THE IMPACT OF EMBEDDING KNOWLEDGE EXCHANGE ON SMALL AND MEDIUM-SIZED ENTERPRISES (SMEs)

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submitted to the University of Hertfordshire in partial fulfilment of the requirement of the degree of PhD

June 2025

Abstract

This research investigates the operational characteristics and organisational strategies that underpin effective knowledge exchange (KE) in small and medium-sized enterprises (SMEs), with a specific focus on Knowledge Transfer Partnerships (KTPs) as a mechanism for embedding knowledge and sustaining innovation. Grounded in human development and organisational learning theories, the study explores how entrepreneurial leadership, absorptive capacity, and organisational culture interact to influence the success of knowledge exchange activities and long-term business transformation.

Using a mixed-methods approach combining survey data and five longitudinal case studies, the research identifies that while KTPs generate positive impacts across business performance dimensions, these effects are highly dependent on internal organisational factors. Entrepreneurial leadership is the strongest predictor of sustained outcomes whereas hierarchical or passive leadership constrained longer-term outcomes. Repeated or staged collaborations generate cumulative capability building and higher returns. Case studies demonstrated that what works is leadership centred KE, organisation wide learning, longitudinal engagement and strategic integration. The study affirms the heterogeneity of the SME sector, cautioning against one-size-fits-all approaches to KE interventions.

Of the forty-five companies surveyed 60% of them declared a growth pattern of greater than 6% in the intervening period between the end of their KTPs project and the survey in 2018. An additional noteworthy result is that, collectively, 45% of the surveyed SMEs reported a growth of exceeding 10%. Correlation analysis revealed strong but non-linear interdependencies between knowledge, operational, and leadership impacts, highlighting the complexity of change processes in SME contexts. The concept of absorptive capacity proved vital reinforcing the role of inclusive knowledge practices in achieving lasting impact.

This research contributes to theory and practice by supporting the premise that strategic embedding of KE, especially when championed by entrepreneurial leaders, enables long-term innovation, growth, and competitive advantage. The findings have

direct implications for policymakers such as recommendations for adoption of a dynamic capability approach. Higher education institutions, and SMEs themselves, should prioritise leadership development, organisational learning, and tailored support based on SME readiness, as future initiatives. Recommendations for further research include expanding the dataset to enhance generalisability and strengthening of evaluation metrics.

Acknowledgements

My thanks and deep appreciation to my family for their unstinting support, David and Lauren thank you. I could not have done this without your love and support.
To my undaunted Supervisors my thanks for the feedback, reviews, and discussions. Professor Rodney Day has been a stalwart supporter giving constant encouragement over the years. Thanks to you for your patience and sharing of knowledge, skills, and experience.
Dr Chris Brown has been a great second supervisor and guided me for a long time. His feedback was crucial, supportive, and adopted without question.

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CRM	Customer Relationship Management
FAME	Jordan Watch database of major public and private British companies
GDP	Gross Domestic Product
KT Offices	Knowledge Transfer Offices
KTPs	Knowledge Transfer Partnerships
MNC	Multi-National Companies
MIS	Management Information Systems
SMEs	Small and Medium-sized Enterprises
UK	United Kingdom

Chapter 1 Introduction

This chapter serves as an introduction to the dissertation. It begins by presenting the background of the study and establishing the broader research context, followed by a justification for the significance and necessity of the research. The chapter then outlines the methodological approach adopted for the study and clearly states the research aims and objectives. Finally, it concludes with a structured overview of the thesis, providing a roadmap for the chapters that follow.

1.1 Background

Successive UK governments have demonstrated a sustained commitment to increasing research and development (R&D) expenditure. In 2021, this commitment was reaffirmed with a pledge to invest 2.4% of Gross Domestic Product (GDP) in R&D by 2027 (BEIS, 2021; Office for National Statistics, 2021). Additionally, in 2024, a £20.4 billion investment was announced, "reinforcing the government's commitment to back the UK's R&D ecosystem" (Department for Science, Innovation and Technology, 2024). In alignment with this vision, initiatives were introduced in 2022, such as "Help to Grow: Management," which offered management training, and "Help to Grow: Digital," which supported adoption of digital technologies. This activity represents critical steps toward strengthening businesses capabilities including leadership and advancing the broader innovation landscape. This current Labour government has declared growth as its main approach by focusing on sectors which offer that opportunity including advanced manufacturing and creative industries (Reeves & Reynolds, 2024).

A significant barrier to realizing the full potential of innovation-driven improvements is the low rate of diffusion. Presently, the United Kingdom ranks 12th globally in terms of knowledge and technology outputs, underscoring the need for enhanced mechanisms to promote effective knowledge exchange (World Intellectual Property Organization, 2023, p. 215). This issue is particularly pronounced among small and medium-sized enterprises (SMEs) as of October 2024, the United Kingdom housed 5.5 million private sector businesses (Department for Business & Trade, 2024), with SMEs comprising

99.8% of the total business population. This statistic underscores the necessity of addressing the barriers to productivity growth, which are vital for enhancing the nation's GDP among SMEs.

The UK Industrial Strategy post-2021, encapsulated in the plan *"Build Back for Better: Our Plan for Growth"* (GOV.UK, 2021), incorporated the challenges introduced by Brexit and the COVID-19 pandemic. The 2022 Enterprise Research Centre report, "The State of Small Business Britain", evaluated the post-Brexit and post-COVID-19 environment and identified persistent challenges requiring attention from policymakers, practitioners, and researchers (Enterprise Research Centre, 2022). More recently the Labour Government has declared growth as its Industrial Strategy going forward (Reeves & Reynolds, 2024) and the research and development sector is supported with record £20.4 billion investment in the budget last Autumn (Department for Science, Innovation and Technology, 2024). This strategy emphasizes infrastructure, skills development, and innovation as its foundational pillars and includes targeted initiatives to support SMEs. The UK continues to lag in productivity and in 2024 UK productivity in GDP per hour (US$) was greater than Japan and Canada but much lower than US and European trading partners Germany and France as shown in Figure 1 below.

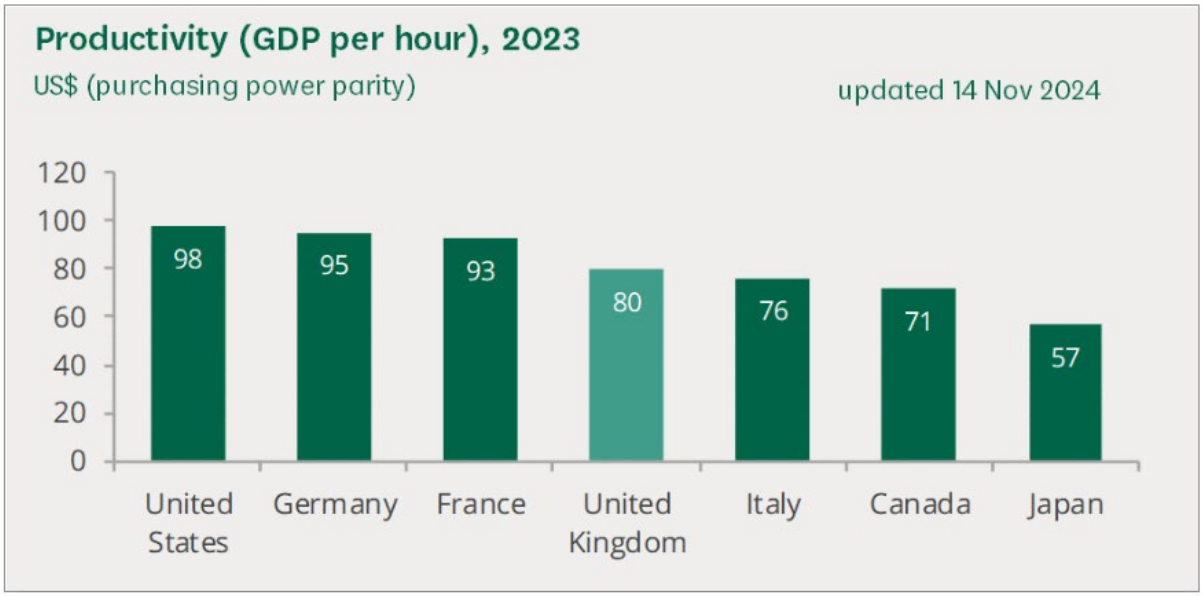

Figure 1 Productivity: Economic Indicators (Harari, 2024)

The UK Government's Industrial Strategy, under successive administrations, has focused on enhancing national productivity. Support has been provided through various initiatives, such as the Business Basics Programme (GOV.UK, 2021), which aims to encourage businesses, particularly SMEs, to adopt improved management practices and advance their technological capabilities to drive productivity growth. As part of this effort, Innovate UK introduced a delivery plan for 2021–2025, outlining specific actions to nurture high-growth-potential SMEs (Innovate UK, 2022).

There is growing recognition that post-pandemic support strategies must extend further to facilitate long term recovery, particularly as UK small businesses contend with the compounded effects of Brexit and the current rises in costs from salaries to energy. These challenges are encapsulated in the series of reports from the Enterprise Research Centre. The report, (Enterprise Research Centre, 2022) highlights critical issues such as rising energy prices and escalating costs associated with doing business. The work by Karen Bonner presented at the second session at The State of Small Business Britain Conference Report 2024 (Enterprise Research Centre, 2024) exploring productivity and tracking previous recognised high growth business patterns in order to better understand growth and what is required in terms of support. Considerations covered reoccurring themes of trust issues with advisors when seeking advice, cost of advice, what is impactful advice, and that generic advice has a longer-term impact.

Achieving sustainable change to ensure long-term survival in the marketplace requires support from the knowledge economy, intellectual capital, and the distinctive combinations of products and services offered by businesses, alongside their unique knowledge and capabilities. Over the past two decades, entrepreneurial leadership has gained recognition as an effective leadership approach for fostering creativity, driving innovation, and improving organisational performance, particularly in increasingly uncertain and competitive market environments (Hensellek, et al., 2023; Leitch & Volery, 2017).

In summary, this section has outlined the primary focus of the research and established the foundational issues under investigation, along with their broader implications. The following section situates the study within its relevant context,

thereby clarifying the significance of the research contribution and articulating the underlying motivation for undertaking this inquiry.

1.2 Study Context

Economic growth remains a central priority in the strategic agenda of the newly elected Labour Government. In alignment with this national focus, the present study investigates the role of sustainable growth practices within businesses, emphasising the contribution of knowledge exchange to long-term development. The dissemination and application of knowledge, key drivers of productivity, are widely acknowledged as essential to advancing national economic performance (OECD, 2024, p. 22). Increasingly, Higher Education Institutions (HEIs) are pivotal in shaping management practices and fostering innovation, leveraging collaborative partnerships with industry to build a dynamic and responsive knowledge base.

This research draws on the Triple Helix Model of Innovation (Etzkowitz & Chunyan, 2017, p. 311), which conceptualises the interaction between universities, industry, and government. This model provides a framework to examine how University-Industry Collaboration (UIC) can be strengthened to support innovation and contribute to sustainable economic growth. Within this context, the study evaluates the mechanisms and impacts of knowledge exchange as a catalyst for sustainable business transformation.

Specifically, the research explores the influence of knowledge absorption on organisational leadership, the operational characteristics embedded in practice, and the extent to which these processes contribute to value creation and capture within business models. These objectives are encapsulated in the overarching aim for this research:

To what extent does the impact of knowledge exchange deliver sustainable change to businesses?

Drawing on this researcher's professional experience as a Knowledge Transfer Partnership (KTP) Supervisor and Academic Lead for six funded KTP projects, this

research is informed by practical engagement with knowledge exchange mechanisms. A key insight from this experience is the critical importance of demonstrating the longevity and sustainability of implemented changes to engage and retain industrial partners. Industry stakeholders are often persuaded by empirical evidence of bottom-line benefits, which are central to both UK Government evaluations and KTP promotional activities.

Personal participation in various national workshops and initiatives aimed at enhancing business participation in KTPs further highlighted the need for clearer articulation of success metrics. This research received institutional support from the University's Knowledge Transfer Office, which acknowledged the strategic value of articulating bottom-line impacts to increase engagement in UIC initiatives.

This study aims to develop actionable strategies that businesses can use to identify success factors in knowledge exchange and their contribution to sustainable transformation. The research outcomes are particularly relevant to SMEs that have not yet engaged with national agendas around productivity, innovation, and growth. In doing so, this research contributes to the academic field of knowledge exchange by offering insights into how such practices can be practically embedded within business operations. It also investigates the role of entrepreneurial leadership in facilitating these changes, providing evidence-based recommendations for business advisors, university knowledge exchange offices, and policymakers.

The findings of this study have wider implications for various stakeholders, including business leaders seeking to leverage innovation for long-term sustainability and profitability. This research contributes to the evolving discourse on University Industry Collaboration (UIC) and its potential to support national economic growth through embedded, sustainable change. Furthermore, this work offers pedagogical value by informing postgraduate curricula with empirical findings and in-depth case studies focusing on strategy implementation in SMEs. While this study lays important groundwork, it also identifies the need for future longitudinal research to enhance generalisability and support theoretical development. Large-scale, longer-term investigations would be essential to build on these insights and confirm broader applicability.

This thesis contributes to the theoretical understanding of knowledge exchange in business environments, with a specific focus on activities that promote sustainable change. The research adopts an iterative, mixed methods design grounded in social research traditions, integrating both qualitative and quantitative data to generate and refine emerging theoretical insights. While the study initially considered an action research approach, practical constraints necessitated the adoption of a mixed methods strategy, guided by principles of grounded theory.

The next section details the research methodology, including the design, data collection processes, and analytical framework employed.

1.3 Research Methodology overview

This research contributes to the development of theoretical frameworks in the field of knowledge exchange (KE), particularly within the context of business practice and sustainable organisational change. The study explores the mechanisms and activities through which KE initiatives contribute to sustained transformation in SMEs, offering new insights into how such practices can be embedded and scaled.

The theoretical development process in this research is iterative and reflective, grounded in empirical data. As is typical in theory-building research, additional data collection is sometimes required to refine emergent insights and delineate the theory's boundaries. This approach aligns with grounded theory methodology, which facilitates the development of theories that are closely connected to the data (Saunders, et al., 2023). The study adopts an inductive research strategy characteristic of social research, where theoretical insights evolve from engagement with empirical observations. Although an action research methodology was initially considered, it was deemed impractical given the constraints of the research setting. A mixed methods approach was therefore adopted, combining qualitative depth with the breadth of quantitative data.

The methodological design is informed by the researcher's ontological and epistemological positions (Dawson, 2009). Drawing on extensive professional experience in supervising KTP projects, and working closely with business leaders

and their teams, the researcher brings both insider knowledge and reflective academic inquiry to the study. Access to relevant KTP documentation and formal support from the university's KTP office has further facilitated data collection.

Desk-based research supports the empirical phases of the study, enabling the identification and mapping of key concepts across multiple stakeholder perspectives. This includes a review of the existing literature on knowledge exchange theory, entrepreneurial leadership, and organisational change. These insights inform the social research methodology employed, helping to elucidate the relationships among key variables, influencing factors, and observable business practices.

The research is underpinned by middle-range theory, as conceptualised by Merton (Merton, 1968, p. 64). In contrast to grand theories that attempt to explain broad societal phenomena, middle-range theory focuses on specific, observable relationships within a defined context (Robertson & Turner, 1991). This makes it a fitting theoretical orientation for the study, which aims to understand and explain the situated impact of knowledge exchange within business environments. The use of social research methods, combining both qualitative and quantitative approaches, supports a rigorous yet contextualised exploration of these phenomena.

Adopting an exploratory research design, the study seeks to generate new understanding of SME leadership behaviour, operational dynamics, and marketplace interactions. A key motivator for this inquiry is the finding from Kantar Public, which notes that while SMEs often report confidence in their inherent management practices, they demonstrate a "lower propensity to innovate" (BEIS, 2019). Consequently, a quantitative approach was selected to examine patterns across identified variables, providing an evidence base for broader generalisations.

To complement this, a qualitative case study approach was employed to explore underlying management practices, leadership dynamics, and the lived experience of knowledge exchange within businesses. This inductive strategy facilitates a richer theoretical interpretation of the data. Five in-depth business case studies offer insights into real-time implementation processes, leadership decision-making, and the long-term impacts of knowledge exchange activities.

In total, quantitative data were collected from forty-five SMEs to identify statistical patterns, supported by the qualitative case studies to contextualise and deepen understanding. This mixed methods approach enables triangulation of findings and enhances the validity of conclusions drawn. Social research encompasses a wide array of methodological strategies, including surveys, case studies, experiments, ethnography, phenomenology, grounded theory, and action research, each suited to different research approaches. Given the focus of this study on the impact of knowledge exchange within businesses, a social research framework is appropriate, recognising that organisations are dynamic systems shaped and managed by people.

The following section outlines the specific aims and objectives of the study, framed within the broader national agenda for innovation and enhanced University-Industry Collaboration (UIC). These aims form the foundation for evaluating the sustainable impact of knowledge exchange practices in business contexts.

1.4 Research Aims and Objectives

The central aim of this research is to explore the extent and if there are sustainable changes due to the impact of KE from the perspective of businesses, with a particular focus on how such engagement contributes to sustainable organisational change. The study seeks to understand how knowledge, when effectively transferred and embedded within business operations, can lead to long-term improvements in business practices, innovation capability, and economic longevity.

This inquiry is situated within the broader national agenda that prioritises productivity growth and highlights UIC as a critical lever for innovation and economic development. By examining the structures, processes, and outcomes associated with UIC and KE practices, the study aims to uncover the mechanisms through which businesses, particularly SMEs, achieve sustainable transformation.

The research adopts an exploratory and inductive approach, utilising a mixed methods design. The methodological strategy includes five in-depth case studies complemented by a supporting survey, enabling both depth and breadth in the

analysis of knowledge exchange dynamics, outcomes and long-term impact. The study is positioned as an incremental contribution to knowledge by applying theoretical and empirical insights to a practical, real-world context.

Research Objectives:
This study is guided by the following three core objectives:

1. To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.
2. To explore the long-term impacts of embedding knowledge within business processes.
3. To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

Research Questions
To support these objectives, the following research questions were formulated:

1. What are the organisational parameters and approaches that deliver long-term impact through knowledge exchange?
2. What is the effect of embedding knowledge on organisational learning and the development of entrepreneurial leadership?
3. What long-term impacts do SMEs achieve through collaboration with universities?
4. Through what processes do SMEs embed knowledge gained via university-industry collaboration?
5. Why and how does this embedded knowledge lead to sustainable change and value capture within business models?

This study seeks to examine the operational characteristics and organisational strategies that underpin effective knowledge exchange, explore the long-term impacts of embedding knowledge within business processes, and identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs. Through the combined use of case studies and survey data, the research enables comparative analysis across diverse organisational contexts, facilitating the

identification of patterns and relationships between operational characteristics, leadership behaviours, and sustainable outcomes. In doing so, it advances understanding of how knowledge exchange mechanisms drive business transformation and informs both academic theory and practical strategies for enhancing university–industry collaboration and SME development.

1.5 Structure of the thesis

In the introduction, Chapter 1, the premise was developed for the research, and the context of the research have been established. The main thematic areas have been introduced knowledge exchange impact on businesses, entrepreneurship, small medium-size enterprises, the business models, organisational processes, and the leadership. The aim and objectives are identified to support the research to test and explore the impact of embedding knowledge exchange and the longer-term outcomes for businesses.

The literature review, Chapter 2 provides contribution to the growing body of literature on business process management examining how knowledge exchange impacts operational processes and drives continuous improvement. By synthesising these streams, the thesis will provide a holistic understanding of how knowledge exchange impacts influence long-term sustainable change in business.

Chapter 3 sets the theoretical context and methodology for this research and the approach taken both qualitatively and quantitatively. In social research, the pattern is couched in terms of how individuals understand and sense the world around them. In this study, social research provides the methodological foundation to investigate the complex and dynamic processes of knowledge exchange between universities and businesses. This chapter discusses the pilot for the data collection, develops the evidence-based criteria for analysis supporting the method and strategy. There is mapping of the questions constructed for use in the survey and the support of the selection is covered. There is a definition of the validity and reliability of the survey as well as discussion of revision implemented due to the pilot study work.

Chapter 4 provides the results from data collection. The qualitative data was collated from semi-structured interviews, initial and final KTP reports curated into five case studies to provide depth and free text entries from the web survey. The quantitative data was collected using a web-based survey.

Chapter 5 discusses the implications of the findings in the context of the research objectives and highlights relationships. The results and outcomes are established in the context of this research, linked to the established theory and contribution to knowledge from this research.

The final section, Chapter 6 sets out the conclusions from the research and identifies where future work can be undertaken associated with the methods and approach, survey design and the analysis strategy. The outcomes also identify possible further studies, issues and additional research questions that are arrived at, and that allow the research to continue in other contexts to further inform academics and business practitioners.

The next chapter presents the review of the existing body of literature under key sections of knowledge exchange, organisational learning, business models, UIC, SMEs and KTP mechanism within the context of the research. It explores how embedding knowledge exchange influences long-term performance, highlights the role of organisational learning and knowledge absorption, and considers the impact of innovation, leadership, and strategy in driving sustainable business growth.

Chapter 2.0 Literature Review

2.1 Introduction

This chapter consists of seven sections. It begins by presenting the theoretical aspects of this subject area of Knowledge Exchange (KE) by defining it within the context of this research. Initially a clear preview of KE, a core aspect of this research, the review explores the challenges of embedding KE and its amplification for long term performance. The inclusion of papers criteria for the literature review is defined as follows:

1. Studies in which knowledge facilitation constitutes the primary focus of investigation.
2. Studies that propose, describe, or analyse a knowledge exchange process or conceptual framework.
3. Studies reporting on a case study analysis in which a knowledge flow process is examined.
4. Studies that examine and /or address the mechanisms, tools, or practices used to facilitate knowledge flow.

The literature review continues to examine the role of organisational processes supporting learning enabling knowledge absorption, fostering deeper understanding, enhancing business flexibility and growth with focus on SME adoption. This development is considered in conjunction with the innovative practices of entrepreneurial businesses, the barriers, highlighting the critical role of leadership and organisational strategies in shaping a framework for long-term success and sustainable growth especially for SMEs. Followed by an examination of the current state of KE among stakeholders such as University-Industry collaborative practice perspectives, identifying challenges and the broader business environment.

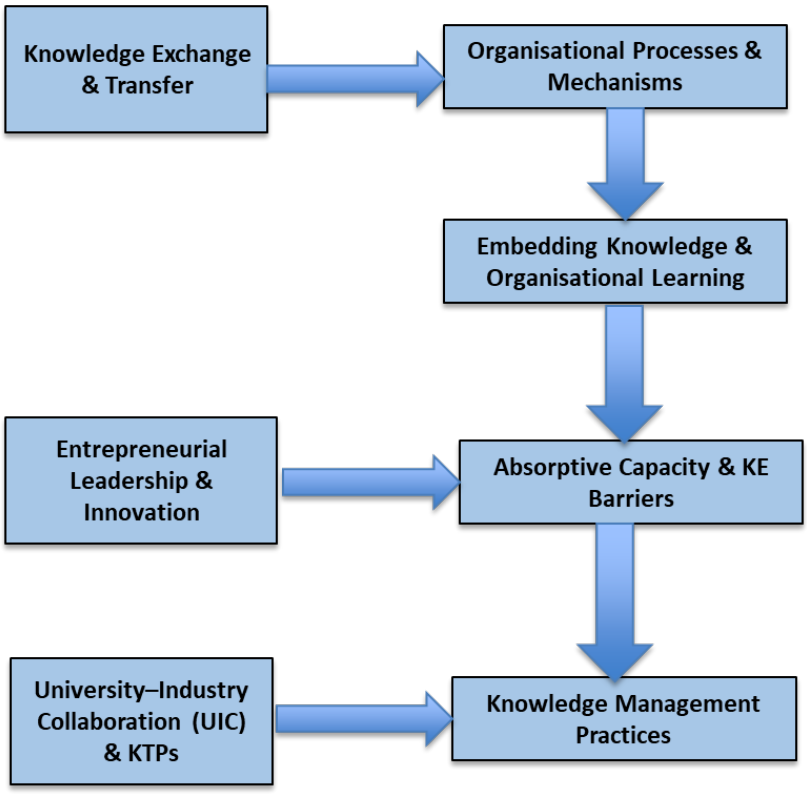

Figure 2 Key perspectives

The research aim will be to conceptualise and synthesise key perspectives on these themes, thereby fulfilling its primary objective to examine knowledge exchange mechanisms, identify relevant organisational characteristics and assess strategies that impact on the business. The overarching research aim being addressed:

To what extent does the impact of knowledge exchange deliver sustainable change to businesses?

This study is guided by three core objectives: to examine the operational characteristics and organisational strategies that underpin effective knowledge exchange; to explore the long-term impacts of embedding knowledge within business processes; and to identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs. This allowed the development of a set of research questions designed to achieve the objectives and address the overarching research question. Accordingly, the following research questions were formulated:

1. What are the organisational parameters and approaches that deliver long-term impact through knowledge exchange?
2. What is the effect of embedding knowledge on organisational learning and the development of entrepreneurial leadership?
3. What long-term impacts do SMEs achieve through collaboration with universities?
4. Through what processes do SMEs embed knowledge gained via university-industry collaboration?
5. Why and how does this embedded knowledge lead to sustainable change and value capture within business models?

Table 1 below maps the Research Questions to the aligned Research Objectives.

Table 1 Mapping of Research Questions and aligned Research Objectives

Research Question	**Aligned Research Objective**
RQ1. What are the organisational parameters and approaches that deliver long-term impact through knowledge exchange?	Objective 1: To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.
RQ2. What is the effect of embedding knowledge on organisational learning and the development of entrepreneurial leadership?	Objective 1 & 2: To examine effective KE strategies and explore the long-term impacts of embedding knowledge within business processes.
RQ3. What long-term impacts do SMEs achieve through collaboration with universities?	Objective 3: To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.
RQ4. Through what processes do SMEs embed knowledge gained via university–industry collaboration?	Objective 2: To explore the long-term impacts of embedding knowledge within business processes.
RQ5. Why and how does this embedded knowledge lead to sustainable change and value capture within business models?	Objective 3: To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

Finally, this research contributes to business process management literature by analysing the role of knowledge exchange in optimising operational processes and fostering continuous improvement through innovation. By synthesising these interdisciplinary perspectives, the thesis aims to provide a comprehensive understanding of how knowledge exchange serves as a catalyst for sustainable

business transformation, and this research will contribute to multiple academic streams as well as the activities of practitioners.

2.2 Knowledge Exchange and Transfer in SMEs

Knowledge encompasses facts, information and skills acquired through experience or education and covers both theoretical and practical understanding of a subject. Often attributed to Plato, knowledge is traditionally defined as justified, true and believed. The intangible nature of knowledge exchange, which holds inherent worth, and value highlights the significance of the knowledge economy. As a result, knowledge should be recognised as a crucial component of intangible assets, contributing to overall economic value and revenue generation (Allee, 2008; Allee, 2009) through continued research and publications on value network analysis. An early vanguard of the changes required by businesses to achieve future profitability based on information and knowledge was contrasted with the then traditional hierarchical management structures in support of the increased importance of knowledge and information (Drucker, 1988).

