in detail in this thesis. First, it is possible that university and KTO top management set generation of income from all modes of knowledge and technology transfer as a strategic goal. This strategy then entails the development of a vibrant set of business development activities and IP-focused commercialisation practice, explaining why these two co-occur. Alternatively, the university and KTO top management may set income generation as a strategic goal for business development activities, but not for licensing and spin-outs. However, sales-focused BD managers affect the way that managers responsible for the commercialisation of academic research perform their work, through informal interactions. This is likely to occur when the communication of strategic goals to staff is poor. Future studies could explore these possibilities to explain the co-occurrence of vibrant business development practice and an IP-focused commercialisation practice.

***Generalisability of the theoretical propositions.*** Amin and Roberts (2008c) point out that there are different types of communities that are loci of situated learning. They distinguish craft-task-based communities, professional communities, and expert, high creativity and virtual communities. The COPs in KTOs have the characteristics of professional communities and, thus, the findings related to the effects of learning in these communities are not generalisable to other COP types. Investigation of the interplay between strategic practices of management and situated learning in professional COPs in other organisational contexts and in other kinds of COPs would verify whether the mechanisms uncovered by this thesis research are more prevalent.

#### **10.4 Summary**

This thesis argues that there is a need to enrich our understanding of learning in university KTOs. The practice-based view of organisational knowledge and learning

adopted in six case studies has produced some new insights. The research reveals that KTOs tend to develop either IP-focused or match-making commercialisation practice – each of which is based on different implicit assumptions about generating science-based innovation, and associated with a different set of abilities. The findings demonstrate that KTO abilities to commercialise academic research are developed and refined through informal social learning, highlighting the importance of knowledge transfer managers' social interactions within KTO and across KTOs, and interactions with other professionals. The research has found that evolving commercialisation practice is shaped by situated learning and the strategic practices of KTO management, implying that both knowledge transfer managers and KTO management play crucial roles in the development and refinement of the abilities to commercialise academic research. The thesis contributes to the literature on the commercialisation of academic research by showing how and why university KTOs learn and to the situated learning theory by revealing the interplay between situated learning and strategic practices of management in bringing about changes to organisational practices.

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## 12 Annex

### 12.1 Annex 1 - The distribution of universities across different levels of commercialisation performance measures

Improvement in the number of licence agreements			
Improvement in generating invention disclosures			
	High	Medium	Low
	Group 1 1. University of Liverpool 2. University of Reading 3. St George's Hospital Medical School 4. University of Edinburgh	Group 4 1. University of Durham 2. University of Hull 3. Imperial College London 4. University of Manchester 5. University of Newcastle upon Tyne 6. University of Surrey 7. Queen's University Belfast	Group 7 1. University of Bradford 2. Institute of Cancer Research 3. Cranfield University 4. University of Hertfordshire 5. King's College London 6. School of Pharmacy 7. University of Southampton 8. University of Sussex 9. University of Wolverhampton 10. University of St Andrews
	Group 2 1. Aston University 2. University of Exeter 3. University of Leeds 4. University of Leicester 5. Royal Veterinary College 6. Herriot-Watt University	Group 5 1. University of Bristol 2. University of Oxford 3. Keele University 4. Queen Mary, University of London 5. Royal College of Art 6. University College London 7. University of the West of England, Bristol 8. Cardiff University	Group 8 1. University of Cambridge 2. University of the Arts London 3. London South Bank University 4. University of Salford 5. Robert Gordon University 6. University of Strathclyde
	Group 3 1. Birmingham City University 2. Coventry University 3. University of East Anglia 4. Liverpool John Moores University 5. Sheffield Hallam University 6. University of Teesside 7. University of York 8. Aberystwyth University 9. Bangor University 10. University of Glamorgan 11. Swansea University	Group 6 1. University of Brighton 2. De Montfort University 3. University of Kent 4. Loughborough University 5. University of Nottingham 6. University of Warwick University of Glasgow	Group 9 1. University of Birmingham 2. Staffordshire University 3. University of Aberdeen 4. University of Dundee



## 12.2 Annex 2 - List of interviewees

Position of an interviewee	Interview date
<b>Case Study A</b>	
Director of a KTO	30.11.2010
Head of Commercial Development	01.12.2010
Licensing Manager	30.11.2010
Business Development Manager 1	07.01.2011
Business Development Manager 2	01.12.2010
Marketing manager	30.11.2010
<b>Case Study B</b>	
Director of a KTO	10.01.2011
Licensing Manager	10.01.2011
IP Manager 1	10.01.2011
IP Manager 2	14.03.2011
Former Business Development Manager	14.03.2011
<b>Case Study C</b>	
Director of a KTO	26.10.2010
IP Manager	10.11.2010
Contract Manager	10.11.2010
Business Development Manager	21.01.2010
Research Enterprise Coordinator	22.06.2011
Innovation Advisor	15.12.2011
<b>Case Study D</b>	
Director of a KTO	06.12.2010
IP Manager	07.12.2010
Contract Manager	07.12.2010
Business Development Manager 1	06.12.2010
Business Development Manager 2	06.12.2010
<b>Case Study E</b>	
Director of a KTO	12.01.2011
Senior Administrator	13.01.2011
Senior Business Development Manager	12.01.2011
Business Development Manager 1	12.01.2011
Business Development Manager 2	20.01.2011
Academic	13.01.2011
<b>Case Study F</b>	
Senior Manager on behalf of a KTO director	18.01.2011
Licensing Manager	18.01.2011
Spin-out Manager	17.01.2011
Business Development Manager 1	17.01.2011
Business Development Manager 2	17.01.2011
Marketing Manager	17.01.2011