Existing literature within specific research areas such as organisation theory, innovation and entrepreneurism, and people's behaviours the term Knowledge Exchange (KE) can be conflated with Knowledge Management terminology. Knowledge Management (KM) defines the dynamic processes required to effectively manage knowledge. In some cases, KE is viewed as a collaborative process between producers and users, designed to address institutional barriers and challenges that hinder the flow of knowledge (Zheng, et al., 2019). KE has also been described as a form of knowledge sharing (Hakkarainen, 2020), while (Karcher, et al., 2022) used the term KE as an umbrella concept encompassing knowledge brokering, co-production, boundary organisations, and social connections. For the purposes of this thesis KE will be maintained throughout and will reflect the process of sharing knowledge and experience between individuals and organisations. This part of the review highlights the philosophical foundations and practical mechanisms of knowledge and knowledge-exchange processes, establishing KE as a strategic organisational capability distinct from knowledge management, sharing, and transfer. Collectively,

their work clarifies the social structures, organisational conditions, and operational dynamics through which knowledge exchange takes place.

Economic growth for the United Kingdom has been at the forefront of successive government activity and public discussion through evaluation internationally (Van Reenen & Xuyi, 2024) and review of productivity and growth within industrial strategies (Criscuolo & Lalanne, 2024). The dissemination of knowledge, fostering national productivity improvements, serves as a critical driver of a nation's progress towards economic growth (OECD, 2024). The Organisation for Economic Co-operation and Development (OECD) play a pivotal role in fostering entrepreneurship and supporting SMEs as key drivers of sustainable and inclusive economic growth due to their global prevalence. Strengthening the resilience of SMEs and entrepreneurs unlocking potential are the basis of global SME focused OECD policies (OECD, 2022). For these businesses to thrive, substantial support is essential. However, accessing expertise, specialised skills, financial resources, and innovative knowledge often present considerable challenges, particularly for smaller businesses (Sullivan-Taylor & Branicki, 2011). Even larger organisations may face limitations, including the need for innovative perspectives or specialised technical capabilities, to maintain their competitive edge in a dynamic marketplace.
Policymakers have consistently worked to create an environment that enables UK businesses to contribute to the goal of improving national productivity. Metrics tracking national productivity are readily available and have been documented in reports and publications from government bodies and consultants commissioned by the UK Government (BEIS, 2019; BEIS, 2021; BEIS, 2022; GOV.UK, 2023; GOV.UK, 2023). These reports provide a comprehensive view, assessing the extent of the changes or improvements while identifying areas requiring further attention. Furthermore, global comparisons of GDP are frequently conducted, with a particular focus on the UK's position within the Group of Seven (G7), which includes the United States, the United Kingdom, France, Germany, Italy, Canada, and Japan (ONS, 2025).

The influence of technological advancements on innovation and their subsequent dissemination constitutes a pivotal factor in evaluating broader economic and societal progress. A significant barrier to realizing the full potential of innovation-driven improvements is the low rate of diffusion. Presently, the United Kingdom ranks 12th

globally in terms of knowledge and technology outputs, underscoring the need for enhanced mechanisms to promote effective knowledge exchange (World Intellectual Property Organization, 2023). This issue of lack of diffusion is particularly pronounced among SMEs (BEIS, 2019). As of October 2022, the United Kingdom housed 5.5 million businesses (Department for Business & Trade, 2024), with SMEs comprising 99.8% of the total business population. This statistic underscores the necessity of addressing the barriers to productivity growth, and the inclusion of SMEs which are vital for enhancing the nation's GDP.

Knowledge acquisition by businesses embracing knowledge exchange can enhance internal capabilities, either through the recruitment of requisite skills and expertise or through learning derived from collaborative engagement on projects with external specialists. Another example includes the temporary involvement of a consultant expert to facilitate a specific innovation initiative within a designated timeframe. Examining the literature reviewed by (Ahmad & Schroeder, 2011, p. 20) identified three dimensions of a learning-based technology strategy "Proactive technology posture", "Process adaption and experimentation" and "Collaborative technology sourcing". While these dimensions do not independently correlate directly with a business's or manufacturing plant's competitiveness, the study highlights that their alignment significantly influences and enhances plant competitiveness.

An improved internal capability either through recruitment of the required skills and capability or the learning achieved through contact on projects with external experts all can assist in knowledge being gained by a business. Another example may be the involvement of a consultant expert for an innovation project for a designated period. Engagement in university industry collaboration gives businesses access to knowledge sources to enable innovation. The contexts in which the knowledge exchange is applied can be complex due to people's behaviour; the competitive environment and other internal characteristics (Bruneel, et al., 2010) hence not one size fits all. This section has identified that knowledge should be recognised as a crucial component of intangible assets hence the objectives of this research are supported in terms of what is effective knowledge exchange, having long term impact and contribution to sustaining a business.

The next section discusses the importance and the basic process of embedding knowledge, the enhancements that can be achieved and the managerial interventions required to influence the sustainable business practices for long term success.

2.2.1 Embedding Knowledge

The knowledge acquired by businesses can enhance internal capabilities through various mechanisms, including the recruitment of skilled personnel, experiential learning from collaboration with external experts on projects, and the upskilling of employees to drive innovation (Nonaka & Teece, 2001). The rate of learning must account for pre-existing and institutionalised knowledge, necessitating that organisations develop proficiency in internal knowledge exchange through structured planning and formalised processes. Exchange of knowledge within an open-loop system offers certain advantages, primarily due to its lower operational costs and simplicity. In such a system, processes are executed repetitively without the incorporation of feedback mechanisms, making it a cost-effective approach in many scenarios. However, the absence of feedback may limit the system's adaptability and responsiveness to evolving knowledge needs.

Conversely, a closed-loop system for exchange of knowledge integrates feedback as a critical component, where each stage of the process informs and influences subsequent actions. Research by (Zull, 2004) highlights the connection between experiential learning and feedback loops within brain function processes, reinforcing the idea that learning is inherently iterative. Similarly, (Schwartz, 2007) discusses closed-loop systems in the context of the cortex in learning, emphasising that effective knowledge exchange relies on feedback and experiential learning to refine responses and enhance organisational learning. By incorporating feedback mechanisms, closed-loop systems facilitate continuous improvement and adaptability, making them a more dynamic and sustainable for knowledge exchange compared to open-loop systems.

Figure 3 below outlines the sequential stages of the knowledge exchange process. The process begins with the "Knowledge" stage, which encompasses innovation and generation of new ideas. This is followed by "Assessment" where these ideas are critically evaluated for feasibility and strategic alignment before proceeding to "Implementation," where they are integrated into the business norms and practices.

The subsequent stage, “Embedding” ensures the newly implemented knowledge becomes an established and routine part of the organisational structure. Finally, the accumulated knowledge is stored in the businesses “Knowledge Bank” facilitating future access and continuous learning. A fundamental aspect of the Knowledge Exchange Loop, Figure 3, is the incorporation of a feedback mechanism at each stage. This feedback loop serves to reinforce learning, ensuring the explicit knowledge is systematically embedded while tacit knowledge is effectively recorded and retained.

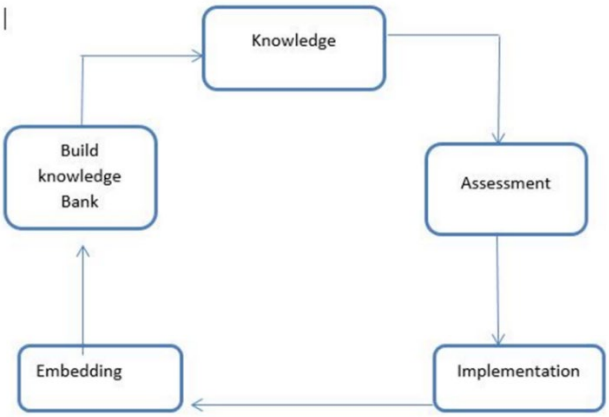

Figure 3 Knowledge Exchange Loop (Knowledge – Assessment – Implementation – Embedding – Build knowledge bank©)

An in depth understanding of knowledge exchange (KE), its characteristics, implementation outcomes and its impact on businesses has gained increasing importance for scholars, policymakers, and practitioners. Knowledge exchange has been discussed in terms of the feedback loop, and this fundamental stage plays its part in the whole knowledge exchange learning process. The significance of knowledge exchange extends to national productivity, which is widely recognised as a key driver of economic prosperity. The effectiveness of knowledge exchange within a business is contingent upon multiple factors, including its decision-making processes, organisational culture, learning capabilities, expertise, leadership, and entrepreneurial orientation. These elements influence how knowledge is generated, assessed, disseminated, and institutionalised or learned within the business, shaping its ability to sustain innovation and competitive advantage.

In this next section we turn to consider the application of the triple helix model where collaboration with higher education institutions (HEIs) can support business growth.

2.3 University-Industry Collaboration and KTPs

Increasingly Higher Education Institutions (HEIs) play a pivotal role in fostering management practices and innovation by leveraging industry partnerships to create a robust knowledge base. In contrast to commercialisation activities, most notably the production of intellectual property and the pursuit of faculty entrepreneurship, academic engagement represents a far more pervasive mode of interaction between universities and external organisations. It spans a wider array of disciplinary fields, including those that traditionally generate fewer patentable outputs or spin-out ventures. As a result, academic engagement has been shown to carry greater overall economic significance for both universities and industry partners, functioning as a key channel through which knowledge is transferred, collaborative relationships are formed, and innovation capacity is enhanced (Cohen, et al., 2002). This broader reach and sustained relevance position academic engagement as a central component of contemporary university–industry relations, often yielding benefits that surpass those associated solely with formal commercialisation mechanisms.

The application of the triple helix model (Etzkowitz & Chunyan, 2017) strengthens the collaboration between industry, government, and universities, fostering innovation and economic growth. Performance metrics captured for the Knowledge Exchange Framework (KEF) is claimed as transformative engagement (Johnson, 2022) and these metrics are “linked to eligibility for Higher Education Innovation Funding (HEIF)” (UKRI, 2023) adjacent to other HEI measures such as REF and TEF.

There has been a growing adoption of the Triple Helix model within innovation systems, though approaches vary and success depends on the willingness and active participation of clusters. Similarly, research on knowledge exchange between universities and industry has shown that mutual adoption of such practices can enhance performance and competitiveness for both businesses and universities within their respective sectors (Etzkowitz & Chunyan, 2017; Anatan, 2015).

Knowledge exchange by universities is an example of good practice in relation to technology transfer. Universities motivated by their impact on society, have the potential to support riskier start up research and development and the more research

a university conducts there is increased likelihood of technology transfer. This is detailed in the UK Innovation Strategy, Leading the future by creating it July 2021 (GOV.UK, 2021),

"One of the UK's challenges is to enhance the technology transfer skills and expertise of a broader range of universities, and to make the UK university sector as accessible as possible to investors."

Continuing the strategic direction set out in the UKRI Strategy 2022–2027, UK Research and Innovation (UKRI, 2022) asserts that support from leading universities in the UK has the potential to "increase adoption and diffusion of innovations by businesses across the UK.".

Funding for research and raising accessibility to UK knowledge bases, Universities, become a priority in the targeted funding by UK Governments. These initiatives as policies for Innovate UK have prompted businesses to engage and key initiatives to be disseminated across the UK including Catapult Centres, Innovation vouchers and KTPs programmes. Government strategies published from 2017 to 2024 with support from Council for Science and Technology and OECD all strive to ensure accessibility to the productivity and growth potential through supportive strategies (De Wit-de Vries, et al., 2019). A benchmarking study using data from OECD used scales to provide clarity using a non-financial method to compare dedicated policy outcomes across 12 countries (Kergroach, et al., 2018). The use of radar charts to compare the relative impacts was thought relevant for this study in presenting the analysis of data to all stakeholders transparently.

Now to explore further the research and reviews related to UIC interactions.

2.3.1 UIC interactions

The interaction between universities and industries can assist businesses in surmounting innovation-related obstacles. The collaboration activities range from joint funding for technology transfer, consultation with direct feed from universities into keystone projects within various industry sectors. Two national reviews of KTPs,

(Regeneris, 2010; Ternouth, et al., 2012) captured the impact of the programme on the company partner and the UK economy, respectively. More recently the Final Report on the evaluation of KTP delivers impressive statistics and the slew of beneficial outcomes (UKRI, 2023). Similarly, (Canhoto, et al., 2016) recognized the joint creation of value in digital research initiatives that entail cooperation between academic institutions and industries.

Conversely, (Alunurm, et al., 2020) emphasised the obstacles encountered in collaborations between universities and industries include differing objectives and values, trust deficits, and challenges related to intellectual property rights. Other studies explore the benefits to a greater degree and expand on identifying the good practices such as using the impacts to encourage better collaboration practices and entrepreneurship highlighting what can be achieved (Rosli, et al., 2018; Compagnucci & Spigarelli, 2024). There are other issues related to the interaction between universities and industries and according to research findings (Chryssou, 2020; Kowalska-Styczen, et al., 2018) these are in the main limitations in resources and expertise. It is imperative to tackle these barriers effectively to optimise the advantages derived from university-industry collaborations.

A review of university-industry collaborations (UIC) by Esther De Wit-de Vries (De Wit-de Vries, et al., 2019) highlighted that, at that time, research predominately focused on academic engagement and management. One key outcome of that study was a proposed research agenda, which underscored the significance of businesses effort to absorb knowledge as a critical factor in effective collaboration (De Wit-de Vries, et al., 2019). Knowledge exchange has been studied for its potential to enhance productivity, contribute to GDP growth and increase national wealth. However, there remains scope for further exploration of the practical characteristics of knowledge exchange and the role of leadership in shaping its impact, thereby contributing to the existing body of knowledge.

The collaboration between universities and industry is encouraged by the funding rules established by central Government prompting and encouraging collaboration with industry and universities and other knowledge centres to drive innovation and economic development. Barriers exist in these collaborations as the next step in

gaining technological knowledge for SMEs must come from external sources. There are cultural differences and approaches between industry and universities (O'Dwyer, et al., 2023) and various activities that are required to build trust. Innovation potential is crucial for all businesses large or small and what makes it successful is subject to continued research as shown in this systematic literature review (Rybnicek & Konigsgruber, 2019). The engagement of HEIs has been a crucial element in the transfer of knowledge and the research literature has developed over time understanding an HEI's place in the innovation system for university-industry-government. Now, the third mission of the Universities is discussed as an ecosystem and entrepreneurship education (Nicotra, et al., 2021).

There are many studies that focus on collaboration between universities and industry barriers and enablers, and these range from trust, IP policies, communication, cultural to name a few but not one size fits all as all have differing contexts and selected in other studies for being descriptors of a university-industry collaboration. Knowledge exchange is the acquisition of knowledge from one situation and applying it to another. Transferring of knowledge from an expert to a non-expert in an organisation and the review of the process of university to industry transfer of knowledge (Agrawal, 2003) found that universities as a source of new knowledge are important especially in the sectors related to science and technology. The flow of knowledge exchange has been explored further in terms of open innovation between universities and businesses (Striukova & Rayna, 2015) and it is recognised that this contributes to recruitment and knowledge resources.

Universities serve as vital facilitators in knowledge transfer, supporting businesses in leveraging intellectual capital and implementing effective business model adaptations. Partnerships between industry and universities often supported by government is regarded as crucial to improving systems of innovation and encouraging economic growth (O'Dwyer, et al., 2023). The collaboration is not always a harmonious one and the absorption of innovative ideas and the capacity of the business partner depends on factors, including the inclination of the business management to be open to latest ideas, new people, and new methods of working.

The interaction between universities and industries can assist businesses in surmounting innovation-related obstacles. The collaboration activities range from joint funding for technology transfer, consultation with direct feed from universities into keystone projects within various industry sectors. There is opportunity here in a contextualised application to explore that further. The next section provides an expanded section of the approaches to KE by SMEs as they are a key sector for collaborations by universities as identified in this section.

Managing knowledge assets has received increased attention at UK government level with changes to intended routes due to political situations and events with successive governments. Underlying this was a repeated call by experts for adoption of a national industrial strategy that UK industry can adopt for sustainable growth. Sustainable change for achieving long term survival in the marketplace must be supported by the knowledge economy, intellectual capital, specific product, and service combinations that can be provided and the uniqueness of the business knowledge and capabilities. The launch of Technology Innovation Centres, later rebranded as Catapult Centres, a government's initiative was announced March 2011 as investment in response to calls for help for UK industry to commercialise the knowledge outputs of the research base in the UK. It was envisaged that these centres would assist in transforming the UK's capability for innovation in specific technology areas in high value manufacturing to drive future economic growth. The current government has committed to increasing public and private sector R&D expenditure to 2.4% of GDP by 2027 to support the UK being a science superpower with a world-class research and innovation system (Office for National Statistics, 2021).

The influence and contribution of SMEs to the GDP as a measure of the national wealth is well recognised. SMEs represent 99.8% of all private businesses in the UK, contributing 48.7% of total private sector turnover. As such, they serve as a critical component of the national economy. Recognizing the importance of knowledge exchange, various innovation networks, government-funded initiatives, and industry-specific professional federations have sought to improve accessibility to knowledge resources for smaller enterprises. In contrast, multinational corporations (MNCs) prioritise the seamless transfer of knowledge and best practices across their global operations. Effective knowledge adoption within MNCs has demonstrated a tangible

impact on operational efficiency and profitability, reinforcing the importance of structured and sustainable knowledge exchange mechanisms across organisations of all sizes. The accessibility and success in MNCs whilst encouraging is tempered by the need for improvements in replication of successful adoption and improvements from site to site.

As early as 2015, the Dowling review, an independent assessment of Business-University Research Collaborations, put forth recommendations to enhance the scope and depth of collaborations. It particularly highlighted the need for increased funding for KTPs (Department for Business, Innovation & Skills, 2015). The review noted that certain small businesses, despite recognising the missed opportunities in avoiding collaboration with universities, were deterred by the complexities of funding systems. Subsequently, in 2017, the “Industrial Strategy: building a Britain for the future” (BEIS, 2017) presented a vision to drive prosperity and productivity enhancement. This theme persisted in 2021 “UK Innovation Strategy: leading the future by creating it” where the focus remained on embedding knowledge exchange outcomes and elevating productivity (BEIS, 2021). The most recent Labour Government has declared an Industrial Strategy focused on growth (Reeves & Reynolds, 2024). Knowledge must be in place to capitalise opportunities for innovation but that the capacity to absorb new knowledge and embed culture change is implicit to support innovation cycling for the benefit of the business.

The sections 2.1 to 2.4 in the literature review explores knowledge exchange (KE), with a focus on how knowledge flows within businesses and its impact on long-term performance. It examines organisational learning, emphasizing the role of structural, cultural, and leadership factors in shaping effective knowledge exchange. The discussion also draws on literature around sustainable business practices to consider how knowledge assimilation supports organisational sustainability and long-term success. The following two sections shift focus to the distinctive role of SMEs in the UK’s national research and technology transfer strategies. They address the practical challenges of external knowledge exchange, particularly in the context of university–industry collaborations (UICs). These partnerships are shown to add significant value to SMEs, setting the stage for this research's focus on KTP projects involving SMEs.

The next section moves to discussion and review of existing literature on organisational learning which enables knowledge absorption, fostering deeper understanding and enhancing business flexibility

2.4 Organisational learning

According to experiential learning theory, experience constitutes the core medium through which individuals engage in problem-solving and meaning making. This theoretical perspective is firmly grounded in human development theories and draws extensively upon the foundational works of John Dewey, Kurt Lewin, Jean Piaget, William James, and Carl Jung, among others. Collectively, these scholars emphasise the cyclical nature of learning as an iterative process involving concrete experience, reflective observation, abstract conceptualisation, and active experimentation. Effective feedback within organisational contexts necessitates a continuous and adaptive process of reflection and response (Kolb & Kolb, 2005).

In parallel, organisational learning extends these principles to the collective level, describing the mechanisms through which knowledge is created, retained, and disseminated within an organisation (Senge, 2006). Such learning processes underpin organisational transformation by facilitating the integration and accessibility of knowledge across structural and functional boundaries. However, it has been cautioned that “individual learning does not guarantee organizational learning. But without it no organizational learning occurs,” highlighting the interdependence between personal and collective learning processes (Senge, 2006).

Empirical research further substantiates the critical role of learning in organisational performance. A learning-oriented culture and strong dynamic capabilities were found to foster innovation, while both innovation and organisational efficiency were shown to enhance firm performance “a learning culture and dynamic capabilities facilitate innovation; and innovation and efficiency facilitate a firm’s performance” (Hsu & Sabherwal, 2012, p. 510). Their findings highlight the mediating role of innovation and efficiency in translating learning-oriented practices into tangible business outcomes, suggesting that continuous learning and adaptability are essential drivers of sustained organisational success.

2.4.1 Absorptive capacity

The term that has been coined to describe the ability to of a business to recognise the value of new knowledge, assimilate it and apply it to commercial ends is 'absorptive capacity' (Cohen & Levinthal, 1990). The definition is proposed as (Cohen & Levinthal, 1990, p. 128):
"The ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends."

Their empirical analysis based on research across 1,719 businesses demonstrated that the application of new knowledge is influenced by factors such as management openness to new ideas, people and working methods. They demonstrate how absorptive capacity is critical at every stage of the innovation process and they describe the process as follows:

• Acquisition: identification of relevant external information from knowledge sources.
• Assimilation: routines and processes to analyse, process, interpret and understand the information.
• Transformation: modification and adaptation of external knowledge and its combination with existing and internally generated knowledge.
• Exploitation: extending existing competencies or creating new ones by incorporating transformed knowledge into operations, leading to the creation of new products, systems, processes, or organisational forms.

This was further supported by (Aribi & Dupouet, 2015), who emphasised that absorptive capacity depends not only on cognitive factors but also on the external environment in which the business operates. The enabling role of absorptive capacity was a key outcome from this systematic literature review (van Wijk, et al., 2008) where it was proposed and consistently demonstrated that prior experience and related knowledge constitute critical foundations for absorptive capacity, thereby facilitating the effective transfer of knowledge both within and across organisational boundaries.

Organisational learning occurs at varying rates across different activities (Argyris, 1999), with these variations explored through learning curve models (Argote, 2013). Explicit knowledge is factual and readily transferable, whereas tacit knowledge is rooted in experience and is most effectively shared through practice. Key themes for advancing research in this domain include “organizational experience,” “context,” and “organizational learning process” (Argote & Miron-Spektor, 2011).This aligns with the strategic frameworks developed by Porter which stress the need for businesses to adapt to external and internal forces, particularly in rapidly changing technological landscapes (Porter, 2004).

Successful organisational learning ensures that knowledge is retained and disseminated throughout the business, enabling the organisation to stay competitive in an evolving market (Argote & Ingram, 2000). The next section explores barriers to knowledge exchange in organisations.

2.5 Entrepreneurial Leadership & Innovation

Early scholarship identified the increasing significance of effective knowledge translation as a fundamental competency for achieving sustained business success. Davis and Botkin argued that a key driver of firm performance lies in an organisation’s capacity to convert information into actionable knowledge, especially explicit knowledge that can be codified, stored, and widely disseminated (Davis & Botkin, 1994). This perspective was later reinforced by Henriksen and Rolstadas, who argued that competitive advantage increasingly depends on the integration of tacit knowledge within dynamic manufacturing strategies (Henriksen & Rolstadas, 2010). Such strategies must evolve continuously through learning processes that enable the adaptation of implicit expertise, which, by its nature, is challenging to formalise, articulate, or transfer.

Despite the centrality of knowledge as a strategic asset, the internal dynamics of organisations frequently pose barriers to its effective utilisation. Others highlighted that although managerial intervention can empower motivated individuals to lead knowledge-based initiatives, it may also inadvertently foster organisational inefficiency (Szulanski, 1996), developed from an eight-company survey and interview. In some

cases, individuals tasked with knowledge dissemination introduce unnecessary complexity, either as a means of demonstrating competence or as an attempt to enhance personal visibility within the organisation. This observation underscores the necessity of balanced leadership approaches that promote innovation while maintaining operational simplicity and efficiency.

The interplay between entrepreneurial agency and knowledge management further complicates this dynamic. It has been observed that entrepreneurs may, at times, leverage organisational resources for personal benefit, raising critical questions about the alignment between individual agency and collective organisational objectives (McMullen & Kier, 2016). In contrast others have highlighted the value of cognitive agility and moral intent in entrepreneurship, illustrating how effective entrepreneurs can make rapid, ethical decisions and mobilise action even in contexts devoid of immediate personal reward (Shepherd, et al., 2010). This juxtaposition between opportunism and altruism highlights a persistent tension within entrepreneurial behaviour, with implications for knowledge sharing, trust, and collaboration, particularly within SMEs.

Entrepreneurship involves the initiation and management of business ventures while accepting associated financial risks, defined by (Oxford University Press, 2023). While this definition captures the economic and transactional dimensions of entrepreneurial activity, it arguably underrepresents the intricate psychological, strategic, and organisational processes that underpin entrepreneurship in knowledge-intensive and innovation-driven contexts. Another argument advanced is that, if control over scarce resources constitutes the basis of economic profit, then skill acquisition together with the effective management of knowledge, know-how, and learning are fundamental to meeting strategic targets (Teece, et al., 1997).

Recent systematic literature reviews have deepened understanding of the evolving construct of entrepreneurial leadership. (Leitch & Volery, 2017; Hoang, et al., 2025) demonstrated that entrepreneurial leadership is not confined to any single organisational form but rather serves as a vital enabler of innovation, growth, and long-term sustainability across a wide range of business contexts. Their analyses underscore the importance of entrepreneurial leadership in shaping talent recruitment

strategies, enhancing organisational adaptability, and navigating complex business environments. These reviews collectively call for more nuanced research into entrepreneurial leadership and leadership teams, particularly across diverse firm sizes, industry sectors, and cultural settings to support new strategy.

Although the broader literature has extensively examined entrepreneurial leadership within large or high-growth firms, research focusing on SMEs offers a more contextualised understanding of the unique challenges and opportunities they encounter. This is shown in the identification of critical leadership behaviours that facilitate growth trajectories in SMEs (Koryak, et al., 2015), and this analysis was extended to explore the interface between entrepreneurial leadership and sustainable business model innovation, paying specific attention to the mechanisms of technology transfer and absorptive capacity within SMEs (Korayim, et al., 2024). Together, these studies highlight the increasing importance of leadership capabilities that transcend traditional managerial roles encompassing strategic vision, adaptability, and the ability to foster cross-boundary innovation.

This review of entrepreneurial leadership is grounded in classic and economic definitions (Teece, et al., 1997) and entrepreneurial leadership behaviour through systematic review (Leitch & Volery, 2017). This is supplemented with the works based on leadership behaviours using a lens for SMEs (Korayim, et al., 2024; Koryak, et al., 2015) coupled with the theoretical work based on entrepreneurial decision making, action, uncertainty and ethics (McMullen & Kier, 2016; Shepherd, et al., 2010).

However, despite these advances, the literature remains fragmented. Empirical studies often lack longitudinal depth, limiting the understanding of the sustained impact of entrepreneurial leadership on organisational performance over time. Moreover, many existing analyses adopt a generalised approach to leadership characteristics without sufficient consideration of contextual factors such as sectoral dynamics, institutional environments, or organisational maturity. Consequently, a significant research gap persists regarding how entrepreneurial leadership operates dynamically within the complex, resource-constrained settings characteristic of SMEs, particularly amid global uncertainty, technological disruption, and the accelerating pace of digital transformation.

2.5.1 Innovation and change management

The definition of the open innovation paradigm assumes that businesses actively seek out and utilise external and internal ideas and routes to market while advancing their technology (Lopes & Carvalho, 2018). There is a need for the knowledge exchange collaboration to influence the supply chain, increase competitiveness and develop knowledge-based economies (Schofield, 2013). The translation of research and development when working with industry can drive innovation and the subsequent realisation of commercial gain examples are typically around value capture through innovation of new products, complementary niche products, licensing, patents and protection of intellectual property rights (Oliver, 2020). Research on the implications of academic engagement provides a viewpoint that SMEs can have longer term impacts beyond the collaboration partners, academics, and non-academic external stakeholders (Rosli, et al., 2018).

Innovation portfolios can range from the radical to incremental process improvement (Dewar & Dutton, 1986). Radical innovations require an elevated level of new knowledge in comparison to the incremental. Innovation types in IT systems including improvements to Management Information Systems (MIS) and Customer Relationship Management (CRM). Other innovations are related to process improvements examples include taking advantage of technological improvements or supply chain innovation with suppliers and product innovation through viable alternatives from re-design to re-engineering or introduction of alternative materials are other examples.

Innovation may be one of the main drivers and this may come from a customer need, new products, technology progress for hardware and/or software and this too requires knowledge exchange and sustainable competitive advantages that come from successful knowledge exchange. There is an exhortation that innovation through technology and research and development should include business models. Sustainable innovation achieved through internal and external knowledge exchange, employing experts and effectively utilising employees' skills. The exit from Europe has opened new markets for UK exports especially in emerging economies and (Jibril, 2023) noted that while it is not necessary to always launch innovative new products a

change of product to suit alternative markets can drive exports. Couple this with online markets through digital platforms a competitive advantage can be achieved through commercialisation and speeding up new product development but can be crowded and extremely competitive (Wu, et al., 2022). There needs to be a fast reaction with a faster cycle of innovation to be first to the marketplace. This means the business model innovation must be supported in the same fast reaction time and there is a need for external knowledge and expertise to deliver that innovation (Teece, 2010).

In exploring innovation capability (Saunila & Ukko, 2014) highlight that there are effects generated internally and externally to the business but that there was not a notable effect on the innovation capability due to the business's industry sector or size. The exploration of the "organizational design and a firm's ability to explore as well as exploit" concluded that "ambidextrous organizational design" was required for success (Tushman, et al., 2010). Research focused on SMEs in the Italian clothing sector provides empirical evidence that to be successful when implementing changes in its business model it should acquire resources at the same time to force its intangible assets to gain advantage (Cucculelli & Bettinelli, 2015).

A report by (BIS, 2010), now BEIS, identified that SMEs that have invested in R&D, are deemed innovative or hold Intellectual Property (IP) and are more likely to achieve internationalisation through exporting. Indeed, they conclude "exporting itself promotes innovation and investment in R&D." Innovative businesses that export gaining success in overseas markets which aids their productivity and growth objectives can increase exposure to "tastes and preferences of foreign customers" prompting more incremental innovation (Jibril & Roper, 2022). For multinational enterprises (MNEs) there is some work focused on the innovation ecosystem where several interested parties form a team and share knowledge to gain innovation, but it is observed that SME management practices do not lend themselves to this approach (Bacon, et al., 2019). Innovation is inherently a dynamic and complex process, making it challenging to measure or model the key factors and interconnections that drive its success. Offering valuable insights in the complexities and achievements involved in integrating innovation and creativity into practical real-world applications (Von Stamm, 2005; Von Stamm & Trifilova, 2009) .

A recurring issue in innovation research is the difficulty of capturing and sustaining profits from innovative activities. This challenge is particularly relevant in the context of emerging technologies and the use of open innovation strategies to appropriate value from innovations such as General-Purpose Technologies (GPTs) (Yang, et al., 2022). Additionally, management plays a crucial role in facilitating innovation by adopting open innovation practices, implementing necessary organisational changes, and actively removing barriers to success (Barham, et al., 2020).

The process or challenge of innovation is an inherently dynamic process and hence difficulties exist in being able to measure or model the factors and key links for successful innovation to provide a deep insight into the issues and successes of combining innovation and creativity into the real world. Innovative practice can develop a value proposition and integrated improvements to processes create value. In this thesis we explore the impacts of knowledge exchange through from an initial proposition and how that translates to a sustainable competitive advantage for the business. The next section now turns to the importance of value capture within the business model based on the outcomes of knowledge exchange.

2.5.2 Knowledge exchange and business models

Business model academic research has lagged business practice, (Zott, et al., 2011; Chesbrough & Rosenbloom, 2002). There are still unanswered questions in relation to how organisation's design and change business models successfully. To exploit fully innovative technological research in a sustainable method there must be a differentiated business model to capture the value as innovative ideas and technologies are commercialised through their business models. In 2007 Chesbrough describes the function of a business model and describes six types of business model framework with the overreaching statement that no business model lasts forever (Chesbrough, 2007). The economics of sustainable innovation and the business model it is claimed are not linked (Boons, et al., 2013). In the context of innovation Teece considers the lack of literature related to the model's business use and their implementation and he concludes that business models should not be able to be replicated by the competition but should take internal and external issues into account (Teece, 2010).

The issue still not proven or identified is how to change the business model strategy to drive value creation to greater levels supporting the business and securing its future as well as sustaining the innovation capability and continuing the knowledge exchange as described by (Boons, et al., 2013).

Explored in this research is the link between the creation of value for the business through knowledge exchange and demonstration of the capitalisation of their strengths through entrepreneurship, innovation of product and services. To ensure sustainability due to a strategic change or improvements to the competitive position through operational processes should be reflected in a change in the business model. Barriers to changing business models are present (Tushman, et al., 2010) discusses ambidextrous organisations. Based on executive surveys there is prevalent recognition of the importance of innovation but there is disappointment with the effects and measurable results from innovation investments (Dervitsiotis, 2011). To reflect changes and developments in the business model, brought about by the exchange of knowledge, improved comprehension of business models and their inherent mechanisms capturing new value is necessary which may entail business model innovation. Press defines this as:

"A plan for the successful operation of a business, identifying sources of revenue, the intended customer base, products, and details of financing" (Press, 2018).

Wirtz's analysis of business model innovation and its development alongside future research directions produced a synopsis of publications, centred on business model innovation, over time in three thematic areas: corporate strategy, innovation and technology management, and entrepreneurship (Wirtz, et al., 2016). The paper continues by commenting on "the more elaborate guidelines and handbooks for practitioners" (Wirtz, et al., 2016). A business model is comprised of a business system coupled with a profit model. The business system is the production/delivery aspects, which deliver products or services to its customers. The strategies for achieving this are inherent in the profit model where resources and their costs are combined for each product or service and suitable margins identified. As defined by (Teece, 2010, p. 183):

"The essence of a business model is in defining how the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit."

The next section develops the linkage of knowledge management and competitive advantage leading from the review of knowledge exchange and business models.

2.5.3 Competitive Advantage and innovation

The growing pursuit of competitive advantage, along with the rapid pace of innovation cycles, compels organisations to integrate external knowledge and expertise to foster strategic business model innovation. To achieve this, organisations need to expand their knowledge base, especially in technology and strategic applications, to enhance resource efficiency and reinforce the business rationale for these advancements (Adams & Comber, 2013; Hooker & Achur, 2014).

Further insights into sustainable business models were provided by (Schaltegger, et al., 2016), emphasise that long-term corporate sustainability necessitates an equally sustainable business model. (Amit & Zott, Spring 2012) further argue that business model innovation complements product and process innovation. Many key authors have defined business models through frameworks to aid high-level overview and to allow comparisons and contrasts in certain business categories or sectors. As discussed by (Zott, et al., 2011) centring the business model for use as an analytical tool has devolved in literature by researchers and practitioners into three areas. The first of these is related to IT and e-business, the second to performance and gaining competitive advantage and finally the third classification is related to innovation and technology management, supporting the use as an analytical tool (Teece, 2017).

An expansion on the previous definition by (Boons, et al., 2013) incorporates specifics for success include planning for value, the formation of methods for linking supply to customers and how the profits are divided across the business. The profit model and the business system should attain equal profile for success it is claimed by (Itami & Nishino, 2010) and the importance of business model strategic innovation is supported by (Chesbrough, 2010). The business system characterises the delivery or production aspects, which deliver products or services to its customers. Indeed, there are

examples of new arrivals into a marketplace that have more ability to isolate and take advantage of an area previously underexploited or not thought worth noting by those that were incumbent in those competitive areas; examples of these are Amazon and Google.

Emphasising that businesses need to recognize the circumstances or opportunities that prompt a change in their business model (Johnson, et al., 2008), it is essential that they also possess the knowledge and skills required to identify the components that enable and support such a transformation. They further expand that this may be where managers do not perform well in not realising when the model needs to change or indeed how to implement such a change. Business model frameworks provide an opportunity to analyse the situation encompassing value proposition, profit, processes, and resources and adopt a strategic approach. This approach identifies value creation areas and the opportunity for value capture providing focus for future actions and perhaps where the business model needs to change. This has been identified as a significant task for both start-ups and established businesses (Barjak, et al., 2014). Supporting this is work by (Chesbrough, 2017, p. 12) where he and his colleague Richard S. Rosenbloom, Professor Emeritus of Harvard have a working definition:

"A better business model often will beat a better idea or technology."

Businesses that successfully control and manage an increase in knowledge management and expertise can achieve growth and hence competitive advantage as it leads to stimulation of creativity and innovations (Chen & Huang, 2009). First published in 1959 (Penrose & Pitelis, 2009) sought to explore and explain the elusive explanation for the achievement of competitive advantage focusing on internal causes. In the article exploring strategy (Porter, 1996) he proposes that organisations need to maintain effectiveness operationally and developing strategies that "*reinforce and extend the company's position".*

Business requirements for competitive advantage coupled with a faster cycle of innovation means that there is a need for external knowledge and expertise to deliver accompanying innovation in the Business Model strategic direction. There is a need to increase the level of knowledge within businesses in terms of technology and

strategies that can be applied to improve their resource efficiency especially around the business case for doing so (Adams & Comber, 2013; Hooker & Achur, 2014). Common themes are listed below from a comprehensive business model literature review (Zott, et al., 2011, p. 1020):

- Business Model is evolving as a new unit of analysis.
- Emphasis on a holistic approach to explaining how firms “do business.”
- The activity of the business decides how the concept of the Business Model is proposed.
- Value creation and value capture must be explained in the Business model and not a sole focus on value capture.

The research by (Schaltegger, et al., 2016) provided more insight into the business model and the latter of the two themes listed above where sustainability for the company needs to have a matching business model that is sustainable. An article by (Amit & Zott, Spring 2012) highlights that changing business models is complementary to product or process innovation. Business model innovation has been identified as a crucial factor in the success of both start-ups and established businesses (Chesbrough, 2010; Porter, 2008; Porter, 2004). However, the degree of success varies across different innovation systems, as do the agents operating within them.

In contemporary business environments, knowledge management has emerged as a fundamental activity for organisations seeking to maintain a competitive edge. Businesses increasingly recognise that competitiveness is tied to the effective management and utilisation of knowledge. The UK government’s “Help to Grow Initiative” (GOV.UK, 2021), which provides training for SME business leaders to enhance productivity, is aligned with the BEIS SMEs Action Plan (GOV.UK, 2023). These initiatives underscore the significance of strategic knowledge management in fostering business growth and sustainability and ultimately gain in productivity.
The strategic management of organisational knowledge is instrumental in achieving competitive advantage. A business's ability to leverage its resources, particularly knowledge, determines its capacity to achieve its goals. For knowledge to serve as a source of competitive advantage, it must be valuable, transferable, and applicable.

Creativity and innovation are essential in sustaining this advantage, allowing businesses to navigate evolving market conditions and supply chain dynamics while generating value. However, capturing this value necessitates adjustments to the business model. Numerous examples illustrate how businesses fail to adapt their models in response to environmental shifts with their market sectors (Gassmann & Frankenberger, 2014; Lindgardt, et al., 2009). In such cases, innovation-whether though product development, process optimisation, or management restructuring is required to maintain relevance and growth.

Over time frameworks have been developed to define and dissect the critical components of a business model, each offering varying levels of granularity and conceptual orientation, typically encompassing between four and nine elements. A comprehensive assessment of these frameworks established a comparative foundation for evaluating their relevance and application within different research and industry contexts (Hartmann, et al., 2016). This analysis underscores that while frameworks differ in scope and terminology, they converge on foundational elements that are indispensable for understanding how firms generate and sustain value.

Among the most widely cited frameworks are: the nine building blocks model proposed in the *Business Model Canvas* by Osterwalder and Pigneur (Osterwalder & Pigneur, 2010), which provides a highly visual and modular approach; Johnson's four-box framework (Johnson, 2010) which focuses more narrowly on strategic alignment highlighting when a business model must change; Chesbrough's six-function framework (Chesbrough, 2017), which emphasizes innovation and openness in business model design with the view that this may outperform superior technologies; and Muegge's four-factor framework (Muegge, 2012), which takes a systems view with particular attention to technological ecosystems. Despite their differing emphases, a comparative analysis reveals a shared core among these models, specifically, the triad of value proposition, value creation, and value capture, as shown in Table 2.

Table 2 Business Model comparison (Source: adapted from (Hartmann, et al., 2016))

	Value Proposition	Value Creation		Value Capture		Cost structure
Nine building blocks: Business Model canvas Osterwalder & Pigneur, 2010, p. 16	Block 2. Value propositions	Block 6. Key resources	Block 7. Key activities Block 8. Key partnerships	Block 1. Customer segments Block 3. Channels Block 4. Customer relationships	Block 5. Revenue streams	Block 9. Cost structure
Four box framework Johnson, 2010, p. 24	Box 1. Customer value proposition	Box 3. Key resources Box 4.Key processes			Box 2. Profit formula	
Six function framework Chesbrough, 2017, p. 109	Function 1. Value proposition Function 3. Value Chain Function 5. Value network	Function 6. Competitive strategy		Function 2. Market segment	Function 4 a. Profit potential	Function 4 b. Cost structure
Four Factor framework Muegge, 2012, p. 11	Factor 2. Stakeholder value propositions	Factor 4. Capabilities (includes resources and processes)		Factor 1. Importance (pain point)	Factor 3. Profit formula	

These three components value proposition, value creation, and value capture are not only recurrent but critical for any robust business model. The value proposition defines the offering that meets customer needs, while value creation refers to the internal processes and resources that enable delivery of this offering. Value capture, in contrast, pertains to how a firm monetizes its efforts and sustains operations. As Chesbrough (Chesbrough, 2017) argues, an effective business model must ensure not only that value is created but that the focal firm is positioned to capture and retain it, particularly important in competitive and innovation-driven markets. However, excessive focus on value capture may undermine long-term sustainability. Other work stress the importance of maintaining equilibrium between value creation and capture, noting that firms must navigate inherent trade-offs between short-term profitability and long-term ecosystem health (Cennamo & Santalo, 2013).

This section illustrated that while business model frameworks offer varying lenses, their convergence around key functions suggests a universal set of concerns for strategy and innovation scholars. The interplay between creating, delivering, and capturing value remains central to theoretical development and practical application, particularly in dynamic and digitally mediated markets. Future research might examine how these core components interact under different environmental contingencies or organisational configurations.

Selection of the categories as shown in the four-box framework (Johnson, 2010) reflects value proposition, value creation, value capture and will be a focus for this research around the impact on the business and recognisable to stakeholders from the operational management of the business. The others with six and nine categories

are overly complex and would require external support and /or training to implement within this study. The selection of Johnson's framework over Muegge's four-factor framework (Muegge, 2012) is based on the clarity and focus of Johnson's on key processes and key resources for value creation.

2.6 Barriers to knowledge exchange within organisations

Barriers to knowledge exchange within organisations stem from both structural and institutionalised constraints. While internal barriers can slow the dissemination of knowledge, (Senge, 2006) argues that individuals have the capacity to overcome even the most entrenched obstacles. Institutional barriers, by contrast, often remain unchallenged, reinforcing the status quo. Business model innovation has emerged as a critical approach for overcoming these barriers, with connectivity to sustainable competitiveness (Wirtz, et al., 2016).

The complexities of knowledge exchange within and between organisations require further exploration, as such processes are neither instantaneous nor cost-free (Hansen, 1999). Differences in organisational cultures and processes can hinder effective knowledge transfer (Easterby-Smith, et al., 2008; Inkpen & Tsang, 2005; Inkpen & Pien, 2006). To facilitate knowledge exchange, it is essential to frame new ideas in a context that employees can comprehend and engage with. Motivating employees to tackle challenging tasks can foster creativity, drive innovation, and promote knowledge sharing (Garg & Rastogi, 2006). While outsourcing innovation may not always be feasible, technology transfer can enhance knowledge exchange. Top management plays a crucial role in shaping and communicating a clear knowledge vision within the business (Nonaka & Teece, 2001).

Emphasis that learning is inherently cyclical, is a concept reflected in Kolb's Cycle of Experiential learning (Kolb & Kolb, 2009). Organisational development and improvement are intrinsically linked to the learning capacity of individuals within a business. As a business expands into multinational and global operations, the demand for efficient knowledge exchange increases, driving further interest in organisational learning (Argote, 2013). Three dimensions of a learning-based technology strategy are identified in this work although it does note that while these elements may not

directly enhance business or manufacturing competitiveness in isolation, their strategic alignment significantly contributes to overall business performance (Ahmad & Schroeder, 2011).

Empirical studies have established a direct correlation between knowledge transfer and business performance. For example, (Williams, 2007) found that replication and adaptation enhance knowledge exchange, ultimately leading to measurable performance improvements in the telecommunications industry. An outcome from (Dawson, 2000) emphasises that knowledge capabilities and their continuous development should be considered holistically across a business, incorporating available technology, skills and behavioural factors. However, research by (Done, et al., 2011) suggests that short-term best practice interventions often fail to yield sustained improvements, particularly in SMEs due to resource constraints, including limited time and financial investment. (Parnaby & Towill, 2010, p. 7) reinforce this perspective, asserting:

"*In order to be effective, change management needs to be embedded within a highly active learning industrial organisation*."

This assertion is not contingent upon the size of the business but instead highlights the central importance of internal learning capabilities (Chen, et al., 2010). Businesses are encouraged to integrate both internal creativity and external knowledge resources, emphasising the strategic value of collaborative approaches (Von Stamm, 2005). Collaboration is further recognised as a key driver of innovation, with research demonstrating how co-creation and shared learning mechanisms enable more adaptive organisational practices (Tidd & Bessant, 2013). However, the relationship between organisational design and strategic learning remains an area requiring deeper clarification, with calls for further investigation into how structural configurations support or inhibit learning-based innovation processes (Tushman, et al., 2010).

Positioning knowledge exchange as a critical component of knowledge management, highlights its role not only in creating competitive advantages but also in reducing costs and fostering innovation (Ladd & Heminger, 2003). Within businesses knowledge transactions benefit both the provider and the recipient, facilitating shared

understanding and stimulating the creation of new ideas, which is fundamental to innovation. Several studies have examined knowledge exchange mechanisms to identify best practice for sustaining business competitiveness developing absorptive capacity (Adams & Comber, 2013), impact of KTP associates (UKRI, 2023) and integration of sustainable capacity to innovate (Ternouth, et al., 2012). Together these reports highlighted a critical limitation: while knowledge transfer initiatives often aim to solve business challenges, they do not always result in widespread knowledge absorption within the business (Abreu, et al., 2008). Although governments have developed strategies to promote knowledge exchange, challenges persist due to the complexities inherent in various industry sectors and the unique approaches adopted by individual businesses.

The next section will explore the significance in the context of SMEs in the UK national objectives around economic growth. The factors isolated for research in previous sections in this chapter are now developing to match the objectives of the research. The focus will be how embedding knowledge exchange influences long-term performance, highlights the role of organisational learning and knowledge absorption, and considers the impact of innovation, leadership, and strategy in driving sustainable business growth for SMEs. The next section provides comment on the past initiatives and the current state of SMEs in the UK covering leadership, knowledge exchange, competitive advantage and innovation in this sector.

2.7 SMEs

The UK Government has launched initiatives since 2010 to improve and increase opportunities for SMEs. SMEs, “any business with fewer than 250 employees” (Rhodes, 2017) play a significant role in the national economy, and there is a need to help them improve their competitiveness as markets expand and operational activity develops in a global environment. In October 2024 there were 5.5 million businesses (Department for Business & Trade, 2024) and SMEs account for 99.8% of the business population. At this time total employment in SMEs was 16.6 million (60% of the total), whilst turnover estimated at £2.8 trillion (52%). Employment in small businesses (with 0 to 49 employees) was thirteen million (47% of the total), with a turnover of £0.9 trillion (18%) (Department for Business & Trade, 2024).

In 2022 the G7 countries' average (excluding the UK) output per worker was 13% above the UK in 2019 and the UK was the second slowest on output per hour between 2009 and 2019 (Office for National Statistics, 2022). A key component for future UK Government Industrial strategy is raising productivity (BEIS, 2017) and supported by other programmes including the Business Basics Programme (GOV.UK, 2021) and "Help to Grow" (GOV.UK, 2021) to encourage SMEs to adopt management techniques in areas such as financial management and adopt existing technologies to boost productivity.

Innovate UK announced a delivery plan for 2021/2025 to grow public expenditure to £22billion per year on R&D (Innovate UK, 2022). As part of the 5-point plan there is a specific action to nurture high growth potential SMEs to develop them to mid-size with strong productivity and exports from the Department for International Trade (DIT) (Cabinet Office, 2023). Graham Stuart MP, Minister for Exports highlights in his foreword that the core aim of DIT is to support SMEs and declares:

"SMEs are the lifeblood of our economy and the engine room for economic growth."
The evidence of the spending allocation and activity shown in the Table 3 below from reports compiled for the Cabinet Office.

Table 3 Current breakdown of Central Government spend with SMEs 2020 to 2021 and 2021 to 2022 (Cabinet Office, 2023).

DIT	**Spend with SMEs - financial year 2020 to 2021 (£m)**	**Spend with SMEs - financial year 2021 to 2022 reported 15 Aug 2023 (£m)**
Total procurement spends	£71,633 million	£79,154 million
Direct Spend with SMEs	£10,186 million	£9,774 million
Indirect Spend with SMEs	£9,083 million	£11,185 million

This next section will consider SMEs and leadership.

2.7.1 SME and Leadership

For SMEs, leadership is fundamental to driving business model transformation. Key enablers of success include access to networking opportunities, overcoming resistance to change, and securing investment or funding for technological advancements (BEIS, 2019).

SMEs often face constraints in implementing improvement initiatives due to leadership reluctance to seek external support, non-disclosure policies, and a failure to identify knowledge gaps. A strong focus on daily operations results in short-term decision-making and reactive strategies (Ates & Bititci, 2011; Pal, et al., 2014), alongside hesitancy in investing in external expertise (Mole, 2021). Typically, continuous management pressure is required to drive successful improvements whereas strategic leaps can be high-risk and highly visible. This visibility can deter managerial engagement, particularly when immediate financial returns are uncertain. Additionally, strategic advancements require individuals willing to assume significant risks. The entrenched "firefighting" approach within SME culture, due to resource constraints, presents a systemic challenge (Hayes, et al., 2005). Nevertheless, SME leadership often embodied by owner-managers possesses the autonomy, expertise, and experience to make rapid and adaptive decisions (Desouza & Awazu, 2006).

There are concerns raised that SMEs frequently adopt an unstructured and reactive approach to business model innovation (Lindgren, 2012). Studies indicate that SMEs often lag in adopting Information Technology, require top management support for new initiatives, and need to foster a knowledge-sharing culture with reward systems to incentivise employee participation. Internationalisation remains a crucial growth avenue for SMEs, actively supported by UK government initiatives (BEIS, 2019; BEIS, 2021; GOV.UK, 2021). Research conducted globally highlights similar leadership challenges among SMEs, irrespective of geographical context. Demonstrating this aspect, studies in Taiwan examined the impact of CEO attributes on SME performance (Hsu, et al., 2013), while research in Dubai investigated the influence of managerial practices on innovation (Al-Ansari, et al., 2013). Furthermore, Garcia (Garcia, 2011) analysed SMEs in the Philippines, Singapore, and the USA, concluding that

managerial support for employees is more influential than statistical analysis alone. Technological, organisational, and environmental factors influence the adoption and implementation of knowledge management identified in (Lin, 2014). Given resource limitations, SMEs must effectively disseminate internal knowledge, skills, and expertise.

However, contractual, planning, and recruitment challenges present initial barriers, as SME management often resists external intervention. Research across various countries, including Taiwan (Lin, 2014), Dubai (Al-Ansari, et al., 2013), Spain (Calvo-Mora, et al., 2016), and Turkey (Alpkan, et al., 2007), suggests that while SMEs' lean structures enable them to respond dynamically to market shifts, they do not inherently guarantee a competitive advantage. Additional studies highlight that SMEs tend to prioritise acquiring new technology for product innovations rather than investing in organisational innovation (Salavou, et al., 2004). Others argue that SMEs' preference for self-governance often leads to resistance to external assistance (Laforet & Tann, 2006). There are claims that SMEs frequently fail to leverage flexibility and speed in accessing new market opportunities (O'Regan, et al., 2006).
Effective SME leadership must actively engage employees to unlock intellectual capital, drive growth, and sustain competitive advantage. Key strategies to enhance employee satisfaction that are succinct are offered here, including:

- Offering equity or partnership opportunities.
- Providing informal learning and development opportunities.
- Clearly communicating vision and strategic decisions to ensure inclusivity.
- Empowering employees to take initiative. (Batra, 2017)

Research in Taiwan underscores the importance of employee rewards in fostering knowledge management success (Lin, 2014). However, others such as (Wong, 2005) note that many SMEs lack structured reward systems, impeding knowledge exchange and organisational learning. Specific critical success factors were identified (Wong, 2005) with acknowledgment that effective people management leading to retention will prevent knowledge loss which is a key issue for SMEs.

Entrepreneurship, as defined by the Oxford University Press (Oxford University Press, 2023), involves initiating and managing businesses with an inherent degree of financial risk. Entrepreneurial persistence is critical in identifying market opportunities and achieving competitive advantage (Caglio & Katz, 2001). Decision-making within SMEs often takes place in uncertain environments due to limited expertise and financial constraints (Lynch & Corbett, 2021).

SME engagement remains a priority for the UK Department for Business & Trade. Initiatives such as the SME Finance Charter provide financial support through bank pledges, while government procurement policies aim to increase SME participation by simplifying contract processes and ensuring prompt payments (GOV.UK, 2018; GOV.UK, 2023). Across the globe, SMEs are acknowledged as vital drivers of economic growth, particularly in emerging markets (Owalla, et al., 2022; Motta, 2020; Pauluzzo, 2021) and the sustainability of SME is crucially entwined with continuous innovation (Bahta, et al., 2021; GOV.UK, 2021; Innovate UK, 2022). However, persistent challenges remain, including outdated workplace practices, resource constraints, skill retention issues, and slow technology adoption (BEIS, 2019; BEIS, 2021; GOV.UK, 2021; Owalla, et al., 2022).

Academic research has explored key factors that have been identified as constraining SME productivity, such as leadership styles, absorptive capacity, and staff retention, and their implications for innovation, decision-making, and international expansion ((Bilan, et al., 2020; Dunne, et al., 2016; Mandhachitara & Allapach, 2017). SMEs frequently face investment constraints, requiring a delicate balance between short-term financial pressures and long-term R&D investment (Bakhtiari, 2020). Employee retention, critical for sustaining long-term growth, presents an additional challenge (BEIS, 2021).

SME leadership is frequently characterised by self-employed owner-managers who may lack formal business qualifications, financial negotiation skills, or experience in strategic decision-making. A considerable proportion of SMEs operate as family-run enterprises, which often reinforces insular and internally focused decision-making practices (Hessels & Parker, 2013). To address these challenges, leadership development and structured management training are essential for SMEs to build

resilience, embrace innovation, and maintain competitiveness in an evolving market landscape.

Research highlights that smaller manufacturing businesses tend to make decisions without a long-term strategic perspective (Panizzolo, 1998). Given SMEs' significant contributions to national economies through job creation and innovation embedding knowledge and strategic foresight is essential for securing competitive advantage beyond addressing immediate operational challenges (Massaro, et al., 2016).

This research contributes to reinforcing how SMEs can leverage comparative insights from similar enterprises, adopt best practices, and replicate successful strategies to achieve sustainable growth and competitive advantage. SMEs or more specifically their leadership, must be encouraged to engage in comparing themselves to similar successful businesses engaging in networking opportunities, overcoming resistance to change (Al-Ansari, et al., 2013; Desouza & Awazu, 2006; Laforet & Tann, 2006; Panizzolo, 1998), and securing investment or funding for technological improvements are a critical route to gaining successful entrepreneurial leadership (BEIS, 2019). The next section further develops knowledge management and exchange in the SME context.

2.7.2 SME Knowledge Management and Exchange

The integration of knowledge into a business's activities and the impact of knowledge sharing can result in a direct impact on the business performance indicators such as sales and profitability. The knowledge management integration does not matter in terms of size of the business but will have positive results and improvements (Al-Jabri & Al-Busaidi, 2018; Calvo-Mora, et al., 2016). Support for recognition of the effects of knowledge and its effects on business performance is developed by the empirical investigation research by (Hsu & Sabherwal, 2012).

Knowledge management and exchange is a critical business function. If knowledge cannot be accessed and exists in isolation, it has no value for any business (Audretsch & Belitski, 2021). The importance of continuation of the study of knowledge management in SMEs and that little work has been carried out to date is commented

on in literature (Al-Jabri & Al-Busaidi, 2018). There is acknowledgement that to improve operational performance a key component is knowledge exchange and the integration of that determines the long-term existence of the business as it is a source of competitive advantage. Motivating employees when challenged with tasks to do; this can transform into creative ideas and facilitate innovation and the sharing of information (Garg & Rastogi, 2006). To create the knowledge vision, it is the duty of the top managers to devise and create the knowledge vision and communicate it within the company (Nonaka & Teece, 2001).

Research that has focussed on knowledge exchange and knowledge management identifying the benefits and the relationship with improvements in business performance has shown to have a positive effect (Garcia, 2011; GOV.UK, 2021). Government reviews and strategic plans have strands related to improving the abilities of SMEs to access public sector contracts, become a supplier to major public sector areas, expand into a global market and to develop the innovation capabilities.

The issue of knowledge exchange within SMEs warrants particular attention due to structural and operational constraints. These include limited resources for R&D, reduced purchasing power for acquiring external expertise and specialised skills, challenges in retaining a skilled workforce, and constrained capacity to invest in emerging technologies. In contrast to large manufacturing firms, which typically possess the financial and organisational resources to adopt advanced technologies and sophisticated manufacturing systems, SMEs often face significant barriers in accessing and implementing such innovations.

There is a need to increase the level of knowledge within SME's regarding technology and strategy that can be applied to improve their resource efficiency especially around the business case for doing so (Chesbrough, 2017; Desouza & Awazu, 2006). Research commissioned as part of the "Business Basics Programme" identified factors that influence the adoption of management and basic technologies and found that SMEs need to overcome inherent attitudes and there is a need to reverse reluctant adoption (BEIS, 2019). Innovate UK through the Knowledge Transfer Partnerships have consistently introduced different support activities for SMEs promoting engagement altering the accessibility thresholds examples include the Management

KTP (mKTP) (Innovate UK KTN, 2023) and flexibility in the length of the projects to suit the business.

SMEs issues and challenges include outdated workplace practices, self-employed owner manager status, resource constraints, poor skill retention and slow adoption of innovative technology. SMEs are a major contributor to the economic growth of most national and global markets there is a continued need to consider knowledge sharing or exchange to achieve a competitive advantage and growth. The report “Unlocking SME productivity”, updated in 2020 (Centre for Economic Performance, 2020) highlighted two key challenges that for SMEs to achieve high growth there are poor management practices to overcome and a need to improve access to finance. SME operational issues, management styles, innovation practices or knowledge management have been the subject of useful systematic literature reviews that guide researchers (Massaro, et al., 2016; Durst, et al., 2023).

Changing global and national patterns in productivity slowdown has promoted the UK Governments to initiate policy related to funding actions and support initiatives for all businesses. One aim is to encourage SMEs to increase innovation activities, grow in exports and embedding knowledge into the business hence continue to support various knowledge exchange initiatives including KTPs. Recent initiatives in the United Kingdom focus on understanding how growth takes place and harnessing this for sustainable competitive advantage. A comprehensive literature review based on knowledge management in SMEs highlighted implications applying focus to the unique characteristics of SMEs are an inconsistent definition preventing international comparisons and that comparisons to actions and outcomes of large businesses is too large an assumption (Massaro, et al., 2016).

Barriers to innovation adoption among SMEs were examined in a study conducted by Kantar on behalf of the Department for Business, Energy and Industrial Strategy. Drawing on survey data from 40 SMEs, the research classified firms according to their respective stages of adoption, identified key barriers to adoption, and proposed tailored solutions. The findings emphasised the importance of developing strategies that are aligned with the typological characteristics of decision-makers, particularly

with respect to their propensity to adopt, or not adopt, innovative practices (BEIS, 2019).

Investigating the barriers to Knowledge Management practices in SMEs (Cerchione, et al., 2015) confirmed that SMEs using knowledge management practices adds to the growth of SMEs in many areas, but they need to exploit newer technology. A study of Malaysian SMEs (Lee, et al., 2016) concludes that a critical relationship exists between Knowledge Management, Technology Innovation and Competitive Advantage and that if all are applied this supports the devising of new successful strategies for SMEs. An earlier paper (McAdam & Reid, 2001) explored knowledge management in large and small business in the UK and found that the SME sector should develop knowledge management as a business driver rather than considering it as costly and using scarce resources. Knowledge exchange within the SME context involves the transfer of information either between individuals or from one department to another. The usefulness of this knowledge hinges on its ability to contribute to the success of the company that harnesses it. This knowledge exchange can be categorised into two main types: explicit and tacit knowledge.

Explicit knowledge refers to formalised information that can be readily articulated, codified, and communicated through structured formats such as scientific formulas, data sets, technical specifications, and manuals. This knowledge is easily stored, transmitted, and processed using conventional information systems. In contrast, tacit knowledge is inherently more complex to articulate and transfer, as it encompasses first-hand experiences, emotions, values, insights, and intuitions that are within individuals. This form of knowledge is context-specific and acquired through practice, making it difficult to formalise or share through traditional means. Importantly, tacit, and explicit knowledge are not mutually exclusive; rather, they are interdependent and complementary, together constituting an integrated framework for effective knowledge sharing and organisational learning.

Investigating factors influencing knowledge exchange, the Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03) presents an interesting paper for its review of four factors (Ladd & Heminger, 2003, p. 2). These four factors were considered as they had an influence on knowledge exchange. The

first is “Organizational Self Knowledge” as discussed in the journal Organizational Behaviour and Human Decision Processes (Rulke, et al., 2000) this covers the knowledge that the individuals know in the organisation. Partner Similarity; individual interest in the knowledge exchange (Darr & Kurtzberg, 2000); and Relational Channel; the depth of human-to-human contact see (Ladd & Heminger, 2003). For knowledge exchange to take place within a company there must be comfort about sharing. This comfort comes in through trust, teamwork, and openness. Research identifying the knowledge exchange factors in relation to SMEs resulted in the implication that knowledge exchange performance can be measured in this sector and the dimension of time was a novel finding for the model used (Sondari & Akbar, 2016).

Knowledge management is the process of collecting, developing, and spreading knowledge assets to enable organisational learning. Knowledge creation, retention and transfer are adaptive processes that are a function of experience and embedding leads to knowledge retention. The management of knowledge and learning leading in part to innovation is described in many formats and from different angles based on context but as each company differs in culture, economics, people, processes, and products there still no one solution exactly fits all result. One of the earlier researchers in this area (Panizzolo, 1998, p. 40) suggested that a model of “learning by learning” rather than learning by doing. Another earlier pair of researchers in the same vein (Keeble & Wilkinson, 1999) championed regional clusters for high technology SMEs in Europe recognising that this would lead to collective learning perhaps which is exemplified by Catapult Network UK set up by Innovation UK (UKRI, 2022). Driving innovation by accelerating research application is a key objective for this organisation to underpin the long terms success of KTPs.

SMEs still face challenges in establishing knowledge management processes as typically they have fewer resources and tend to depend on external knowledge sources such as customers, suppliers, networks (Al-Jabri & Al-Busaidi, 2018), and tacit knowledge (Audretsch & Belitski, 2021; Cerchione & Esposito, 2017) identified a need for SMEs to exploit knowledge management better to increase the impact mainly in the areas related to ICT but there is acknowledgement that due to their limited access to technological knowledge and qualified staff (Calvo-Mora, et al., 2016) this can be a barrier to progress. (Hutchinson & Quintas, 2008) concluded that SMEs do

conduct processes that are knowledge management however the activity tends to be carried out in an informal manner and this was supported by (Desouza & Awazu, 2006) who identified unique identifiers, listed below, in SMES that could influence their knowledge management approaches:

1: socialisation activity
2: common knowledge
3: linked in internal capture
4: loss on knowledge not an issue
5: knowledge from a person focused approach than a technological aspect

A conclusion from research on knowledge management systems within SMEs was a proposed taxonomy for the difference in strategies employed by SMEs for knowledge exchange (Cerchione & Esposito, 2017). However, one finding was that SMEs may not be aware of is the value of adopting and maintaining knowledge management practices and the need to exploit digital technology to improve the impact of the knowledge gained (Cerchione & Esposito, 2017).

When considering SMEs within the context of knowledge acquisition and organisational growth, it is essential to understand the dynamics of learning as well as the drivers and motivators that enable the effective application of newly acquired knowledge within internal strategic processes. Sustainable competitive advantage, as posited by, is closely tied to the capacity for successful knowledge exchange (Itami & Nishino, 2010). One of the greatest challenges in broadening the knowledge exchange policy agenda concerns the absorbing and embedding knowledge across businesses. The next section focuses on the action and reaction to innovation by SMEs.

2.7.3 SME and Innovation

One of the principal challenges facing small businesses is the imperative to engage in continuous innovation to ensure both survival and growth. This necessitates not only the creation of value through novel ideas and technologies but also the integration of these innovations within the broader business system to enable effective value capture. However, SMEs often encounter significant barriers in undertaking R&D and

implementing innovative practices. A commonly cited constraint is the shortage of skills and expertise required to foster and sustain innovation.

The capacity of SMEs to attract and retain individuals with advanced skills and knowledge, essential for generating new insights and translating them into commercially viable innovations, is increasingly critical in the context of rapid technological advancement. Emerging technologies such as Big Data, Artificial Intelligence (AI), and autonomous systems exemplify the dynamic and sophisticated landscape in which SMEs must now operate. Nevertheless, the availability of appropriately skilled personnel, particularly within the STEM arenas, remains limited, thereby hampering the innovation potential of SMEs.

According to the UK Innovation Survey 2019 (BEIS, 2020), there was a reported 38% decline in overall business innovation activity compared to the 2016–2018 period. Disaggregating this data reveals that innovation activity decreased by 37% among SMEs and by 50% among large enterprises. In contrast, the UK Innovation Survey 2021 (BEIS, 2022), covering the 2018–2020 period, indicated that 45% of UK businesses were innovation-active, a notable increase from 38% in the previous survey cycle. During the same period, 58% of large businesses reported engaging in innovation activities, compared to 44% of SMEs.

The UK Innovation Survey (BEIS, 2020) defines an “innovation-active” business as one that has undertaken at least one of the following activities during the survey period: the introduction of new or significantly improved goods or services, the implementation of new processes, engagement in R&D, or the acquisition of external knowledge, machinery, or software intended to support innovation.

In the context of the UK Innovation Survey, businesses are categorised according to the scope and nature of their innovation-related activities. A firm is classified as innovation-active if it has engaged in any of the following three activities during the survey period: (1) the introduction of a new or significantly improved product (good or service) or process; (2) involvement in innovation projects that are ongoing, have been scaled back, or were abandoned; and (3) the implementation of new or significantly improved organisational structures, business practices, or marketing strategies. A

broader category, termed broader innovator, includes businesses that have participated in any of the activities as well as (4) investment in innovation-supporting activities, such as internal R&D, employee training, and the acquisition of external knowledge, machinery, or equipment.

Additionally, firms engaging solely in activity (3), the adoption of improved organisational, structural, or marketing innovations, are designated as wider innovators. These classifications offer a nuanced understanding of the levels and types of innovation activity across firms of varying sizes and sectors. While these innovation activities present significant opportunities for growth and competitive advantage, they are not without their challenges. Businesses must capitalise on their existing strengths, core competencies, and specialised capabilities, particularly where niche markets and focused expertise offer competitive differentiation. Successfully navigating these challenges involves not only strategic investment in innovation but also the development of internal capacities to absorb and apply new knowledge effectively.

Cost remains the most significant constraint on innovation, consistently identified as the highest-rated barrier to innovative activity. Additionally, the shortage of qualified personnel has become an increasingly prominent issue. Between the 2014–2016 and 2016–2018 UK Innovation Survey periods, the proportion of broader innovators citing this as a barrier rose from 10% to 14%. Meanwhile, the lack of access to technological information has remained steady at 3%, although this barrier increased marginally by 1% among larger firms.

The importance of overcoming these barriers was explicitly highlighted at the EEF Manufacturing Conference on February 2018 (BEIS, 2018), where calls were made to enhance productivity as a pathway to national prosperity. These calls were closely linked to concerns about the skills deficit affecting all industrial sectors. More recently, the Make UK Report 2023 (Make UK, 2023) outlined strategic plans for industrial growth, particularly from a manufacturing perspective. However, the report also cited continuing challenges such as unequal regional access to innovation-related initiatives, which risk undermining nationwide growth efforts.

Within academic and practitioner literature, there has been sustained advocacy for the removal of barriers to innovation and for the adoption of Business Model Innovation (BMI) as a means of securing competitive advantage. Research indicates that SMEs in the manufacturing sector can enhance their performance by emulating the formal structures and strategies of larger firms (Terziovski, 2010). However, existing literature acknowledges that SMEs generally operate through more informal mechanisms, highlighting their distinct approach to innovation compared to larger enterprises (Bos-Brouwers, 2010). Their study found that medium-sized firms within the SME category are more likely to adopt formal structures than their smaller counterparts.

Customer-centric problem-solving emerged as a common feature of innovation activity within SMEs, reflecting a direct link between innovation and customer needs. In a study of Finnish SMEs, it was concluded that neither firm size nor industry sector significantly influenced innovation capability (Saunila & Ukko, 2014). Contrary to earlier assumptions, their findings suggested that resource constraints traditionally associated with smaller firms do not necessarily inhibit innovation, although they may shape how innovation is pursued.

The Enterprise Research Centre's report The State of Small Business Britain 2022: From Crisis to Crisis (Enterprise Research Centre, 2022) further reinforces the view that while innovation offers substantial benefits to SMEs, there remains a pattern of underinvestment in this area. The COVID-19 pandemic further exacerbated this situation by negatively affecting both R&D expenditure and overall innovation activity across the UK.

High-growth SMEs have often been characterised by a focus on price-based competition within their respective markets. However, as O'Regan et al. (O'Regan, et al., 2006) argue, long-term sustainability is more effectively supported through a strategic emphasis on innovation and R&D. Empirical research has consistently demonstrated a positive correlation between innovation capability and improved business performance among SMEs (Agyapong, et al., 2017; Al-Ansari, et al., 2013; Bigliardi & Galati, 2013). These findings affirm the critical role that innovation plays not only in driving competitiveness but also in enhancing the resilience and sustainability of SMEs.

While numerous factors influence the outcome of innovation-related projects, including leadership effectiveness and resource constraints, a notable mechanism for enabling transformative learning and behavioural change in SMEs is the KTP. The role of the KTP Associate, supported by the academic lead, acts as a critical catalyst in this process, fostering both short-term project implementation and long-term knowledge integration. These initiatives often lead to more than just immediate financial returns; they also deliver strategic outcomes that enhance future capabilities and promote enduring competitive advantage.

Empirical work by, (Dubouloz, et al., 2021) based on case studies involving seven SMEs, highlighted that innovation tends to be more complex for SMEs than for larger firms. This complexity arises predominantly from internal rather than external barriers. These internal constraints include financial limitations, a shortage of skilled personnel, time constraints, and a generally weaker absorptive capacity, factors that collectively limit the firm's ability to recognise, assimilate, and apply new knowledge effectively.

Within the field of open innovation, Henry Chesbrough has been instrumental in demonstrating the strategic benefits of leveraging external sources of knowledge. Research by Brunswicker and Chesbrough (Brunswicker & Chesbrough, 2014; Brunswicker & Chesbrough, 2015; Chesbrough, 2017) has shown that open innovation practices can lead to faster product development cycles and overall improvements in organisational performance, particularly for firms willing to collaborate across traditional boundaries. Further insights into the mechanisms of knowledge transfer are offered by (Bacon, et al., 2019), who examined how innovation emerges through the transfer of knowledge across diverse organisational types and ecosystems. Their findings contribute to a more nuanced understanding of the complexity involved in fostering innovation across institutional and organisational boundaries.

Moreover, innovative SMEs that engage in exporting activities often experience enhanced growth outcomes. Participation in international markets not only drives competitiveness but also exposes businesses to new ideas and innovation pathways, whether in product development, process improvement, or business model

adaptation. While both product/process enhancement and innovation demand investment and collaborative effort, innovation is typically distinguished by its reliance on creativity and novel applications within existing or evolving business models.

Critically, the UK's broader innovation policy ecosystem often assumes a level of strategic readiness and absorptive capacity that SMEs have not yet developed. Without adequate support for foundational business practices, such as data literacy, change management, or digital maturity, many SMEs remain unable to benefit from more advanced knowledge transfer or innovation funding schemes. Thus, while current policies have laid important groundwork, they require further refinement to reflect the diversity of SME capacities, the complexity of innovation adoption, and the regional disparities in access to institutional support.

The next section discusses expectations for competitiveness and the SMEs

2.7.4 SME and Competitiveness

In the context of enhancing innovation and productivity as mechanisms to promote national economic prosperity, knowledge exchange between higher education institutions and businesses has been a key focus of UK policy. The Higher Education Funding Council for England (HEFCE), now replaced by the Office for Students (OfS), undertook a survey during 2015–2016 to explore effective models of university–business interaction and concluded that the role of universities in facilitating technology transfer to SMEs could be instrumental in supporting the UK's progression toward a successful knowledge-based economy (HEFCE, 2017).

While the policy intent is commendable, its execution has raised concerns. One of the core criticisms of the knowledge exchange agenda is the degree to which university outputs align with the specific needs and absorptive capacities of SMEs. University-industry collaborations often operate under mismatched expectations, where academic research may not be easily translatable into actionable insights for SMEs constrained by time, resources, and strategic direction. This misalignment points to a systemic gap between policy formulation and practical implementation.

A structural shift in developed economies is highlighted, with a growing number of small businesses and a relative decline in large enterprises (Stokes, 2010). This change suggests that innovation policy must increasingly focus on the SME sector. However, despite policy efforts to support SME engagement with innovative technologies and strategies for improved resource efficiency and management practices, the uptake and impact of such policies remain inconsistent.

A critical assessment by (McKenzie, 2021) of management training programmes targeted at SMEs, questions the depth and sustainability of their outcomes. While these programmes aim to upskill leaders and improve business performance, evidence suggests they often deliver surface-level changes without enabling enduring behavioural or strategic transformation. This raises important questions about the long-term return on public investment in such initiatives and whether alternative models, such as embedded support or peer-learning networks, might offer greater impact.

The importance of strengthening SME competitiveness is not solely national; it also holds strategic relevance at the industry level, particularly where SMEs act as suppliers within broader value chains. According to (Watson, 2010), SMEs benefit more from engagement with a limited but relevant network of knowledge sources than from reliance on large-scale public support systems that often lack strategic focus. This insight reinforces the notion that policy must shift from a one-size-fits-all model to more tailored, sector-specific interventions.

Furthermore, the report by Kantar Public (BEIS, 2019) emphasises the need for clearer communication of policy measures. SMEs frequently cite an excess of technical jargon and a lack of clarity around how support programmes apply to their specific contexts. This highlights a persistent weakness in government policy delivery: while well-intentioned, the language and design of schemes remain inaccessible to the very firms they are intended to support.

The integration and strategic management of technology have been identified as key drivers of competitiveness for firms across all sizes. Ahmad and Schroeder emphasise that the use of technology within a business is not only a functional necessity but also a determinant of long-term competitive advantage (Ahmad & Schroeder, 2011). Their

study underscores the importance of continuous learning as a foundational element in realising the full potential of technology adoption. Liu and Barrar concluded that firms that successfully align technological capabilities with their overarching strategies perform significantly better, both financially and operationally, but they also caution that while smaller firms are increasingly able to serve mass markets and larger firms engage in mass customisation, such paradigms may act as constraints, limiting the scope for strategic differentiation (Liu & Barrar, 2008).

Critically, while the strategic alignment of technology and business goals is endorsed in literature, its realisation within SMEs remains uneven. SMEs often lack the organisational structures, human capital, and financial resources needed to pursue such integration at scale. Policy frameworks advocating digitalisation and Industry 4.0 initiatives have sometimes assumed that SMEs possess the absorptive capacity required to implement advanced technologies. This misalignment between policy ambition and practical capacity continues to be a recurring challenge.

The Organisation for Economic Co-operation and Development (OECD), comprising thirty-eight member states including the United Kingdom, has extensively highlighted the economic significance of SMEs. In its 2017 report addressing the role of SMEs in a global and digitalised economy, the OECD stated that SMEs account for approximately 99% of businesses, 70% of jobs, and contribute to 33% of GDP in the OECD area (OECD, 2023). However, the report also notes a shift from historically domestic-focused SME operations to increasing global exposure driven by technological advancement, evolving consumer demands, and international market connectivity. This globalisation introduces heightened strategic complexity, particularly for SMEs lacking the infrastructure or experience to compete internationally (Singh, et al., 2010).

Outsourcing and supply chain collaboration have been identified as potential strategies to mitigate some of these challenges. For instance, DiGregorio et al. discuss how outsourcing allows SMEs to access global efficiencies and scale, thereby creating competitive advantage (DiGregorio, et al., 2009). Similarly, Mesquita and Lazzarini argue that strategic collaborations within supply chains can enhance innovation and operational performance (Mesquita & Lazzarini, 2008). However, these models are not without risk. Outsourcing can lead to over-dependence on external suppliers and

a loss of core competencies, while collaborative strategies require a high level of trust, coordination, and alignment that is often difficult to achieve across organisational boundaries, particularly for resource-constrained SMEs.

The rise of e-commerce has been a significant equaliser, allowing smaller businesses to bypass traditional sales infrastructure and engage customers directly. This development has eroded some of the competitive advantage traditionally held by larger firms with extensive physical distribution networks. Nonetheless, digital competitiveness requires more than just access to e-commerce platforms; it demands skills in digital marketing, data analytics, and customer relationship management, areas where SMEs frequently face deficits.

Examples from industry history further illuminate the importance of strategic innovation. In the 1980s and 1990s, Japanese automotive manufacturers such as Toyota outperformed U.S. competitors by prioritising product quality and reliability over aesthetics and planned obsolescence (Hayes, et al., 2005). This shift in strategy not only altered consumer expectations but also demonstrated the long-term value of customer-centric innovation. Today, companies such as Apple and Sony exemplify how continual innovation in product design and business models can sustain competitive advantage over time.

Each business operates within a distinct and complex system shaped by its environment, capabilities, and strategic orientation. In the case of SMEs, one of the persistent challenges lies in the limited managerial capacity to conceptualise and adapt business model components in a structured and strategic manner. As Lindgren observes, SMEs frequently focus narrowly on the value proposition and customer targeting rather than pursuing dynamic and adaptive business model innovation (Lindgren, 2012). This limited scope can restrict responsiveness to fast-changing market conditions, technological shifts, and evolving customer expectations.

The tension between value creation and value capture remains a fundamental strategic issue. As Amit and Zott argue, “an emphasis on value creation without regard to value capture would be naïve,” highlighting the necessity for SMEs to develop mechanisms not only to innovate but also to commercialise and sustain the gains

derived from such innovation (Amit & Zott, 2015). However, many SMEs lack the systemic processes required to manage this balance effectively, particularly when constrained by resource limitations or operating in volatile environments.

Recognition of intellectual capital as a strategic asset adds further complexity, emphasising the integration of cultural, human, and technological dimensions as essential for sustainable performance, as digital infrastructures become increasingly central to knowledge-based competition (Meso & Smith, 2000). Nevertheless, the effective harnessing of intellectual capital in SMEs often remains underdeveloped due to low levels of formal knowledge management practices and inadequate digital maturity.

Empirical studies have long highlighted the important economic role of SMEs, particularly in employment and innovation (Massaro, et al., 2016). Yet strategic decision-making in SMEs is often reactive and short-term, reflecting a lack of long-term strategic planning capacity (Panizzolo, 1998). This reactive orientation is compounded by the pressure to remain agile with limited resources, which can inhibit investment in long-term capability development.

Exploring the link between knowledge exchange and competitiveness in SMEs organisational adaptability is critical (Zonooz, et al., 2011). These findings stress that employees must possess not only the ability and motivation to share knowledge but also the structural opportunity to do so. While this aligns with broader innovation literature, many SMEs operate in lean environments where formal knowledge-sharing systems are absent, and where knowledge often remains tacit and siloed raising a practical challenge.

Internationalisation is promoted as a strategic lever for SME growth, especially in emerging markets. Advocating for collaborative approaches to gain access to new markets and resources is explored (Mesquita & Lazzarini, 2008). However, this requires capabilities in partnership management, cross-cultural negotiation, and logistics, which are often weakly developed in smaller firms. Thus, while international collaboration can offer significant benefits, its feasibility varies widely across SME contexts.

Critically, not all SMEs are engines of innovation-led growth. There are arguments propositioned that policy assumptions portraying SMEs as uniform drivers of growth are flawed (Nightingale & Coad, 2013; Storey, 2009). This research highlights that SMEs do not prioritise innovation or growth and may instead focus on stability or survival. This is a vital corrective to overly broad policy narratives, which risk misallocating resources or designing support schemes that fail to reflect SME heterogeneity. Reinforcing this critique it has been identified that the predominant barriers to innovation in SMEs are internal, namely financial limitations, lack of skilled personnel, and time constraints (Dubouloz, et al., 2021). These findings align with broader evidence that innovation support policies often fail to address these internal constraints, focusing instead on external enablers such as funding or ecosystem building. In his work on open innovation, Chesbrough acknowledges these structural limitations while also highlighting that SMEs harbour considerable untapped potential. While examples of success demonstrate that SMEs can adopt open innovation principles effectively, widespread adoption remains constrained by a lack of absorptive capacity, limited partner networks, and often a cultural resistance to openness (Chesbrough, 2017).

Sustained innovation thus requires a holistic approach to capability development, encompassing technological infrastructure, human capital, and organisational learning. Dawson underscores the importance of aligning skills, behaviours, and technology across the organisation to build enduring knowledge capabilities (Dawson, 2000). However, a cautionary approach is highlighted by Done that many interventions in SMEs deliver limited long-term gains (Done, et al., 2011). These findings point to unrealistic expectations and underline the necessity for context-specific, long-duration interventions that consider SMEs' operational realities.

Current policy frameworks often suffer from a one-size-fits-all approach to SME innovation but do offer key literature for policy analysis and contextualising barriers. While the theoretical literature supports the importance of knowledge exchange, value capture, and technological integration, practical implementation is hindered by systemic constraints within SMEs (BEIS, 2019) including short-term decision-making and reactive strategies (Ates & Bititci, 2011; Pal, et al., 2014). Furthermore, policies

fail to account for the diversity of SME objectives, life cycle stages, and sectoral contexts. As such, there is a growing need for differentiated innovation policy that aligns support with firm-specific capabilities and strategic intent, as well as more longitudinal research to evaluate the sustainability and impact of innovation interventions in SMEs. This research does not have the resources for extensive longitudinal research but aims to identify how sustainable change and value capture is achieved and support future work by assessing the impact of actions taken in knowledge transfer projects for embedding knowledge.

In summary, while technological advancement and globalisation offer unprecedented opportunities for SMEs (Ahmad & Schroeder, 2011; Itami & Nishino, 2010), these same forces present significant challenges and constraints (Agyapong, et al., 2017; Bakhtiari, 2020; Bigliardi & Galati, 2013; Dubouloz, et al., 2021). Effective strategy and technology integration is essential but often remains aspirational due to the resource and capability constraints SMEs face. The following section outlines the operational framework of the KTP, a nationally coordinated funding initiative designed to facilitate innovation and enhance competitive advantage in businesses through structured knowledge exchange with academic institutions.

2.8 Knowledge Transfer Partnership

KTPs function as a strategic mechanism through which SMEs can access and integrate external knowledge. Their success, however, is contingent on the willingness and capacity of these businesses to engage with externally supported initiatives, particularly those backed by UK government funding. Over the past decade, a range of independent evaluations have been conducted to examine the structure, implementation, and outcomes of KTPs, with a focus on identifying critical success factors and evaluating their financial and strategic contributions to the long-term sustainability of the UK economy (Technology Strategy Board, 2012; Innovate UK, 2013; Innovate UK, 2014; Siora, et al., 2015).

These evaluations have produced valuable insights, particularly in relation to programme effectiveness, value for money, and the development of best practices in collaborative innovation. Despite these contributions, a gap remains in the

understanding of how knowledge transfer processes evolve and sustain over time within SMEs. This research seeks to address that gap by critically exploring the long-term operational impacts of knowledge transfer activities. Specifically, it investigates how knowledge embedded through KTPs contributes to organisational learning, strategic transformation, and sustained innovation within SMEs.

The next section identifies the impacts for maximising the value of transferred knowledge. A critique of existing practices is aimed at identifying the embedding of successful impact under the KTP umbrella and further capabilities for businesses in the context of SMEs.

2.8.1 Impact of KTPs

Research undertaken by Innovate UK (UKRI, 2023) evaluated the economic and broader impacts of participation in its funded programmes. A series of annual KTP reports spanning 2011 to 2015 (Technology Strategy Board, 2012; Innovate UK, 2013; Innovate UK, 2014; Siora, et al., 2015) provided a statistical assessment of funding outcomes, associated benefits, and key performance indicators. These evaluations collectively underscore the achievements and strategic value of KTPs and are substantiated by earlier strategic review reports (Regeneris, 2010; Ternouth, et al., 2012).

In particular, the Regeneris Consulting report found that KTPs yield a notably positive return on investment and contribute meaningfully to job creation (Regeneris, 2010). The review concluded that KTPs represent “reasonably good value for money,” particularly when targeted toward high-impact areas of innovation. Figure 4 presents a comparative analysis of return on investment (ROI) for SMEs engaged in KTPs relative to those involved in other publicly funded innovation programmes.

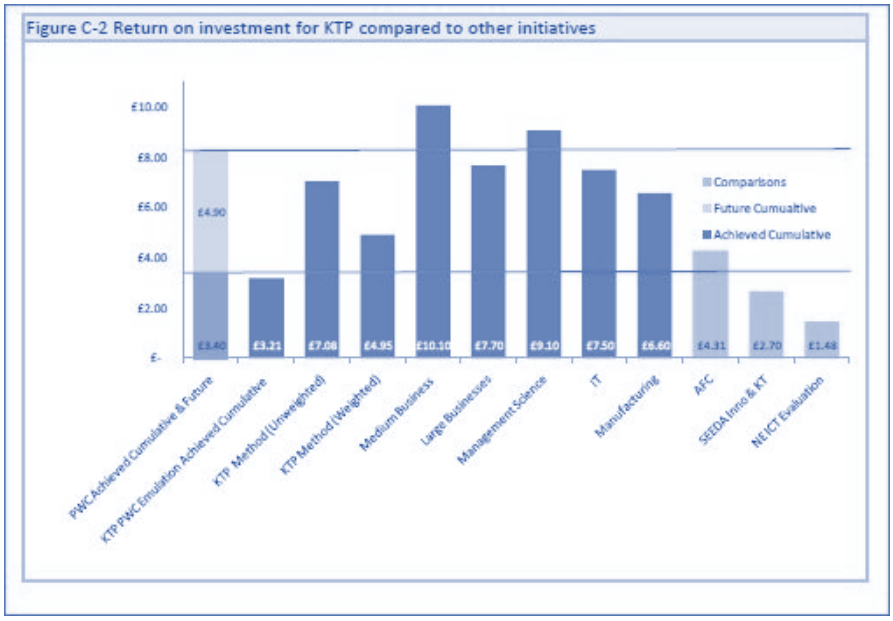

Figure 4 Recreated from Figure C-2 Return on investment for KTP compared to other initiatives. Sample of KTPs projects 2001/02 to 2007/08 (Regeneris, 2010, p. Appendix C p8)I

Successive UK Government strategies, notably those published in 2017 and 2021 and supported by the Council for Science and Technology and the OECD, have underscored the importance of enhancing productivity and economic growth through targeted support for innovation. In alignment with these goals, Innovate UK has continuously adapted its KTP framework to better serve the needs of SMEs. Notable developments include the introduction of Management KTPs (mKTPs) and the provision of flexible project durations, enhancing accessibility and alignment with diverse business requirements (Innovate UK KTN, 2023).

A key milestone in evaluating the impact of KTPs was the 2012 report commissioned by the Council for Industry and Higher Education (CIHE), now the National Centre for Universities and Business (NCUB). This strategic review identified critical success factors for KTPs and concluded that the funding model actively "stimulates and facilitates organisational learning" (Ternouth, et al., 2012, p. 6). Within this context, the report introduced a generic process model for knowledge transfer within an open innovation framework, known as the "5Cs":

- Company Opportunity
- Co-recognition

- Co-formulation
- Co-creation
- Commercialisation

This model represents a comprehensive pathway for collaborative innovation and highlights the iterative nature of effective knowledge exchange (Ternouth, et al., 2012)

Research asserts that KTPs significantly enhance a business's absorptive capacity, enabling organisations to internalise external knowledge and translate it into long-term strategic advantage (Ternouth, et al., 2012). This absorptive capacity is achieved not only through the structured processes embedded in KTPs but also through the cultivation of a learning-oriented organisational culture. However, the 2012 review scope was focused solely on projects deemed successful and relying on final reports submitted at the conclusion of each project, typically spanning 12 to 30 months (Ternouth, et al., 2012). This methodology supports this research as the focus was impact, a key element for this study. A change in the scope allows this research to explore further for implications for long-term knowledge integration and sustained impact.

The complexities of knowledge embedding within KTP projects have been further examined in prior research, which highlights significant challenges in knowledge diffusion and long-term application (Abreu, et al., 2008). The feasibility of effective knowledge embedding is, in fact, a critical component of the KTP grant application process. A 2015 evaluation reinforced the continued contribution to the UK economic value for KTPs but also reveals that SMEs frequently apply solutions in isolation, without fully assimilating the knowledge into broader business practices (Siora, et al., 2015). Final KTP reports are submitted within one month of project completion and are structured to document the original project objectives, rationale, key achievements, and outcomes for both the SME and the academic partner(s). These reports require SMEs to provide explicit evidence of the impact on financial performance, strategic planning, and organisational capability. New knowledge and skills acquired and indicators of embedded capabilities, shifts in competitive positioning, profitability, and cultural transformation are all detailed in the final report.

This reporting framework facilitates the evaluation of business model transformation by capturing the project's contribution to value proposition development, value creation processes, and value capture mechanisms. However, a significant gap remains in comprehending the operational mechanisms that drive these transformations, an understanding that is essential for securing SME managerial commitment to engaging in such collaborative partnerships.

The next section provides the synthesis of the literature review and presents the conceptual framework.

2.9 Synthesis of Literature and Conceptual Framework

Successive UK governments have prioritised national productivity within their Industrial Strategy. To support this agenda, a range of initiatives has been implemented, including the Business Basics Programme (GOV.UK, 2021), which seeks to encourage firms, particularly SMEs, to adopt enhanced management practices and strengthen their technological capabilities as a means of improving productivity. In alignment with these objectives, Innovate UK introduced its 2021–2025 delivery plan (Innovate UK, 2022), setting out targeted actions designed to foster the development of SMEs with high growth potential.

Other work has drawn attention to the significance of businesses effort to absorb knowledge as a critical factor in effective collaboration (De Wit-de Vries, et al., 2019) hence a mediator to the success and impact of knowledge exchange. The demand of competitive advantage increasingly depends on the integration of tacit knowledge for example within dynamic manufacturing strategies, which moderates the processes and potential successful outcomes for the business in any sector (Henriksen & Rolstadas, 2010). Such strategies must evolve continuously through learning processes that enable the adaptation of implicit expertise, which, by its nature, is challenging to formalise, articulate, or transfer. A significant research gap persists regarding how transformative and entrepreneurial leadership operates dynamically within the complex, resource-constrained settings characteristic of SMEs. Systematic literature reviews (Leitch & Volery, 2017; Hoang, et al., 2025) demonstrated that entrepreneurial leadership is not confined to any single organisational form but rather

serves as a vital enabler of innovation, growth, and long-term sustainability across a wide range of business contexts.

Successful organisational learning ensure that knowledge is retained and disseminated throughout the business, enabling the organisation to stay competitive in an evolving market (Senge, 2006). The mediating role of innovation and efficiency in translating learning-oriented practices into tangible business outcomes, suggesting that continuous learning and adaptability are essential drivers of sustained organisational success. While outsourcing innovation may not always be feasible, technology transfer can enhance knowledge exchange. Leaders and senior management play a crucial role in shaping and communicating a clear knowledge vision within the business (Nonaka & Teece, 2001).

This study adopts a mixed-methods approach to examine how KE, UIC, and KTPs contribute to sustained organisational outcomes with focus on SME type businesses. The conceptual framework identifies a set of mediating mechanisms that explain how and why KE initiatives translate into innovation, competitiveness, and long-term performance, while also recognising moderating conditions that shape when and under what circumstances these effects are most pronounced. Within the quantitative strand, these mediating and moderating relationships provide a theoretically grounded basis for model specification and testing. The qualitative strand complements this by exploring how these mechanisms operate in practice, how they are experienced by organisational actors, and how contextual factors influence their effectiveness over time.

At the core of the framework, absorptive capacity functions as a central mediating mechanism through which externally sourced knowledge is recognised, assimilated, and applied within SMEs. Quantitatively, absorptive capacity is examined as a mediating variable linking KE, UIC, and KTP engagement to innovation and performance outcomes. Qualitatively, it is explored through organisational narratives that capture learning routines, capability development, and constraints on knowledge use. Organisational learning practices further mediate this relationship by enabling knowledge to move beyond individual actors and become embedded at the organisational level. While survey-based measures assess the extent and outcomes

of learning practices, qualitative data provide insight into how learning is enacted, sustained, and institutionalised within SMEs. Similarly, knowledge management systems and routines mediate the relationship between KE and knowledge embedding by supporting the codification, storage, and reuse of knowledge. These mechanisms are examined quantitatively through their association with embedding and innovation outcomes, and qualitatively through detailed accounts of system use and informal practices.

The embedding of knowledge in organisational processes represents a downstream mediating mechanism that links learning and knowledge management to longer-term organisational outcomes. This construct is examined quantitatively in relation to competitiveness, sustainability, and performance, while qualitative inquiry explores how embedded knowledge reshapes routines, decision-making, and strategic orientation over time.

Entrepreneurial leadership development also functions as a key mediator by explaining how engagement in KE initiatives contributes to adaptive capacity and innovation, particularly within SME contexts. Quantitative analysis assesses its mediating role between KE and innovation capability, while qualitative evidence captures leadership learning trajectories and shifts in managerial practice. Finally, innovation capability mediates the relationship between embedded knowledge and competitive advantage by translating learning into value creation. This mechanism is examined quantitatively through performance and competitiveness indicators, and qualitatively through case-based evidence of innovation processes and outcomes.

In addition to these mediating mechanisms, the framework incorporates several moderating conditions that reflect the contextual and contingent nature of knowledge exchange. Entrepreneurial and adaptive leadership behaviours are conceptualised as moderators that influence the strength of relationships between KE, organisational learning, and knowledge embedding. Quantitative interaction effects test these moderating influences, while qualitative findings illuminate how leadership styles shape engagement with KE initiatives. Operational characteristics and organisational strategies further moderate the effectiveness of KE by determining the degree of strategic alignment and organisational readiness for knowledge use.

Barriers to knowledge exchange, including cultural, structural, time, and resource constraints, are treated as negative moderators, weakening the impact of KE on learning and embedding; these are explored statistically and through in-depth accounts of organisational challenges. SME characteristics, such as firm size, resource availability, and managerial capacity, moderate the effectiveness of UIC and KTP engagement, while the strength and form of university–industry collaboration moderate the extent to which SMEs extract value from KE activities. Finally, change management capability moderates the relationship between embedded knowledge and long-term performance, with quantitative analysis assessing outcome variability and qualitative data providing insight into why embedded knowledge succeeds or fails to translate into sustained change.

The reviewed academic material and reviews highlighted a critical limitation: while knowledge transfer initiatives often aim to solve business challenges, they do not always result in widespread knowledge absorption within the business (Abreu, et al., 2008). Positioning knowledge exchange as a critical component of knowledge management, highlights its role not only in creating competitive advantages but also in reducing costs and fostering innovation (Ladd & Heminger, 2003). Academic engagement provides a viewpoint that SMEs can have longer term impacts beyond the collaboration partners, academics, and non-academic external stakeholders (Rosli, et al., 2018).

This framework will allow contextualising of the key areas guided by the overarching research question:

To what extent does the impact of knowledge exchange deliver sustainable change to businesses?

This synthesis highlights the identified gaps in existing literature and practice, aligning them with the research objectives. In doing so, it establishes a foundation for exploring how knowledge exchange mechanisms, particularly within the KTP framework, contribute to enduring organisational transformation and strategic value creation. The literature review highlights that knowledge exchange is a non-linear and often problematic process, heavily influenced by leadership capability, entrepreneurial

mindset, and organisational learning. These elements are not only influential but shown to be critical enablers of sustained innovation. This study therefore seeks to understand how such factors interplay within post-KTP environments to drive business model transformation, enhance knowledge absorption, and support long-term innovation within SMEs. This chapter has contributed to the first of the three objectives:

Objective 1: To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.

This research positions KTP project outcomes as a pivotal mechanism for driving long-term change within UK SMEs. While high-level assessments provide a national overview of SME performance, funding, innovation practices, and investment trends, this study narrows the focus to KTPs as a specific and impactful form of industry-university collaboration. Previous studies have primarily measured KTP success through immediate, project-specific outputs. However, other literature from Research Policy to Business Management journals (Rosli, et al., 2018; Rossi, et al., 2022; De Wit-de Vries, et al., 2019) has shifted attention to the long-term impacts, emphasising the role of engaged scholarship, trust-building, and leadership commitment in sustaining meaningful knowledge transfer. Thus, the long-term viewpoint will be adopted to address the success of embedding knowledge exchange the second of the three objectives

Objective 2: To explore the long-term impacts of embedding knowledge within business processes.

This research adopts a business-centric lens, focusing on how knowledge is absorbed, embedded, and operationalised within SMEs after the formal evaluations of UIC collaboration KTP period ends. By shifting from institutional to enterprise-level analysis, it broadens the appeal and relevance of KTPs to a wider stakeholder base, particularly those involved in day-to-day management and strategic decision-making. This supports the research activity to achieve the final of the three objectives:

Objective 3: To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

Government policy, including initiatives like Help to Grow (GOV.UK, 2023), continues to encourage best practice adoption, despite persistent resistance among SMEs (BEIS, 2019). Typologies of resistance and decision-making behaviours in SMEs highlight the importance of understanding leadership dynamics, operational culture, and the process of knowledge exchange. This study adds to the knowledge base by focusing on leadership and business model actions to assess from the participants what the impacts are embedding knowledge in a business and the specific context of an SME. In doing so, it contributes evidence to support more widespread adoption of innovation-led strategies among SMEs by business leaders.

In addition to the review of peer-reviewed scholarly literature, this chapter undertakes a critical appraisal of key policy and evaluation reports pertaining to university and SME knowledge exchange. The appraisal considers the scope, evidential quality of these reports, as well as their alignment with established academic findings and informs the operationalisation of the framework elements used in this thesis.

The focus of this study gives boundaries for the research represented by the conceptual framework (Miles, et al., 2019) shown in Figure 5. The framework conceptualises organisational learning, absorptive capacity, and knowledge embedding as key mediating mechanisms through which knowledge exchange influences innovation and competitiveness, while leadership, organisational context, and barriers to knowledge exchange act as moderating conditions shaping the effectiveness of these relationships. It integrates elements from organisational learning theory, knowledge-based views of the firm, and change management perspectives to explain how embedded knowledge processes shape long-term organisational outcomes.

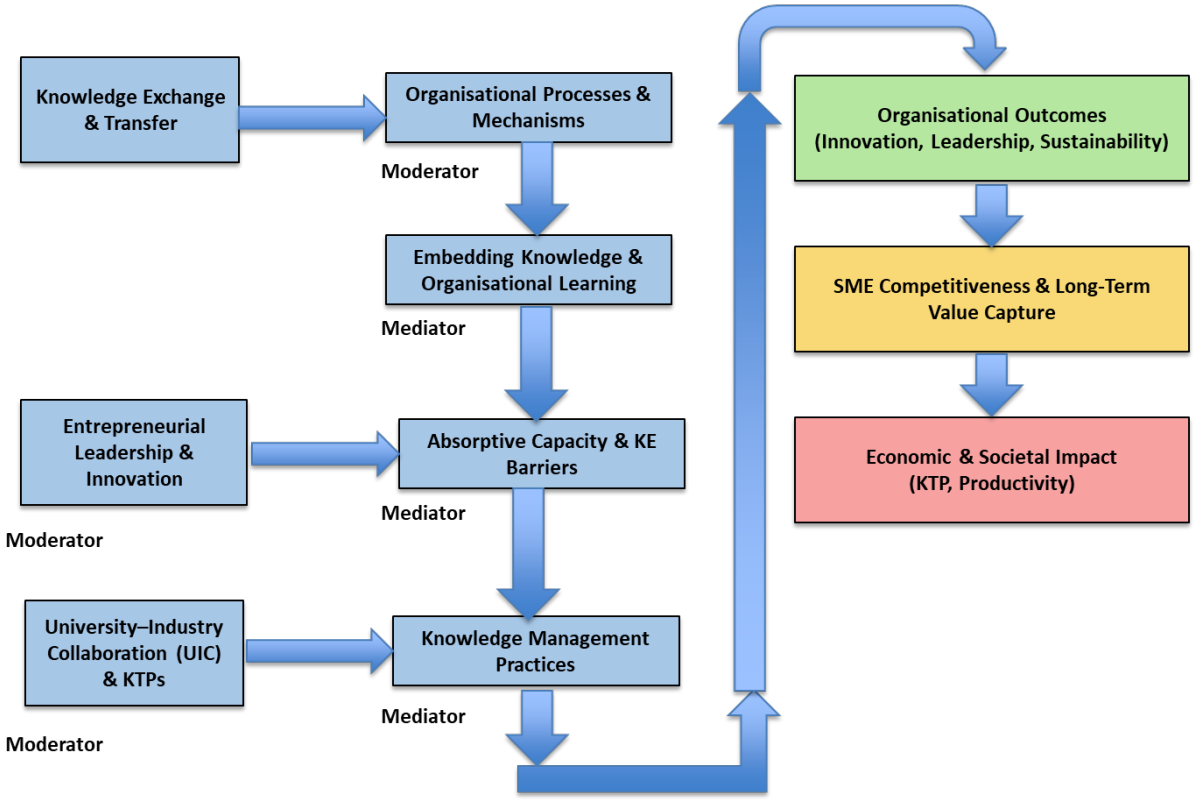

Figure 5 Conceptual Framework

Knowledge Exchange is examined by identifying the nature of interactions, KE activities, and support mechanisms involved in each case. These flows are then traced into organisational characteristics by analysing managerial routines, operational changes, and structural adjustments enacted during the collaboration from survey and interviews. Absorptive capacity and barriers are analysed by examining prior knowledge bases, internal competencies, and constraints that shape a firm's ability to utilise university-derived knowledge using the survey and interviews to establish any patterns. To assess embedded knowledge, the cases explore how new knowledge is internalised, routinised, or formalised within business practices after long term organisational changes.

Resulting organisational outcomes, including innovation, leadership development, and sustainability shifts, are evaluated using evidence of behavioural, operational, or strategic change. These feed into assessments of SME competitiveness and long-term value capture, which consider market performance, capability strengthening, and emergent strategic positioning. Finally, sustainable business change and value

capture is operationalised using productivity changes, value generation, and broader contributions to regional or national growth agendas, particularly in the context of KTP policy objectives.

Leadership strategies are operationalised through leadership behaviours, decision-making patterns, and evidence of innovation capability development. The role of UIC and KTP structures is captured by mapping partnership governance, relational dynamics, and collaborative processes. Knowledge exchange practices, influenced by the operational characteristics and the formation of embedded knowledge, are assessed through documentation, communication flows, and systems used to store, apply, or disseminate knowledge.

The use of the KTP reports, the survey patterns and the case studies are cross analysed to establish the missing knowledge and where it has been embedded. The linking of the operational characteristics gained from the survey to the information gained from the interviews and the history based on the case studies will capture the sustainable changes.

This chapter has reviewed the relevant literature and defined the relevant concepts to explore key impacts of knowledge exchange to ascertain the extent that that process delivers sustainable change to a business as dictated by the overarching aim of this research:

To what extent does the impact of knowledge exchange deliver sustainable change to businesses?

The next chapter turns to the research methodology and approach strategy.

Chapter 3 Research methodology

This chapter provides an overview of research methodology, including the principal research paradigms, methodological traditions and approaches commonly employed within social research. The chapter proceeds by outlining the philosophical foundations underpinning the research, followed by a justification of the research design and the ethical considerations underpinning the research design. The chapter then identifies and justifies the specific methodological approach selected for this thesis, explaining its relevance to the research aims and its suitability for addressing the empirical questions under investigation. In addition, the chapter details the research methods utilised in the study, together with the procedures followed during data collection and analysis. Finally, this chapter is summarised for the examination, the suitability of various research methods in relation to the study's aims and a justified methodological approach adopted for this thesis.

3.1 Introduction

Research is the systematic investigation of materials, sources, and phenomena to establish facts, generate evidence, and produce new knowledge through rigorous analysis, observation, and critical inquiry (OED, 2025). Scientific research is distinguished by its reliance on empirical data, gathered through qualitative or quantitative methods, and the application of statistical analyses to validate findings. Social research encompasses diverse strategies, including surveys, case studies, ethnography, phenomenology, grounded theory, and mixed methods.

The Saunders Research Onion provides a structured framework for designing and justifying a research methodology. It presents the research process as a series of layers that guide researchers from broad philosophical assumptions to detailed data-collection procedures (Saunders, et al., 2023). The outer layer, research philosophy, establishes the researcher's worldview and assumptions about knowledge. The next layer, research approach, defines how theory and data relate, whether the study is deductive, inductive, or abductive. The research strategy then specifies the overall design, such as surveys, case studies, experiments, or ethnography. The methodological choice identifies whether the study employs quantitative, qualitative,

or mixed methods. The time horizon distinguishes between cross-sectional and longitudinal perspectives. At the centre, techniques and procedures outline specific methods for collecting and analysing data. Together, these layers ensure methodological coherence, transparency, and rigour, enabling researchers to articulate and defend the logic underpinning their research design.

This dissertation is informed by a wide range of academic sources that address core methodological principles, organisational and institutional analysis, social behaviour, and advanced methodological approaches. Foundational guidance on social research methods is drawn from several leading texts. Focusing on business research, in this edition (Saunders, et al., 2023) provides insight in appropriateness and applicability highlighting how research is used in practice supplemented by (Gray, 2022). (Bryman & Bell, 2003) provide a comprehensive overview of research philosophy, methodological choices and research design, while (Flick, 2014) offers a comprehensive introduction to qualitative methodology and practical design considerations. An authoritative account of qualitative, quantitative and mixed-methods paradigms supplied by (Creswell & Creswell, 2023) is complemented by (Creswell & Poth, 2018; Silverman, 2022) detailed discussions of qualitative inquiry in organisational and social contexts.

The emergence of business and management as an academic discipline meant it adopted theories from a mixture of disciplines in the domain of organisational practice. These were based on existing social science, natural sciences, humanities and applied science (Saunders, et al., 2023). There are two opposing perspectives that have emerged, the first the unification camp which advocates the research philosophy of paradigm and methodology, the second the pluralists believe that the diversity is helpful and enriches business and management (Saunders, et al., 2023).

The primary objective is to explore questions within a social context using techniques such as interviews, observations, and document analysis. This research necessitates a social research approach as it is required to examine systems of operations managed by individuals. Explanatory research will introduce questions, prompt emergent themes and abductive reasoning processes will be used to develop insights and add to the theoretical contributions in this field.

3.2 Research Approach

A research approach is applied to allow a specific style of research to be unfolded and enable different methods of doing research to be employed which is termed as a research method by (Yin, 2014). The three conditions that directs the selection of a suitable research approach according to (Yin, 2014, p. 9), is listed as follows:

- the type of research questions posed
- the extent of control a researcher has over actual behavioural events
- the degree of focus on contemporary as opposed to entirely historical events.

Research methods can be quantitative, qualitative or mixed-methods in nature (Cecek-Kecmanovic & Kennan, 2013; Creswell & Poth, 2018). Theory development within social research often involves iterative reflection on the data collected, potentially requiring additional data to define parameters that extend the theory's constructs. Grounded theory, for instance, exemplifies this iterative process, using qualitative data analysis to generate theories closely aligned with the observed data. This approach ensures that the theory is empirically grounded rather than abstractly imposed.

The researcher's prior experience with KTP projects as an academic has significantly shaped the research direction. A desk-based research approach to identify relevant paradigms and apply social research methodologies to elucidate relationships among key concepts, factors, and measurable categories. A critical element of this research is differentiating between belief and opinion, ensuring that such distinctions are quantified.

At the core of this research is the identification of an appropriate paradigm, a conceptual framework, derived from the Greek term meaning "pattern" (Killam, 2013). In social research, paradigms encapsulate how individuals perceive and interpret the world around them. While phenomenology focuses on subjective interpretation, this study also acknowledges other philosophical perspectives, such as positivism and constructivism. Positivism, traditionally associated with quantitative methods,

emphasises objectivity and measurable data, whereas constructivism, aligned with qualitative research, prioritises subjective means to make sense of the data.

This research seeks to systematically collect data and employ a defined analytical strategy to contribute to the wider body of knowledge. A qualitative approach enables an in-depth exploration of participant perspectives and practices, particularly in contexts where sensitivity may affect disclosure. However, this method is susceptible to interviewer bias. In contrast, a quantitative approach enables the collection of measurable data, which can be assessed for reliability and validity. Key advantages of quantitative research include participant anonymity and the efficiency of data analysis.

There are five major research methods experimental, survey, archival analysis, history, and case study the following Table 4 is reproduced from (Yin, 2014) and illustrates the comparison of the three conditions within the five research methods.

Table 4 Relevant situations for different research methods (Yin, 2014)

Strategy	Form of Research Question	Requires control of Behavioural Events	Focuses on Contemporary Events?
Experiment	How, Why?	Yes	Yes
Survey	Who, What, Where, How Many, How Much?	No	Yes
Archival analysis	Who, What, Where, How Many, How Much?	No	Yes/No
History	How, Why?	No	No
Case Study	How, Why?	No	Yes

In social research, two primary philosophical paradigms underpin methodological choices: ontology and epistemology (Bryman, 2015). Ontology concerns the nature of reality and the various forms of existence, examining the assumptions researchers make about what represents reality. It is typically categorised into two perspectives: realism, which posits that reality exists independently of human perception, and relativism, which suggests that reality is constructed through social and experiential contexts. Epistemology, by contrast, focuses on the nature, scope, and acquisition of knowledge. It addresses what constitutes valid knowledge within a discipline and how

such knowledge can be obtained. Epistemological positions are generally classified into positivist and interpretivist approaches. A summary of these philosophical perspectives is presented in Table 5 below.

Table 5 A Summary of Philosophical Considerations (Table adaptation from (Bryman, 2015)

ONTOLOGICAL CONSIDERATIONS	
Realist	**Relativist**
The external world is composed of hard and tangible pre-existing structures	Multiple realities exist as a subjective construct of the mind
independent of an individual's ability to acquire knowledge	There is variance in the socially-transmitting terms across various languages and cultures
EPISTEMOLOGICAL CONSIDERATIONS	
Positivist	**Interpretivist**
Natural science methods are applied to social reality and beyond	There is an emphasis on the realism of context and the absence of universal truth
The laws of causation are conformed by the world and reductionism can be applied to reduce complex issues	Interpretation and understanding are derived from the researcher's frame of reference

The choice of research approach is grounded in epistemological and ontological considerations. In this context, middle range theory, as developed by Robert K. Merton (Merton, 1968, p. 64), provides a theoretical lens for this study. Unlike grand theories such as those proposed by Talcott Parsons (Robertson & Turner, 1991), which seek to explain phenomena at a societal level, middle-range theories focus on specific bounded aspects of social reality. This research, therefore, adopts a middle-range theoretical perspective to offer a nuanced and empirically grounded understanding of the research problem. The exploratory research questions are formulated to achieve the overall aim and objectives of this study. The research questions are listed below, and Table 5 demonstrates their alignment with the research objectives.

RQ1. What are the organisational parameters and approaches that deliver long-term impact generated through knowledge exchange?
RQ2. What is the effect embedding knowledge has on organisational learning and developing entrepreneurial leadership?

RQ3. What are the long-term impacts that SMEs achieve when collaborating with universities?
RQ4. What are the processes through which SMEs embed the knowledge they gain through the UIC knowledge exchange?
RQ5. Why do they achieve sustainable change and improve the business model through to value capture?

Recognising the respective strengths of qualitative and quantitative paradigms, this study adopts a mixed-methods research design to capitalise on their complementary contributions. Case study methodology is employed to facilitate an in-depth examination of the phenomenon of interest. While a single case study facilitates in-depth analysis within a bounded context (McGuinness, et al., 2013), a multiple case study design extends this analytical lens across diverse organisational settings, thereby strengthening analytical robustness. Multiple case studies enable the identification of recurring patterns and comparable outcomes across cases operating in similar contexts, enhancing the explanatory power of the research (Bryman, 2015). In the context of exploratory research, studying a small number of cases in depth using a framework or structure is sufficient to explore the relationships between different elements of a theoretical framework and to clarify the applicability of the framework. Table 6 below contains the primary and secondary sources used in the qualitative and quantitative data collection methodology and maps the data sources used in this mixed method approach.

Table 6 Data sources mapped to exploratory research questions

	Qualitative	Quantitative
RQ1	KTP applications Interim feedback reports (LMC series) Final KTP reports Survey Semi-structured interview	Government databases Innovate UK and ONS Final KTP reports Survey Semi-structured interview
RQ2	KTP applications Interim feedback reports (LMC series) Final KTP reports Survey Semi-structured interview	Government databases Innovate UK and ONS, Survey Semi-structured interview

RQ3	Survey Semi-structured interview	Government databases Innovate UK and ONS, Survey Semi-structured interview
RQ4	Survey Semi-structured interview	Government database Innovate UK Survey Semi-structured interview
RQ5	Interim feedback reports (LMC series) Final KTP reports Survey Semi-structured interview	Survey Semi-structured interview

Utilising the supportive theoretical work on approaches to qualitative research this work will adopt and approach linking themes to research questions through visual frameworks and tables and using qualitative indicators to demonstrate relative emphasis or contribution (Creswell & Poth, 2018). At the same time the work will integrate the theoretical work on utilising case studies (Yin, 2014) where the theory that describes pattern matching and explanation building, including the use of analytic tables that compare empirical findings against theoretical propositions or research questions using graded levels of correspondence.

This approach will allow exploration of the key criteria established within the conceptual framework and develop the exploration to achieve the research objectives summarised below in Table 7.

Table 7 Qualitative and Quantitative mapping for Research Objectives

Qualitative	
Research Objective	**Key Criteria for Analysis**
RO1 Operational characteristics & strategies	Leadership, operational structures, KE mechanisms, organisational readiness
RO2 Long-term impacts of embedded knowledge	Internalisation processes, learning culture, leadership evolution, process integration
RO3 Sustainable change & value capture	Innovation outcomes, performance gains, value capture mechanisms, long-term resilience

Quantitative	
Research Objective	**Key Criteria for Analysis**

RO1 Operational characteristics & strategies	SME size, turnover, KE engagement, leadership support, absorptive capacity
RO2 Long-term embedding of knowledge	Process integration, learning indicators, entrepreneurial leadership scores, retention metrics
RO3 Sustainable change & value capture	Innovation outputs, performance metrics, value capture, sustainability indicators

The next section considers the ethical aspects and the mitigation of risk.

3.2.1 Ethical Considerations and Mitigation of Risks

Anonymity was guaranteed to encourage open, reflective responses in both the survey and interviews. Participants were informed of their right to withdraw at any stage. Risks, benefits, and data confidentiality procedures were addressed within the ethics application. Details regarding data storage, retention periods, and access permissions were clearly outlined.

The EC1a ethics form included a specific request for reassurance from the FAME license holder, confirming the proposed use was consistent with the university's educational license. Written confirmation was obtained and submitted as part of the ethics approval process.

Despite these safeguards, there remained a risk of sampling bias, potentially limiting the generalisability of findings. The survey's limited external validity was acknowledged. However, the mixed-method design, combining quantitative and qualitative data, was adopted to offset this risk (Saunders, et al., 2023, p. 291).

The study was conducted in accordance with institutional ethical guidelines. Informed consent was obtained from all participants, and strict procedures were implemented to ensure participant anonymity and the pseudonymisation of organisational identities. All recordings, transcripts, and documentary materials were stored securely, and the aims and purposes of the research were communicated transparently to participants. Participation was entirely voluntary, and individuals retained the right to withdraw at any stage without penalty. Given the longitudinal nature of the study and the involvement of potentially identifiable SMEs, particular care was taken to manage issues of confidentiality throughout the research process.

The next part of this work considers the methods and approaches as well as setting out the criteria for analysis for the qualitative and quantitative data in two discrete sections.

3.3 Qualitative methods and approach

This study employs a qualitative research methodology, grounded in an inductive reasoning approach that prioritizes social context, subjectivity, and researcher involvement. Qualitative research differs significantly from quantitative research, which follows a deductive approach, relying on empirical data and objective analysis. As discussed by Strauss (Strauss, 1987), qualitative research is characterized by words, descriptions, and holistic perspectives, whereas quantitative research is more focused on numerical data, statistical analysis, and researcher detachment.

Prior to commencing the main survey and interviews, a pilot test was conducted to evaluate and refine the survey questions and then the semi-structured interview format. This was a supervisor suggestion when reviewing at the initial stages of the research to ensure there were no problems in answering the questions and recording the data for the main study (Saunders, et al., 2023, p. 548). While pilot studies are valuable for identifying potential issues in research design, their findings should be interpreted with caution, as small sample sizes may not provide sufficient evidence to support broad conclusions (Thabane, et al., 2010). Nonetheless, the importance of testing research tools on a limited sample can lead to improvements to their suitability for the main data collection phase.

In this study, social research provides the methodological foundation to investigate the complex and dynamic processes of knowledge exchange between universities and businesses. It enables the researcher to explore not only the operational characteristics of organisations but also the social and managerial factors that influence decision-making, innovation, learning, and sustainable change. By employing both qualitative and quantitative methods, social research supports a nuanced understanding of real-world business challenges. It allows the researcher to identify patterns, behaviours, and impacts across different organisational contexts, while recognising the socially constructed nature of business practices.

In line with the interpretivist tradition common in business and management studies, this research values the perspectives of participants and the lived experiences of those engaged in UIC. It uses empirical evidence to contribute to theory development and to inform practice, policy, and pedagogy. Social research in this setting strengthens the bridge between academic inquiry and applied business solutions, enabling impactful research that aligns with societal and economic goals.

Structured interviews, typically associated with closed questions, are commonly used in quantitative research to generate comparable statistics (Bryman, 2015). For this study, semi-structured interviews were employed to allow for a more flexible conversational approach, enabling deeper insights from participants whilst keeping the discussion on track. Unlike structured interviews that follow a strict question sequence, semi-structured interviews provide the opportunity for spontaneous follow-up questions, enhancing the breadth and depth of the collected data.

Unstructured interviews, though valuable for capturing emotional and subjective experiences, were deemed less suitable due to potential difficulties in maintaining topic focus, transcription challenges, and comparative analysis complexities (Bryman, 2015). The chosen semi-structured interview format facilitates rich qualitative data collection, providing insights beyond what structured surveys typically yield and is consistent linking the research questions, objectives and the data collected (Saunders, et al., 2023).

All interview participants are summarised in Table 8 aligning the Case Study participation and interviews. All participants provided informed consent, ensuring their understanding of the research purpose and the use of the gathered data. The interview process was controlled by systematic use of the subject areas listed in the survey to maintain focus on the research objectives while allowing flexibility in responses. The interviews followed a predetermined set of questions, ensuring consistency across participants, whereas the discussion could be directed to glean other data not shown in the survey hence interviews allowed for exploratory discussions while addressing the framework themes.

Table 8 Main characteristics of SMEs in Case Study sample and interviewees

Case Study	Company sector	Size	Core Business Description	KTP interaction level	Interviewees
A	**Charity**	Medium	A medium-sized charitable organisation	Low	Education and Training Manager
B	**Design & Manufacturing**	Micro	Design, manufacture and supply of commercial heating systems and refrigeration plants	Low	Director/Owner
C	**Design & Manufacturing**	Large	Design, manufacture and supply of polymer related components and semi-finished materials	Medium	Site Director
D	**Manufacture & R&D**	Medium	Develop and manufacture antimicrobial products for Health industry sectors	High	Head of Commercial Research & Business Support previously KTP Associate
E	**Manufacture & R&D**	Medium	Design, manufacture and supply industrial power tools and accessories	High	Director/Owner

This research follows an inductive approach rather than a deductive hypothesis-testing model. Through a mixed-method design, the opinions and beliefs of interview participants were triangulated with secondary data sources to enhance the reliability and validity of findings. The study did not begin with a fixed hypothesis but aimed to explore implications derived from the collected qualitative data (Yin, 2014). Testing and analyses of the data in multiple formats as a mixed method study is justified as there is intrinsic complexities in the KTPs projects when they are compared against each other including business classification and the business aims and objectives.

Secondary data played a crucial role in this research, supplementing primary data collection. Secondary data sources included:

- Government databases Innovate UK and ONS,

- KTP applications
- Interim feedback reports
- Final KTP reports

The integration of these sources facilitated data comparison and corroboration, enriching the qualitative analysis. Secondary data helped identify research problems, refine research design, develop sampling strategies, and analyse findings (Creswell & Poth, 2018).

A convenience sampling technique was adopted, selecting participants based on accessibility and relevance to the research context. The pilot study aimed to assess the effectiveness of the semi-structured interview framework and assist in any refinements necessary to the questions in the survey. The direct contacts were to senior managers with decision making responsibilities for staff, investment and growth already identified as having been previous UH KTP partners. Three former KTP project company partners from the University of Hertfordshire KTP database participated, ensuring a pragmatic sampling approach. The pilot study validated the interview structure, confirming clarity and comprehensibility of questions through an independent colleague review.

To ensure methodological rigor, qualitative researchers must clearly articulate the strategies employed in data collection, coding, analysis, and theory generation (Glaser, 1967, p. 244). In qualitative research, data are categorized and coded to form meaningful patterns, which contribute to theory development (Corbin & Strauss, 2015; Eisenhardt, 1989; Yin, 2014). In this study, the analysis framework incorporated first- and second-order codes and overarching categories, following established grounded theory methodologies (Creswell & Poth, 2018). The guidance of the conceptual framework is incorporated.

A case study protocol is a critical component in conducting robust case study research, as it enhances the reliability of the study and serves as a structured guide for the researcher throughout the data collection process. Given the inherent risk of methodological ‘looseness ‘often associated with case study research, the use of a clearly defined protocol helps to mitigate this issue. As emphasised by (Yin, 2014), one effective way to address this concern is by establishing a formal set of procedures

and guidelines that govern the research process. These procedures typically include an overview of the project, detailed steps for data collection, and a description of the tools and instruments to be used, ensuring consistency and methodological rigor across all cases.

The key objectives of the analysis will include the identification of common themes and variations, the deepening of understanding of complex phenomena, and the facilitation of both theoretical and practical advancements. In this study, a level of measurement, informed by interview data and curated case study evidence, was applied, utilising a three-point ordinal scale; Low (L), Medium (M), and High (H); to represent the relative strength, impact, or level of engagement within each category. A three-point ordinal scale, comprising Low (L), Medium (M), and High (H), is frequently employed to represent relative strength or impact in a range of analytical contexts, including risk assessment, impact evaluation, and priority setting. As discussed in the SME and Innovation section in the literature review this has previous provenance in the series of Innovation Surveys (BEIS, 2022) where level 1, 2 and 3 are used to distinguish innovation-ready, broader innovator and wider innovator, UKIS is the main data source for business innovation in the UK. The survey is conducted every two years and (BEIS, 2022) is the UK's twelfth survey of this type. This scale provides a straightforward qualitative framework for categorising information and supporting comparative judgements. A three-point ordinal scale is considered ordinal because categories indicate rank order but not equal intervals between them.

This section detailed the selected qualitative methods and approach used in this research the following sections details each of the methods used and their justification.

3.3.1 Pilot study

A Pilot Study was conducted to test both the interview and survey methodologies, highlighting the critical role of pilot studies in informing and improving research processes (Malmqvist, et al., 2019). Although a preliminary set of interview questions was developed based on the research key themes and research objectives, the decision to incorporate a survey was made to enhance methodological robustness and minimise potential bias. The survey served both as a foundation for interview questions and as a triangulation tool to validate findings across methods.

The pilot study also assessed the use of semi-structured interviews, confirming their suitability for eliciting nuanced and in-depth qualitative data. This approach aligned with the mixed-methods research design adopted in the study and facilitated the identification of both practical and methodological challenges. As a result, necessary adjustments were implemented to strengthen the overall research framework.

While semi-structured interviews proved effective for recognising patterns within participant responses, their reliability was inherently constrained by temporal factors and dynamic business environments (Tracy, 2019). A sole reliance on qualitative or quantitative methods posed the risk of methodological bias. Therefore, the use of a mixed-methods approach was essential in enabling triangulation and enhancing the credibility of the findings. Exclusive dependence on quantitative methods would have been insufficient to address the central research question concerning how SMEs integrate knowledge into their business practices (Audretsch & Belitski, 2021). The mixed-methods design facilitates the testing of theoretically proposed mediating and moderating relationships while simultaneously allowing for an in-depth exploration of how these mechanisms operate and evolve within SMEs over time. The following section outlines the rationale for and application of case study methodology in this research.

3.3.2 Case Studies

Case studies serve as an effective method for understanding complex social phenomena, including group behaviour, organisational structures, and management processes within a business context. In operations management research, case studies provide a structured approach to examining these complexities (Voss, et al., 2016). The data collected through case studies help define the research scope, and the use of multiple case studies enhances the credibility and reliability of the findings. To ensure methodological rigor, four key principles must be observed when collecting and analysing case study evidence (Yin, 2014, p. 118):

1. Utilise multiple sources of evidence.
2. Develop a comprehensive case study database.
3. Maintain a clear chain of evidence.

4. Exercise care when using data from electronic sources

In social science research, case study data often reflect intricate human interactions and processes. High-quality case study research necessitates that researchers apply their expertise to assess all available data, address alternative interpretations, and focus analysis on the most significant elements within the research scope (Eisenhardt, 1989). This rigorous approach confirms the validity and reliability of the study's conclusions.

Given the inherent risk of methodological 'looseness' associated with case study research, the use of a clearly defined protocol helps to mitigate this issue. The next section contains a table listing the case study protocol. To maintain focus on the topic of the case study the use of a protocol structured in four sections as described by (Yin, 2014) can facilitate that activity, shown in Table 9.

Table 9 Protocol structure adapted to reflect this research (Yin, 2014, p. 85)

A. Overview of case study research	Overarching aim: To what extent does the impact of knowledge exchange deliver sustainable change to businesses?	Aim
	To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.	**Objective 1**
	To explore the long-term impacts of embedding knowledge within business processes.	**Objective 2**
	To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.	**Objective 3**
B. Data collection procedures	Contacts: Previous KTP Associate or Manager/CEO for Company	
	Send survey and schedule interview	Competitive position impact measure Business Model Impact measure Knowledge Impact measure Operational Impact measure Leadership Impact measure
	Receive completed quantitative survey	
	Send by return KTP Impact Report	

	Send options for meeting f2f, telephone or online	
	Conduct interview after assuring recording by notes or video with transcripts for interview responses	
	Semi structured interview is based on the main survey questions. Eliciting individual and additional information for each case independently. Conversations around each topic area encouraged and based on the survey free text responses, the secondary KTP initial and final reports.	Competitive position impact Business Model Impact Knowledge Impact Operational Impact Leadership Impact
C. Data Collection	Survey responses	
	Interview responses guided by survey questions and the research questions below	Interview and survey responses
Research Questions	RQ1. What are the organisational parameters and approaches that deliver long-term impact generated through knowledge exchange? RQ2. What is the effect embedding knowledge has on organisational learning and developing entrepreneurial leadership? RQ3. What are the long-term impacts that SMEs achieve when collaborating with universities? RQ4. What are the processes through which SMEs embed the knowledge they gain through the UIC knowledge exchange? RQ5. Why do they achieve sustainable change and improve the business model through to value capture?	The first two questions address the first objective to examine the organisational characteristics implemented and approaches taken embedding knowledge within the organisation. Questions 3 and 4 explore the SME sector and its knowledge exchange mechanisms due to its national importance to lever productivity improvements. Finally, question 5 reflects on the sustainable value capture for the business model.
D. Case Study report	Introduction	Secondary data initial and final KTP reports
	KTP objectives and outcomes	Secondary data initial and final KTP reports
	Organisational Growth and Strategic Outcomes	Interview and survey responses and evaluation

	Knowledge Transfer and Capability Development	Interview and survey responses and evaluation
	Long-Term Impact and Strategic Development	Interview and survey responses and evaluation
	Conclusion	
	Report categories used to curate final Case Study reports for each case	

The structure of the case study presentation was designed to follow a systematic and coherent approach (Voss, et al., 2016). Each case study begins with an introduction of the demographics of the respective company, followed by a detailed description of the overall objective of the KTP project. The subsequent section provides a comprehensive account of the case study based on data obtained through semi-structured interviews, supplemented where applicable by information from the first and final KTP reports. The second and third sections detail the organisational growth and strategic outcomes followed by the Knowledge Transfer and capability development. Where available the next section details the long-term impact and strategic development, and all reports complete with a conclusion section. This structured approach ensures the delivery of cohesive case studies, derived from qualitative data, for each participating company (Yin, 2014).

Companies A, B, and C contributed to the research through interviews conducted as part of a Pilot Study. Company D, a former KTP Associate, completed the survey for their current employer, where they now hold a senior position, and agreed to participate in an in-depth semi-structured interview. This interview provided significant insights into their objectives, actions, plans, and outcomes, further substantiating the findings through survey data. Similarly, Company E completed both the survey and the interview in a single session, with all information provided by the Owner/Managing Director. The participation of Company E was facilitated by a strong Higher Education Institution (HEI)-Industry relationship, which enabled their contribution to this study. Their input supported the expansion of knowledge by reflecting on and quantifying the impact of the initial KTP project. Additional businesses that had previously engaged in KTP projects with the University of Hertfordshire (UH) were approached for participation. However, one did not respond due to structural changes within the

company and the loss of direct contact with the researcher, while another declined due to time constraints.

Appendix 10 presents the five case studies, designated as CSA, CSB, CSC, CSD, and CDE. The qualitative data was collected in alignment with a mixed-method approach, culminating in a thorough analysis of the findings. Each case study contributes to the overall analysis and is systematically curated to ensure clear inclusion in the discussion and conclusions. These case studies offer a nuanced perspective on the variability of SME actions and the subsequent impact of KTP projects. Insights were drawn from interviews, publicly available records, and R&D funding data sourced from UK Research and Innovation (Innovate_UK, 2022).

Conducting multiple case studies is inherently resource-intensive, requiring substantial time and financial investment. To balance feasibility with methodological robustness, semi-structured interviews were employed, facilitating triangulation with quantitative data presented in the subsequent section. This approach enhances the validity of the findings and strengthens the overall contribution of the study to both academia and practice.

This next section develops the approach used for the interviews.

3.3.3 Interviews

A qualitative, semi-structured interview approach was employed to complement the ordinal data and factor analysis derived from the web-based survey. The qualitative sample consisted of voluntary participants who provided informed consent for their interviews following their participation in the main quantitative survey. Insights from pilot interview data informed the redesign of the survey to enhance its validity and reliability (Rugg & Petre, 2007).

While the interviews were informal, challenges arose when conversations deviated from the primary topics, complicating transcript preparation (Wisker, 2008). To mitigate these challenges, the interview questions were carefully structured to align with predefined categories, ensuring the systematic allocation of data for analysis and facilitating comparative assessments among participants.

The interviews enriched the research by providing deeper insights into qualitative factors that are not easily captured through quantitative measures. Special consideration was given to the sensitivities involved in interviewing Senior Managers, as discussions about business operations may lead respondents to emphasise positive aspects for external audiences. The adoption of online meetings enhanced accessibility by reducing scheduling conflicts and eliminating travel requirements.

The qualitative data collected from the interviews provided a nuanced understanding of the impact of the KTP at least four years after project completion. The interviews captured opinions and factual insights regarding how the KTP influenced company management strategies for innovation and change. The structured format of the interviews mirrored that of the survey, allowing for a deeper exploration of key research themes. Additionally, the findings facilitated the identification of best practices and highlighted the most and least successful operational areas affected by KTP projects over time. Senior Managers were further consulted to discuss these outcomes, ensuring a comprehensive analysis of post-KTP business transformations.

The next section details the approach for data collection.

3.3.4 Data Collection

To capture both the dynamics and outcomes of KE, the study uses three primary qualitative data collection methods, semi-structured interviews, documentary analysis, and observation, supplemented by a quantitative survey. The data collection is valid and verifiable with data collected from forty-five SMEs and interviews compiled with four UH KTPs project partners and one respondent from the survey agreeing to an interview. Twenty-five respondents did agree to having further contact and requested copies of the KTP Impact Report developed from the survey data but did not make contact after receipt by email. The contacts that were made did require long periods of time to completion due to coordination of calendars. Multiple contacts were made to press for feedback or time to discuss but with this was a slow process. The curation of five case studies was made possible by having access to the initial and final KTP reports and the interview time using a semi-structured interview process.

Semi-structured interviews were conducted with:

- SME owners, directors, and senior managers
- KE facilitators
- KE project leads (e.g., KTP Associates, innovation managers)

Interviews explored:

- organisational motivations and readiness for KE
- processes of knowledge absorption, adaptation, and embedding
- leadership behaviours facilitating change
- challenges encountered during KE
- evidence of long-term organisational improvements
- value creation, capability development, and sustainability outcomes

The semi-structured format allowed for probing emergent themes while ensuring consistency across cases. The data collection by survey and its design enabled the sorting of that data into categories to capture if there had been impact on a business on completion of a KTPs project. The categories provided more detail in their relationship to the value cycle necessary for developing the individual business models. These categories were derived from review of previous survey designs and the literature review of the areas related to knowledge exchange, KTPs projects, SMEs operational activity and business models and these allow for exploration of patterns, insights gained, demonstrate change and actionable strategies to address research questions (BEIS, 2022; Adams & Comber, 2013; Al-Ansari, et al., 2013; Barjak, et al., 2014). Survey data were analysed using descriptive statistics to highlight:

- common KE outcomes
- variations in impact across industries
- prevalence of practices associated with successful knowledge embedding

The semi structured interview with the leaders in the business, the KTPs initial and final reports and access to the UK Innovate database for funded projects allowed for five curated case studies to contribute to the exploration of the data and results to provide analysis supporting further discussion. The case study analysis allowed categorisation of the reality of the actions taken after the KTP project where they impacted the value cycle by relating that to the impact categories.

Including a free text area in the survey as the examples found in the Tailored Design Method (Dillman, 2007) was thought to be prudent and hence avoided the consequence of measurement differences by selecting from the mixed mode situations listed in Figure 6 below "Collection of different data from the same respondents during a single data collection period". This was to take advantage of the time available and there was no consequence to the measurement. The study that forms the basis of the approach studied effects such as changing the order of questions for each mode of the survey with the main aim to ensure:

"*The writing and presentation of questions to respondents in a way that assures receipt by respondents of a common mental stimulus regardless of survey mode*." (Dillman, 2007, p. 95)

The challenges for unimodal and mode specific construction challenges are reviewed by (Dillman, 2007) and Figure 6 below recreated the summary.

Mixed-Mode Situation	Typical Objective	Consequence
Collection of same data from different members of a sample	Reduce cost and nonresponse	Measurement differences
Collection of panel data from same respondent at later time	Reduce cost and nonresponse	Measurement differences
Collection of different data from the same respondents during a single data collection period	Improve measurement and reduce costs	None apparent
Collection of comparison data from different populations	Convenience and reduce cost	Measurement differences
Use one mode only to prompt completion by another mode	Improve coverage and reduce nonresponse	None apparent

Figure 6 Mixed-Mode Situations (Dillman, 2007)

This research will draw upon the following sources to ensure that the design and implementation of the survey strategy is consistent with recognised research development standards and best practice (Cryer, 1996; Denscombe, 2010; Wisker, 2008). The research utilized interviews with key KTP participants, including KTP

partners and KTP Associates, to gather comprehensive data. This approach was informed by prior studies focusing on KTPs (Ternouth, et al., 2012; Siora, et al., 2015). The integration of qualitative interviews with survey findings strengthened the research by providing a robust, multi-dimensional understanding of the impact of KTPs on business strategy and innovation post-project completion.

To ensure rigor in qualitative research, detailed strategies for data collection, coding, analysis, and presentation are applied (Glaser, 1967). Qualitative data will be analysed using pattern matching, explanation building, time-series analysis, logic models, and cross-case synthesis, ultimately leading to overarching themes and theoretical insights (Corbin & Strauss, 2015; Eisenhardt, 1989; Yin, 2014).

Case study methodology was employed for presenting qualitative findings, approached as real-life contextual analysis (Yin, 2014). The case study framework provided a structured yet flexible means of interpreting business transformations resulting from KTP engagements. The individual business reports, where available, were incorporated into the case study analysis to present an organised view of project outcomes, key actions, and contextual factors.

The data collection was not a sequence of discrete events but rather an iterative and cycling process

- **Pilot Study**: Conducted with three former KTP project company partners.
    - Pilot survey
    - Pilot semi-structured interview
- **Main survey**
- **Case Study**: Five case studies (A to E), curated from primary and secondary sources involving SMEs engaged in KTP projects.
- **Data Collection**: Semi-structured interviews; main survey and secondary data integration.
- **Analysis**: Thematic coding, triangulation with secondary sources, case study presentation.

The case studies were conducted in 2016 for Case Studies A, B and C; 2021 for Company AA (Case Study D or CSD), and in 2022 for Company AS (Case Study E or

CSE). These additional cases emerged from ongoing discussions with the previous KTP Associate in Company AA and with the CEO for Company AS where the author was the Academic Lead for a KTP project concluded in early 2023.

The data collection process was planned to be systematic, repeatable, and aligned with the principles of a mixed-method approach. This methodological rigor ensured the acquisition of relevant data necessary for addressing the research questions and contributing to academic knowledge on knowledge exchange and SME engagement. By adopting this qualitative methodology, this study aimed to provide a detailed, contextual understanding of the impact of KTPs on business growth and innovation, while maintaining methodological rigor and ethical research standards.

The next section moves to establishing the criteria for analysis of the qualitative data and aligning this to the conceptual framework categories to address the research objectives. This will provide clear linkage and support for the outcomes based on structured analysis of the data collated consolidated in the emergent themes and resulting conclusions.

3.4 Criteria for analysis - Qualitative

This study adopts a criterion led analytical framework to ensure systematic alignment between the research questions, data sources, and analytical procedures across qualitative and quantitative strands. The analysis will be conducted and progressed through three iterative techniques recommended by (Yin, 2014), pattern matching, which compared empirically observed behaviours and outcomes with theoretically predicted patterns; explanation building, which clarifies causal sequences and provides interpretative insight, particularly where unexpected results or deviations emerged; and cross-case synthesis, which systematically identified similarities, differences, and recurring themes across the participating SMEs.

The study uses a structured cross-case analysis of five KTP case studies, supported by a heatmap matrix to compare the relative intensity of key organisational and knowledge exchange dimensions. A comparable three-point scale (Low, Medium, High) was used to capture observable variation in areas such as leadership support,

knowledge exchange barriers, absorptive capacity, knowledge embedding, innovation outcomes, and sustainability. Once the qualitative content is collated, a three-point ordinal scale, Low (L), Medium (M), and High (H), will be applied to each thematic indicator to support comparability across cases and to reduce subjective interpretation. This approach is supported by long time use in a series of Government Innovation Surveys highlighted above in the data analysis approach (BEIS, 2022; BEIS, 2020).

To populate the cross-case synthesis table, each case study will be systematically analysed through a structured process that integrates multiple qualitative data sources. The first stage involves completing each cell using evidence drawn from coded interview transcripts, observation notes, formal KTP reports, and documentary analysis to ensure factual consistency and triangulation of insights. Finally, the synthesis column of the table will use precise analytical language that will explicitly link the emergent findings back to the study's conceptual framework, relevant theoretical constructs, such as absorptive capacity, organisational learning, and knowledge exchange models, and the broader empirical patterns identified across the dataset. This process ensures methodological rigour, analytical coherence, and a theoretically grounded interpretation of the qualitative evidence. The alignment of themes and research questions will be via visual frameworks and tabular displays, using qualitative indicators to express differential levels of contribution (Creswell & Poth, 2018).

The criteria for qualitative analysis are derived from the conceptual framework, the structure of the semi-structured interviews, and the organisation of case documentation. These criteria are applied consistently across cases with indicators to provide consistency to ensure analytic rigour, comparability, and transparency following the mapping of the Research Objectives to the Research Questions, see Table 5 above.

3.4.1 Criteria for Analysis (Research Objective 1)

Research Objective 1:
To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.

RQ1: What organisational parameters and approaches deliver long-term impact through knowledge exchange?

RQ1 primarily informs analysis of internal organisational and leadership-related factors that shape knowledge exchange capability. Leadership characteristics and strategic orientation are consistently identified as foundational, with studies highlighting how visionary, committed, and strategically clear leaders foster environments conducive to innovation, learning, and external collaboration ((McMullen & Kier, 2016; Salavou, et al., 2004; Laforet & Tann, 2006). Leadership style that ranges from transformational, through supportive to risk averse and in the context of SMEs is supported from the literature reviewed in this study (Shepherd, et al., 2010; Leitch & Volery, 2017; BEIS, 2019; Desouza & Awazu, 2006; Ates & Bititci, 2011; Pal, et al., 2014; Batra, 2017).

RQ3: What long-term impacts do SMEs achieve through collaboration with universities?

RQ3 focuses on outcomes associated with SME university collaboration and the longer-term impacts of knowledge exchange supported by the relevant literature review (Korayim, et al., 2024; Koryak, et al., 2015; Al-Jabri & Al-Busaidi, 2018; Calvo-Mora, et al., 2016; Davis & Botkin, 1994). Patterns of knowledge exchange engagement and levels of organisational readiness are analytically relevant to both research questions, as they link internal organisational conditions to collaborative processes and their impact with focus on SMEs (Szulanski, 2000; Lindgren, 2012; BEIS, 2019; BEIS, 2021; GOV.UK, 2021; Caglio & Katz, 2001; Garg & Rastogi, 2006; Zott, et al., 2011).

The methodology and criteria utilised in the SME studies by (Laforet & Tann, 2006; Salavou, et al., 2004) methodology identified the impact of SMEs using the GDP share in the country, collected data by structured survey alongside conducting semi-structured interviews with industry experts. Previous works identified that qualitative coding sectioned in minimal spreads assists in offering clarity of interpretation due to the free-range aspects of conducting semi-structured interviews. This is shown in the

adoption of coding on three ordinal points High, Medium and Low (H/M/L) to sort the responses based on individual level, organisational and system level impacts. The indicators and the impact areas for each criterion for analysis based on the conceptual framework are listed below:

Leadership Characteristics and Strategic Orientation: Leadership commitment to knowledge exchange, strategic prioritisation, and alignment with organisational goals.

Operational Characteristics and Organisational Structures: Governance arrangements, resource allocation, and internal processes that support or constrain knowledge exchange activity.

Knowledge Exchange (KE) Engagement Patterns: Types, intensity, and continuity of engagement with university partners.

Organisational Readiness and Contextual Factors: Absorptive capacity, prior collaboration experience, and external environmental conditions.

Across levels, knowledge exchange generates cumulative and mutually reinforcing impacts: at the individual level, leaders and employees develop enhanced skills, greater learning capacity, and more adaptive mindsets through sustained exposure to collaborative and co-creative knowledge exchange; at the organisational level, these capabilities become embedded in routines, strengthening absorptive capacity, innovation processes, and long-term performance within SMEs; and at the system level, such developments support the formation of durable university–SME partnerships, deeper collaborative networks, and more robust regional and sectoral innovation ecosystems.

Together, the qualitative criteria support pattern matching between empirical observations and theoretical expectations regarding the organisational conditions associated with effective knowledge exchange. Leadership and operational factors are critical for RQ1 hence strong relevance or primary mapping, and KE engagement patterns and organisational readiness are strongly linked to both RQ1 and RQ3 in terms of impact and collaboration outcomes.

The use of alignment matrices to ensure coherence between research questions, data collection strategies, and analytical procedures, thereby strengthening methodological transparency and rigour is advocated by (Creswell & Poth, 2018). Yin, further supports this approach within case study research by proposing analytic matrices that link propositions and questions to evidence sources and interpretations (Yin, 2014). Collectively, these works provide a strong methodological rationale for summarising the relative strength of alignment between qualitative criteria, their associated indicators, and research questions, thereby justifying the use of an ordinal Low/Medium/High recap to indicate the extent to which each element contributes to addressing the study's objectives. This approach mirrors established evaluation practice in KE and innovation contexts where innovation and knowledge frameworks use scaled judgements of relevance, coherence and impact through benchmarking (OECD, 2024).

Table 10 below recaps the relative strength of alignment between each qualitative criterion, their set of indicators and the research questions for Research Objective 1 using a Low / Medium / High (L / M / H) scale in this study.

Table 10 Relevance of qualitative criteria Research Objective 1

Qualitative Criteria for Analysis	**Indicators**	**RQ1: Organisational parameters & approaches**	**RQ3: Long-term impacts of SME-university collaboration**
1. Leadership Characteristics and Strategic Orientation	- Narrative evidence of leadership vision, commitment, and strategic clarity	H	L
	- Leadership style (transformational, supportive, risk-averse)		
	- Senior management involvement and influence on knowledge initiatives		
	- Adaptability and responsiveness in decision-making		
2. Operational Characteristics and	- Existing processes, routines, and workflow maturity	H	M

Organisational Structures			
	- Presence and utilisation of organisational infrastructure		
	- Internal communication practices and coordination mechanisms		
	- Resource availability and allocation patterns		
3. Knowledge Exchange (KE) Engagement Patterns	- Quality and depth of university-SME interaction	H	H
	- Evidence of co-creation, collaborative problem solving, and iterative learning		
	- Perceived challenges, barriers, and facilitators to KE		
	- Integration of academic and practitioner knowledge		
4. Organisational Readiness and Contextual Factors	- Cultural openness to learning and change	M	H
	- Prior experience with innovation or collaboration		
	- Sector-specific drivers and constraints		

Legend for matrix relevance:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

3.4.2 Criteria for Analysis (Research Objective 2)

Research Objective 2:

To explore the long-term impacts of embedding knowledge within business processes.

Relevant Research Questions:

RQ2: What is the effect of knowledge embedding on organisational learning and entrepreneurial leadership?

RQ2 focuses on the longer-term organisational consequences of knowledge embedding, particularly in relation to learning capabilities (Ahmad & Schroeder, 2011; De Wit-de Vries, et al., 2019) and the evolution of entrepreneurial leadership (Nicotra, et al., 2021; O'Dwyer, et al., 2023; Rybnicek & Konigsgruber, 2019). The previous studies enabled examination of both the mechanisms and outcomes of knowledge embedding.

RQ4: Through what processes do SMEs embed knowledge gained via collaboration?

RQ4 primarily informs analysis of the processes through which externally acquired knowledge becomes embedded within organisational practices based on the theoretical foundations (Cohen & Levinthal, 1990; De Wit-de Vries, et al., 2019; Senge, 2006; Szulanski, 2000) and studies that exploration of UIC collaboration (Bruneel, et al., 2010; Etzkowitz & Chunyan, 2017; Agrawal, 2003). In the context of the study the impacts in the SME context by previous studies informs of their particular constraints and challenges (Sullivan-Taylor & Branicki, 2011; OECD, 2022; OECD, 2024) and

The theoretical foundations demonstrating that effective knowledge embedding and its impacts are shaped by leadership orientation, organisational structures, engagement patterns with universities, and organisational readiness. Leadership commitment and strategic prioritisation (Drucker, 1988; Nonaka & Teece, 2001; Bruneel, et al., 2010) underpin the development of learning cultures and entrepreneurial behaviours (RQ2) and determine whether KE outputs are strategically integrated (RQ4). Organisational structures and feedback-enabled processes (Argote & Ingram, 2000; Zull, 2004; Schwartz, 2007) explain how knowledge becomes part of the routines and institutionalised. University–industry engagement modes (Cohen, et al., 2002; Etzkowitz & Chunyan, 2017; Regeneris, 2010) shape the pathways through which embedding occurs, while absorptive capacity and contextual readiness (De Wit-de Vries, et al., 2019; OECD, 2022) condition the depth and sustainability of embedding. Together, these literatures justify the selection of qualitative criteria and directly inform analysis addressing RQ2 and RQ4.

Collectively, the analytical criteria support explanation building by tracing how and why knowledge embedding processes generate longer-term changes in organisational

behaviour, learning structures, and leadership orientation. The indicators and the impact areas for each criterion for analysis based on the conceptual framework are listed below:

Knowledge Embedding Processes: Mechanisms through which knowledge is internalised, including routinisation, codification practices, and incorporation into roles, workflows, and decision-making structures.

Evidence of Absorptive Capacity: Organisational ability to recognise, assimilate, and apply new knowledge, as reflected in staff learning and training, skill development, organisational flexibility, capability enhancement, and integration of new competencies across functional areas.

Organisational Learning and Cultural Development: Emergence of reflective learning practices, adoption of continuous improvement behaviours, establishment of knowledge-sharing routines, and reinforcement of a learning-oriented culture through leadership practices.

Evolution of Entrepreneurial Leadership: Changes in leadership behaviours following knowledge integration, including increased innovation orientation, risk-taking, strategic agility, and shifts in organisational vision and strategic direction.

The mapping below in Table 11 reflects the differential emphasis of each qualitative criterion in relation to the two research questions. Knowledge Embedding Processes are assigned a high level of relevance to RQ4 because they directly capture the mechanisms through which knowledge is embedded in routines, codification practices, and workflows, while their relevance to RQ2 is moderate, as these processes indirectly shape longer-term learning and leadership outcomes. Evidence of Absorptive Capacity is also highly relevant to RQ4, as it is central to understanding how SMEs recognise, assimilate, and apply externally acquired knowledge; its relevance to RQ2 is moderate because it supports, but does not directly constitute, organisational learning culture or leadership evolution. Organisational Learning and Cultural Development demonstrates high relevance to RQ2, given its focus on learning behaviours, reflective practice, and cultural change as core outcomes, while its

relevance to RQ4 is moderate, as such developments are partly influenced by embedding processes but are not their primary focus. Finally, Evolution of Entrepreneurial Leadership maps strongly to RQ2 because it directly concerns leadership-related outcomes of knowledge embedding, whereas its relevance to RQ4 is moderate, reflecting the indirect influence of embedding processes on leadership change.

Table 11 Relevance of qualitative criteria Research Objective 2

Qualitative Criteria	RQ2: Effect on Organisational Learning & Entrepreneurial Leadership	RQ4: Processes of Knowledge Embedding
Knowledge Embedding Processes	M	H
Evidence of Absorptive Capacity	M	H
Organisational Learning & Cultural Development	H	M
Evolution of Entrepreneurial Leadership	H	M

Legend for matrix relevance:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

3.4.3 Criteria for Analysis (Research Objective 3)

Research Objective 3:
To identify how knowledge exchange contributes to sustainable business change and value capture within SMEs.

- RQ3: What long-term impacts do SMEs achieve through collaboration?

SMEs and the impacts are a key focus for this study and is integrated into the conceptual framework. SMEs' capacity to benefit from knowledge exchange and KTP participation is shaped by leadership orientation, organisational structures, engagement patterns, and organisational readiness. Leadership that articulates a

knowledge vision (Nonaka & Teece, 2001) and adopts an entrepreneurial orientation (Leitch & Volery, 2017) increases the likelihood that externally acquired knowledge is internalised (RQ3), translated into business model change (RQ4), and embedded in ways that generate sustained value capture (RQ5). However, persistent SME constraints; short-termism (Ates & Bititci, 2011), informal KM practices (Hutchinson & Quintas, 2008), and weak absorptive capacity (Dubouloz, et al., 2021) frequently limit these outcomes. KTPs, through structured co-recognition, co-creation, and commercialisation processes (Ternouth, et al., 2012), provide a mechanism to overcome these barriers by strengthening absorptive capacity and institutionalising learning, thereby enabling sustainable organisational change.

- RQ5: Why and how does embedded knowledge lead to sustainable change and value capture?

Embedded knowledge is conceptualised as a driver of sustainable organisational change when it becomes integral to routine practices rather than remaining confined to individual cognition (Senge, 2006; Leitch & Volery, 2017; Johnson, et al., 2008). Such knowledge is sustained when knowledge exchange (KE) is continuous and iterative, rather than episodic or project-bound, and becomes valuable when the organisational context enables its effective exploitation (Argote & Ingram, 2000; Tushman, et al., 2010; Johnson, 2010; Hartmann, et al., 2016). Sustainable change arises when leaders institutionalise embedded knowledge through strategy, governance, and formal structures (Rosli, et al., 2018; Tidd & Bessant, 2013; Hansen, 1999). Accordingly, RQ5 examines why these changes endure and how they generate value. Embedded knowledge constitutes a source of sustainable competitive advantage when it is strategically prioritised, structurally embedded, repeatedly reinforced through ongoing engagement, and supported by organisational readiness. Under these conditions, embedded knowledge reshapes the firm's business model around durable mechanisms of value creation and capture.

Analysis will be structured around the following qualitative criteria:

Innovation and Organisational Outcomes: Evidence of product, process, or service innovations. Improvements in quality, efficiency, or capability maturity. Adoption of

new management or operational models. Perceived value and strategic benefits from innovation

Capability Development and Organisational Transformation: Long-term strengthening of internal systems and competencies. Creation of new functions, departments, or strategic initiatives. Integration of continuous improvement practices. Enhanced resilience and adaptive capacity.

Value Capture and Business Sustainability: Narrative evidence of sustained competitive advantage. New market access, improved customer reach, or efficiency gains. Changes in business model or strategic trajectory. Perceptions of long-term organisational resilience

Sustainability of Knowledge and Processes Beyond the Project: Continuation of university partnerships. Retention of staff and expertise. Ongoing development of knowledge-driven initiatives. Evidence of institutionalised learning.

Innovation and organisational outcomes are directly linked to long-term impacts achieved through collaboration (RQ3, high), while they also contribute to understanding the outcomes of embedded knowledge, though this is not the primary explanatory focus (RQ5, medium). Capability development and organisational transformation reflect longer-term structural impacts (RQ3, medium) and play a central role in explaining how embedded knowledge drives sustainable change (RQ5, high). Value capture and business sustainability provide core evidence of long-term collaborative impact (RQ3, high) and directly address the mechanisms through which value and sustainability are realised (RQ5, high). Finally, the sustainability of knowledge and processes beyond the project indicates the persistence of impact (RQ3, medium) and is key to explaining how embedded knowledge continues to generate value (RQ5, high). These criteria support cross-case analysis to identify patterns of sustainable impact and organisational value creation, and the criteria are mapped in Table 12 below.

Table 12 Relevance of qualitative criteria Research Objective 3

Qualitative Criteria	RQ3: Long-Term Impacts of SME Collaboration	RQ5: How & Why Embedded Knowledge Leads to Sustainable Change & Value Capture
Innovation and Organisational Outcomes	H	M
Capability Development and Organisational Transformation	M	H
Value Capture and Business Sustainability	H	H
Sustainability of Knowledge and Processes Beyond the Project	M	H

Legend for matrix relevance:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

3.4.4 Summary of qualitative criteria for analysis

The qualitative analysis criteria are linked to the analysis techniques in the published works consistently updated from Yin and Creswell (Yin, 2014; Creswell & Poth, 2018).

Pattern Matching

The patterns identified within the conceptual framework, which traces the progression from leadership through operational characteristics, knowledge exchange, and embedded knowledge to sustainability, are systematically compared with empirical narrative data to evaluate the extent of alignment or divergence between theoretical propositions and observed phenomena.

Explanation Building

Causal pathways, illustrating how knowledge exchange drives organisational change, are developed through an iterative process that combines thematic coding, comparative analysis of narrative data, and the continual refinement of theoretical propositions. This approach enables a rigorous tracing of the mechanisms through which knowledge flows translate into structural and operational transformations within the organisation.

Cross-Case Synthesis

Word tables and thematic matrices organise case evidence into comparable categories. This provides a basis for identifying cross-case patterns, typologies, and explanations. Each case study is analysed under the following qualitative themes:

- Sector and Size demographics
- Leadership Characteristics
- Knowledge Exchange Activities & KTPs
  - UIC
  - Knowledge Exchange (KE) Barriers
- Knowledge Embedding & Organisational Learning
  - Evidence of Absorptive Capacity
- Entrepreneurial Leadership and Innovation
- Barriers, context and SME characteristics
- Long-Term Sustainability Outcomes

These categories align directly with the conceptual framework and enable coherent, replicable qualitative analysis grounded in evidence. The following summary outcome, Table 13 shows the qualitative criteria, the derived indicators for analysis mapped to the reference sources.

Table 13 Summary Qualitative Criteria indicators and sources

Qualitative Criteria for Analysis	Indicator	Data source	Relevant Research Questions	Reference Sources
1. Leadership Characteristics and Strategic Orientation	- Narrative evidence of leadership vision, commitment, and strategic clarity	Interviews	RQ1	(McMullen & Kier, 2016); (Salavou, et al., 2004); (Laforet & Tann, 2006); (O'Regan, et al., 2006)
	- Leadership style (transformational, supportive, risk-averse)	Survey	RQ2	(Shepherd et al, 2010); (Leitch & Volery, 2017); (BEIS, 2019); (Desouza & Awazu, 2006); (Ates & Bititci, 2011); (Pal, et al., 2014); (Batra, 2017)
	- Senior management involvement and influence on knowledge initiatives	KTP documentation	RQ1, RQ2	(Szulanski, 1996); (Hoang, et al., 2025); (Sabherwal, 2012); (Mole, 2021); (Lynch & Corbett, 2021)
	- Adaptability and responsiveness in decision-making		RQ2,RQ4	(Teece, et al., 1997); (McMullen & Kier, 2016); (Shepherd, et al., 2010); (Hessels & Parker, 2013)
2. Operational Characteristics and Organisational Structures	- Existing processes, routines, and workflow maturity	Interviews	RQ1, RQ3	(Senge, 2006).
	- Presence and utilisation of organisational infrastructure	Survey		(Ates & Bititci, 2011); (Pal, et al., 2014); (Mole, 2021)
	- Internal communication practices and coordination mechanisms	KTP documentation	RQ2,RQ4	(Kolb & Kolb, 2005); (Hayes, et al., 2005)
	- Resource availability and allocation patterns		RQ5	(Desouza & Awazu, 2006)
3. Knowledge Exchange (KE) Engagement Patterns	- Quality and depth of university-SME interaction	Interviews	RQ1, RQ3	(Korayim, et al., 2024); (Koryak, et al., 2015); (Al-Jabri & Al-Busaidi, 2018); (Calvo-Mora, et al., 2016)
	- Evidence of co-creation, collaborative problem solving, and iterative learning	KTP documentation	RQ2, RQ4	(Hsu, et al., 2013); (Al-Ansari, et al., 2013)

	- Perceived challenges, barriers, and facilitators to KE	Survey	RQ5	(Henriksen & Rolstadas, 2010); (Adams & Comber, 2013); (Hooker & Achur, 2014)
	- Integration of academic and practitioner knowledge		RQ2,RQ4	(Davis & Botkin, 1994)
4. Organisational Readiness and Contextual Factors	- Cultural openness to learning and change	Interviews	RQ1, RQ3	(Szulanski, 1996); (Lindgren, 2012); (BEIS, 2019; BEIS, 2021; GOV.UK, 2021); (Zott, et al., 2011); (Caglio & Katz, 2001); (Garg & Rastogi, 2006)
	- Prior experience with innovation or collaboration	KTP documentation	RQ4	Appendix 17
	- Sector-specific drivers and constraints	Survey	RQ5	(BEIS, 2019; BEIS, 2021; GOV.UK, 2021)

The following section describes the data analysis approach for the qualitative data.

3.5 Data Analysis approach - Qualitative

The techniques used in the current work are among those proposed by (Yin, 2014). Yin proposes five techniques: pattern matching, explanation building, time-series analysis, logic models, and cross-case synthesis. Logic models and time series analysis require measurements during a prolonged period; thus, they cannot be used for this study. Therefore, focus is given to pattern matching, explanation building, and cross-case techniques. The three techniques are made possible by the examination of the recorded interviews, observation notes, and documents.

Pattern matching is a technique used in qualitative data analysis whereby empirically observed patterns are compared with predicted patterns derived from theoretical propositions. This strategy enhances the internal validity of case study research by enabling the researcher to assess the extent to which observed outcomes align with theoretical expectations (Yin, 2014). In this study, the developed conceptual framework guided the development of anticipated patterns, which were then matched against the actual data collected through interviews and survey responses. Where convergence between patterns occurred, theoretical propositions were supported; where divergence was identified, this prompted further interpretation and refinement of the analytical framework.

The second technique used in a case study analysis is to build an explanation of the case, making causal links in a narrative form. The present study has been considered as being exploratory research, making this technique appropriate in analysing the qualitative data. Other strategies were not suitable relying on theoretical propositions and working the data from the ground up did not elicit any appropriate patterns across the whole suite of case studies.

The case study presentation followed a structured and systematic format to ensure coherence and comparability across cases, Appendix 10. Each begins with company demographics and an overview of the respective KTP project's objectives. This is followed by a narrative account based on semi-structured interviews, supplemented by initial and final KTP reports where applicable. Subsequent sections examine organisational growth, strategic outcomes, knowledge transfer, and capability

development. Where relevant, long-term impact and strategic evolution are also addressed. Each case concludes with a summary, enabling a consistent and analytically robust presentation of qualitative data across all participating companies. The nature of explanation building is quite dynamic and interactive and, as previously affirmed, it allowed for robust premise confrontation and improvement cycles, which is one of the advantages of case study methods.

Cross-case analysis represents the final methodological technique employed in this research, involving the systematic comparison of findings across multiple case studies. This synthesis is often facilitated through the construction of word tables, which organise data from each case according to a consistent framework, thereby enabling the aggregation of findings across individual studies. Complementary tables were developed to capture a comprehensive set of features, supporting the grouping of cases and the formation of typologies. While a common critique of using word tables in cross-case analysis is their reliance on interpretative reasoning rather than quantitative measures, this research embraces this approach to identify patterns, similarities, and differences among the cases. Such comparative analysis offered the advantage of generating broader insights and contributions to theory development grounded in evidence. Each case study was listed and the observations from the collected qualitative data will be summarised in each category focused within the lens of the research objectives and presented in table form.

To categorise and sort the qualitative information from the case studies data will be organised into thematic areas based on the conceptual framework that develops the research questions to achieve the overall research objectives. The sections of the quantitative survey supported the ability to maintain boundaries for the qualitative data collection. Prior to the interview the responses to the survey were double checked with the interviewee for veracity. The survey replies were used to verify the noted extent of barriers and challenges in the comments and that improvements or successes were not out of proportion as discussed in the interview.

The researcher was the sole interviewer, and the prospect of unconscious influence was offset by the relationship and trust supported through introductions by the UH KTP office, once the selection sample was contacted. The researcher’s level of experience

as Supervisor and Lead Academic of several KTP projects supported the introductory conversation and that knowledge coupled with the premise of the research aim garnered access to very busy owners and senior managers. This activity supported any future possibility that more contact time could be gained, above the initial survey and interview periods of time, should it be required. The semi-structured interview was selected to ensure the discussion was framed using the survey structure as a guide and allowing focus and search for further detail under each of the categories.

The survey mixed method approaches and methodologies used in the research on the CiHE report Key Attributes for successful KTPs (Ternouth, et al., 2012) and the SME attitudes to adoption of best practice (BEIS, 2019) support the data analysis approach. The three-point ordinal scale limits the researchers bias on identifying the scale of impact and the interpretation of the data due to the free ranging aspect of the semi-structured interviews.

Each Case Study will be analysed under each of the following themes reflecting the conceptual framework:

- Sector and Size demographics
- Leadership Characteristics
- Knowledge Exchange Activities & KTPs
    - UIC
    - Knowledge Exchange (KE) Barriers
- Knowledge Embedding & Organisational Learning
    - Evidence of Absorptive Capacity
- Entrepreneurial Leadership and Innovation
- Barriers, context and SME characteristics
- Long-Term Sustainability Outcomes

The next section follows on to identify the quantitative methods and approach used in this research work.

3.6 Quantitative methods and approach

Quantitative research is positivist, and a deductive type of reasoning applied with logical application and interpretation using variables to evaluate and comes from the primary data collection. The action taken in quantitative research is the testing of the relationships between the identified factors and categories and their relationships. This logical and deductive approach allows for proposed theory or theories, usually set up as hypothesis, to be accepted or rejected and show validity. The empirical nature of the research provides validity as it is repeatable and objective in nature. Quantitative data are analysed by counting the frequency with which certain features occur among participants' responses. The summarised data can then be subjected to a variety of statistical measures to identify patterns or trends and to assess what inferences can be made from the data about the general population, inferential statistics.

This study adopts a positivist and deductive quantitative approach to examine the relationships between organisational conditions, knowledge exchange practices, and long-term business impacts within SMEs participating in KTPs. Quantitative analysis is used to test theoretically informed propositions concerning how knowledge exchange is operationalised, embedded, and translated into sustainable business change. The approach is non-experimental and cross-sectional in design, relying on survey data collected from SMEs whose KTP projects were completed at least four years prior to the study. This timeframe supports assessment of enduring rather than short-term effects. Quantitative analysis proceeds in three sequential stages: (1) data preparation and screening, (2) descriptive and exploratory analysis, and (3) inferential and relational analysis.

Data Preparation

A survey involves asking individuals questions about their opinions, beliefs, attitudes, or behaviours regarding a given topic. Individuals are selected to take part in a survey because they share certain characteristics and form population. They may be questioned by asking them to complete a questionnaire, by face-to-face interview or by telephone interview. Small-scale surveys involving a small number of participants may collect either qualitative or quantitative information but larger scale studies involving hundreds or even thousands of people would collect quantitative data. The

survey is one of the most frequently used research tools it is familiar, and most people have been asked to take part in a survey at some time.

The participants were selected from a web-based database and are industry based. Sampling is the process of selecting a sub-set, of people or social phenomena to be studied, from the larger 'universe' to which they belong, in one of several ways to be either non-representative, based on simple convenience or choice of illustrative cases. Alternatively, they may be representative, typically based on probability theory to make the cases more typical of the universe from which they have been selected. Convenience sampling uses readily available subjects and often used in qualitative and hypothesis generating research projects. Time constraints, a challenge commonly encountered by small businesses like SMEs, adversely affected contribution in several instances, hindering the sharing of reflections. This challenge is acknowledged by (Cerchione, et al., 2015; Hutchinson & Quintas, 2008).

Descriptive and exploratory analysis

Descriptive statistics are used to summarise the characteristics of the sample and provide an overview of patterns across key variables. These include:

- Frequencies and percentages for categorical variables
- Means, medians, and standard deviations for Likert-scale items
- Cross-tabulations by industry sector, business function, and time since KTP completion

This stage establishes the distribution of perceived impacts across the five overarching impact domains:

- Operational Impact (OI)
- Competitive Position Impact (CPI)
- Leadership Impact (LI)
- Knowledge Impact (KI)
- Business Model Impact (BMI)

Exploratory analysis enables initial identification of trends, such as whether impacts are more pronounced in certain sectors, firm sizes, or project time horizons. These descriptive findings provide contextual grounding for subsequent inferential testing.

Inferential and relational analysis

Inferential statistical techniques are employed to examine associations and test relationships between organisational conditions, knowledge exchange practices, and business outcomes. Given the ordinal nature of most measures and the modest sample size, non-parametric techniques are prioritised where appropriate.

Analytical techniques include:

- Correlation analysis, Spearman's rho, to test associations between impact domains (e.g., Knowledge Impact and Business Model Impact).
- Group comparisons, Mann–Whitney U and Kruskal–Wallis tests, to explore differences across sectors, firm sizes, and time since KTP completion.
- Multiple regression analysis, where assumptions permit, to examine the extent to which leadership, operational structures, and knowledge embedding predict business model and competitive position impacts.
- Effect size estimation (e.g., Cohen's d, r) to interpret the magnitude of observed relationships.

Statistical significance is assessed at $\alpha = 0.05$, supplemented by confidence intervals and effect sizes to support substantive interpretation beyond p-values alone.

The next sections detail the data preparation, the descriptive analysis as part of the quantitative methods and approach used in this research including their justification for the survey design, distribution and collection. This followed by further scoping of the analytical approach utilising the criteria for analysis, linking the conceptual framework and the research objectives.

3.6.1 Quantitative data collection

Primary data for this research was collected through a web-based survey administered using the Bristol Online Survey (BOS) platform. The survey design drew heavily from

the Innovation Survey (BEIS, 2020), a well-established methodology that has been previously validated. In addition, the survey structure was informed by the instrument used in the 2010 Strategic Review of KTP projects (Regeneris, 2010), which evaluated projects conducted between 2001/02 and 2007/08. This earlier design served as a template for surveying SMEs that had completed KTP projects.

Web-based surveys are recognised for their cost-effectiveness and broad reach, although response rates can be variable (Dillman, 2007). Drawing on findings from the literature, several design choices were made to maximise response:

- Staggered reminder emails were planned based on insights from (Kofstad, et al., 2008; Trouteaud, 2004), who emphasised their impact on reducing non-response bias.
- (Lietz, 2010; Ambrose & Antsey, 2010) offered insights into questionnaire design from educational and marketing perspectives respectively, reinforcing the decision to adopt Likert scales (1–5) and other categorical response formats.
- (Shropshire, et al., 2009) highlighted the value of early engagement in surveys to minimise abandonment, which informed the front-loading of key interest questions.

In the research area of investigating knowledge transfer conditions and university–industry collaborations there was further support for the use of mixed-method survey designs (Bacon, et al., 2021; Bruneel, et al., 2010).

The timeline for both primary and secondary data collection, as well as subsequent analysis, was significantly impacted by the Covid-19 pandemic. Response rates from SMEs were hindered due to operational disruptions, including the cessation of trading by some businesses. Despite these challenges, the research remained aligned with its original aims and objectives. Data collection continued, allowing for the comparison of planned versus actual activities, and enabling the researcher to enrich the dataset. As the survey was conducted at least four years after the completion of the KTP projects, it allowed for the exploration of longer-term outcomes and impacts, which remain relevant to the study's focus on operational and business performance.

A pilot study was conducted to validate the chosen mixed-methods approach. The importance of pilot testing, where a pilot functions as a scaled-down version of the main study, enables the identification and rectification of methodological issues (Malmqvist, et al., 2019). The pilot study specifically assessed:

- Accessibility of the target sample
- Anticipated response rates
- Suitability and quality of the data collection instrument

Any issues identified during the pilot were addressed prior to the main survey, thereby increasing the reliability and usability of the final data collected.

The use and validity of a pilot study supports this research approach where the survey design, structure and the semi-structured interviews were tested. This pilot study tested the mixed method approach using a survey, a semi structured interview and data from database searches and the KTPs initial and final project documents. Support in academia on the use of questionnaires or surveys is prevalent as they allow coverage in a cost-effective manner to a large sample (Dwyer, 1980; Lavrakas, et al., 2019). However, there are reported challenges with inherent errors due to poor design and the lack of response to surveys. The previous quantitative survey review and research by (Regeneris, 2010) did elicit sufficient responses although their coverage did include all partners' academics and associates which is beyond the resources for this study. The response from businesses reported as 25% hence this gives some support to the actions taken for this research of identifying and asking from responses from 1902 businesses. The previous Annual Reports (Innovate UK, 2013; Innovate UK, 2014) issued by Innovate UK monitor and measure the impacts on the Associate and the economy as well as the benefits for the Knowledge bases.

The survey was structured around key factors to streamline responses and integrate quantitative with qualitative data for deeper insights (Strauss, 1987; Yin, 2014). The use of surveys as a research tool is well-established, and this study builds upon previous surveys, such as periodic KTP reviews, innovation studies, and government-led assessments of SME impact (Ternouth, et al., 2012; Siora, et al., 2015; BEIS, 2022). Employing proven data collection tools from prior research is a widely accepted

practice. The literature review identified several relevant surveys, whose factors and categorizations played a critical role in shaping both the pilot and main survey designs used in this study. Guidance and inspiration from previous surveys conducted in the industrial sector, particularly those conducted by government entities including the Innovation Survey (BEIS, 2020). Additionally, insights were incorporated from review of surveys related to KTPs projects including (Regeneris, 2010; Siora, et al., 2015; Ternouth, et al., 2012; BEIS, 2019).

To improve our understanding the quantitative approach was based on traditional surveys designs to investigate the conditions as they are, non-experimental, hence no attempt to change and experiment under controlled conditions. The use of a survey means it can be repeated in future investigations or even a repeat under the context of this research to check for continued viability or emergent patterns.

3.6.2 Pilot Survey design

The primary business functions were selected from the KTPs Innovate UK web site (Innovate UK, 2015) and the industry sector list based on the Inter Departmental Business Register (IDBR) (ONS, 2015). The IDBR is the comprehensive list of UK businesses that is supplied by government, GOV.UK, for statistical purposes including the Office for National Statistics and the Department for Business Innovation and Skills and this provided the initial categories for use in the pilot as shown in Table 14 below.

Table 14 Pilot study top level sections

Section	Research area
A	**Business Function**
	Industry Sector
	Time factor
B	**KTP**
C	**Innovation**
D	**Leadership and External knowledge**
E	**Business Model**
F	**Additional comments**

The pilot survey was organised as follows:

- Section A: Demographic data, including business function, industry sector, and project completion date.
- Section B: Eight questions on the impact of KTP on business operations and innovation.
- Section C: Exploration of incremental versus radical innovation practices.
- Section D: Internal knowledge use and reliance on external advice.
- Section E: Business performance (e.g., sales, efficiency) scaled selection
- Section F: Business model evolution and competitive positioning.

The survey ordinal scales were labelled to categorise responses without asking participants to disclose sensitive or exact performance metrics. This included percentage range options to reassure participants that only grouped data would be analysed. The Likert-style scaling allowed quantitative grouping and meaningful interpretation, supporting the overall analytical framework, and aligning with best practices in similar studies (Bacon, et al., 2021; Bruneel, et al., 2010).

Further iterations and development through comparisons with other surveys contained in the Bristol Online Survey (BOS) database the final survey structure was finalised as shown in Table 15 below. Appendix 4 has the full survey detail for issuing to respondents and was included in the submission for ethics approval with the University of Hertfordshire.

Table 15 Pilot Survey detail with score conversion

	Question	Research area	Factors	Data Type	Scores conversion plan
A	1	**Business Function**	Innovate.org.uk KTP functions	Category	Quantity
	2	**Industry Sector**	UK SIC 2007 IDBR ONS	Category	Quantity
	3	**Time factor**	Year	Category	Band widthes to track trends of 2 & 5 year intervals
B	4	**KTP**	KTP Impact factor by 8 operational areas	Ordinal Likert scale	1 to 5 (5+4), 3, 2+1)
	5		KTP Impact on Inovation 8 operational areas	Ordinal Likert scale	1 to 5 (5+4), 3, 2+1)
C	6	**Innovation**	Incremental innovation check in 8 operational areas	Category	Yes=1, No=0
	7			Ordinal Likert scale	1 to 5 (5+4), 3, 2+1)
	8		Radical innovation check in 8 operational areas	Scale	Yes=1, No=0
	9			Ordinal Likert scale	1 to 5 (5+4), 3, 2+1)
D	10	**Leadership and External knowledge**	Internal Knowledge & Skills	Scale 1-3	1=2, 2=1, 3=0
	11		External avenues considered	Scale 1-3	1=2, 2=1, 3=0
	12		External advice	Scale 1-3	1=2, 2=1, 3=0
	13		External source public or private	Scale 1-4	1=3, 2=2, 3=1, 4=0
E	14	**Business Model Impact**	Commercial impacts since KTP	Scale 1-3	1=2, 2=1, 3=0
	15		Sales, market share, efficiencies & cost savings	Ordinal Likert scale	
	16		Turnover and Margins 2 areas	Scale 1-4	1=3, 2=2, 3=1, 4=0
F	17		Operating busines model 4 areas	Scale 1-4	1=3, 2=2, 3=1, 4=0
	18		Embedding knowledge 5 areas	Scale 1-4	1=3, 2=2, 3=1, 4=0
	19		Competitive position 5 areas	Scale 1-4	1=3, 2=2, 3=1, 4=0
	20		Grow business	Scale 1-3	1=2, 2=1, 3=0
	21	**Additional comments**	Free text		

The pilot study of three former KTPs Company Partners informed development of the main survey and was used to check and further refine the set of questions. The pilot study determined the robustness of the survey, tested the design, and allowed the researcher to review and make improvements. Issues around the order, continuity and overall relevance was assessed in the Pilot Study. Feedback led to revisions for clarity, flow, and relevance before launching the main study. The pilot identified potential issues in continuity and highlighted necessary improvements.

The initial survey design for the pilot study was structured with the first three demographic questions and then a fourth question categorising the level of growth since the KTPs Project had concluded. The next categories used were labelled as Decline, Same, 0-5%, 6-10% and lastly >10% corresponding to a Likert Scale of 1 to 5. The next group of questions were to elicit responses to categorise the performance aspects and were labelled: None, A little, some extent, quite a lot, significant based on Likert scales of 1 to 5. Several measurement scales categorical, ordinal Likert scale 1 to 5; Yes, No and Don't know were all utilised in this first design. On reflection and use these were modified for the final survey design issued after the post pilot review and

reduced to focus on gaining pertinent measures. All survey modifications were implemented prior to the main survey's release (Saunders, et al., 2023).

Quantitative data were collected using Likert scales, which enabled the numerical quantification of participant responses, and multiple-choice formats, which facilitated the grouping and sorting of data for subsequent analysis. The BOS (Bristol Online Surveys), now the Jisc Online Surveys platform, was employed to administer the survey, and its built-in analytical tools were utilised to process responses upon survey completion. Specifically, the survey design supported comparisons across operational area groupings, segmented by Business Function and Industrial Sector, and allowed for exploratory analyses of temporal variation in relation to the time elapsed since the completion of the KTP projects. It is proposed that such comparisons may yield insights into classification-based differences within the sample.

In experimental research if the sample size is correct getting valid results from the experiment minimises the chance of random errors. If the sample does give valid results and is representative of the population, then the results can be extrapolated back to be indicative of the entire population. Distribution of this survey was to a sample determined by the sampling frame of all KTPs closed projects between 2004 and 2015 which was determined as 2810. Consultation with the local Knowledge Exchange Office (KTO) supported the use of a third party to pass on the request there was no indication of any issues.

Inferential statistics tests identify if the relationships between the variables is statistically significant and typically the lower the probability the higher the confidence level in the results or data. Commonly at least 50% of the sample is needed to participate if a response bias is to be avoided but action can be taken to compensate for that situation to minimise the effect e.g., <120 sample size can be moderated using Cohen’s d process for interpreting the size of the effect. This measure indicates the standard difference between two means and the guidelines suggest a small effect size d = 0.2, a small difference between groups; d = 0.5 a moderate difference and finally d= 0.8 indicates a large difference. The risk of small sample size was further mitigated by utilising case study material to support the primary data and a larger sample of interviews undertaken as they are unimodal.

Confidence intervals consist of a range of values that act as good estimates of the unknown population parameter; however, in infrequent cases, none of these values may cover the value of the parameter. It does not describe any single sample. This value is represented by a percentage, so when we say, "we are 99% confident that the true value of the parameter is in our confidence interval", we express that 99% of the observed confidence intervals hold the true value of the parameter.

The variables or categories that the survey measured were assessed for significance if applicable and included in the comparison. The analysis conducted after the collection of the data was a post hoc analysis with a determined sample size. The sample size is denoted by N, and this is assessed for a desired level of probability by selecting a significance level (α), this provides a level of probability that the results can be generalised.

The survey uses Ordinal Likert scales amongst its measures to indicate the strength of the measure. Likert scales with a full range of non-numerical answers like a range of 5 or 7 answers reduces the option of a neutral reply which introduces difficulties into the analysis. Finer scales such as those mentioned 5 or 7 answers rather than three succinct answers can result in a greater spread of data and less skewing. Evaluation included regression analysis as it is a statistical technique which allows for investigating and modelling the relationship between variables if enough data is available. Tests conducted to establish correlation were made to determine if there was a relationship between two or more variables. In this developmental phase of the design a more detailed classification into section areas further shaped the structure and the layout of the preliminary survey. Consequently, this process yielded a refined outline for the survey design.

Avoiding open questions and closed ordered response categories were the main design feature applied to section B, C E and F (Wisker, 2008). Designation of Section A for classification purposes and a list for selection provided see Table 10. These design features allow for ease of completing the survey, as the respondent does not need to individually scale their response and can focus on each operational area listed (Dillman, 2007). Asking an open-ended question would require much more deliberation for example “Which areas have had an impact by the KTPs project?”

3.6.3 Pilot survey distribution and data collection

The Pilot Study was launched in March 2016 and remained open until August 2016. The decision to restrict the Pilot business contacts to those from University of Hertfordshire was because these KTPs projects had Knowledge base supervision teams from this HEI hence the contact was familiar. This was important to ensure the semi structured interview, and the discussion would take place. The pilot study was included the interviews and survey results for three businesses selected as access for the author was granted through the UH Knowledge Transfer project team and Table 16 below demonstrates the categories for the pilot survey.

Table 16 Pilot Study categories and survey response areas

Category
Growth of the company
Operational Impact
Operational Innovation
Leadership and External Knowledge
Business Model Performance
Business Model – Skills & R&D
Embedding Knowledge
Competitive position

Consideration of various analysis methods were tested in this pilot including the use of various quantitative analytical methods using all software available including Excel data analysis. The translation of the survey responses to scores supported the statistical analysis and the population was not sufficient to provide generalisability and reliability of the results. The initial data sheet from the Pilot Survey can be found in Appendix 5 Survey Data sheets.

3.6.4 Main survey post pilot

Based on the Pilot Study outcomes it became evident that certain elements of personal interest to the author had been included in the survey, which was unrealistic and would unnecessarily broaden its scope. Notably, the measurement of innovation within SMEs was already being addressed by a regular innovation survey, rendering its inclusion inappropriate. Instead, the survey's focus was deliberately narrowed to address the

overarching aim of the aim of the research. Reflection on and examination of the pilot study survey results, several refinements were made to the survey format. Specifically, the number of questions was reduced from 21 to 10, significantly reducing the time required to complete the survey. The redesign aligned with the research's primary aim:

To explore the extent the impact of knowledge exchange from the vantage point of the business that delivers sustainable change.

It is widely supported that web-based questionnaires or surveys allow coverage in a cost-effective manner to a large sample but there are issues with the lack of response to surveys. To mitigate this utilising previous experience which has shown that the launch of a survey followed by several staged reminders can improve response rates. Others including (Kofstad, et al., 2008) have explored the use of reminders in the initial contact and (Trouteaud, 2004) concluded that the mechanisms that worked were the initial invitation and reminder emails to reduce variability in response rates. Continued review of the literature in this area revealed a wide scope of design features over a wide range of context areas but primarily in marketing. Accepting the value of retaining and maintaining the respondent's interest to drive up response rates and prevent early termination by citing these questions early in the survey (Shropshire, et al., 2009), which this researcher considered in the design stage.

The attention given to questionnaire design and development provided from two different worlds the first an educational research basis and the latter in the context of marketing management gave useful pointers to consider at the design stage (Lietz, 2010; Ambrose & Antsey, 2010). The first review solidified the decision to follow the design using Likert 0 to 5 scales by (Lietz, 2010). The use of similar designs in the mixed method study investigation of knowledge transfer conditions (Bacon, et al., 2021) and the work studying the barriers to university-industry collaboration (Bruneel, et al., 2010) supported this design choice. Table 17 itemises the application of the scales.

Table 17 Likert scale applications

Likert scale				
5	4	3	2	1
Significantly	Quite a lot	To some extent	A little	Not at all
>10% increase	6 - 10% increase	0 - 5% increase	Stayed the same	Declined

Ordinal labels for responses enabled grouping into categories and the addition of percentage scales in the labels assisted in reassuring respondents that they were not supplying critical financial or performance information but rather replying into a category. The use of categorical variables is a level of measurement that provided quantitative results on analysis and translating the effects being surveyed.

The main survey is planned to provide supporting quantitative data to add to the qualitative data from the interviews and provide measurements of intangible as well as tangible factors. The quantitative data will use Likert scales to provide quantification and multiple-choice formats to allow for grouping and sorting of the responses.

The main survey, post pilot, was structured with ten entry pages as shown in Appendix 4. Pages 1 and 2 included the introduction and the data protection statements; page 3 allowed selection of the industry sector and the number of employees. The next page asked for date of completion of the last KTPs and the level of growth since the KTP concluded. The next section comprised of the Impact and Innovation areas eight off with the criteria ranging from significantly to not at all. Following on was the section on Leadership and External Knowledge limited to multiple choice between yes, no and do not know. Page 7 was the Business Model area with a Likert scale from declined to >10% for 6 areas including Sales and Turnover and another grid selection for four areas to gauge if knowledge gain had been embedded or included as part of the strategy. Embedding knowledge and Competitive position was page 8 with Likert scales ranging from significantly to not at all categories. Additional comments were sought in page 9 and page 10 was the thank you page with additional contact details.

The survey was a selection of comprehensive choices for the question layout including multiple choice, selection list, free text, date and time, scale, rank, and grid. Refining the survey design was based on the pilot study to assess the research approach and the research questions to achieve the aim and objectives of this study.

3.6.5 Main Survey sampling frame

The original plan for survey distribution involved initiating contact through university Knowledge Transfer Offices (KTOs). This approach assumed that companies would be more likely to respond to a familiar and trusted institutional source. In addition, there was an expectation that KTOs might find value in the survey results to inform their own operations and strategic planning. During initial testing, however, the KTPonline.org database, intended as the primary source of KTO contact information, was found to be outdated. In response, assistance from Innovate UK was sought, resulting in access to a more robust and up-to-date database link (Innovate_UK, 2022), which significantly improved the reliability of the contact information.

An initial contact email was sent to the KTOs. This email contained a link to a newly designed web-based survey comprising ten thematic question areas. A small sample of the companies was cross-checked online to confirm the industry classifications and ensure the accuracy of the database filtering process. A total 111 contacts were asked to forward the web link for the web-based survey element allowing access to the 2,786-closed KTPs company partners. A check made with the local KTO suggested that there would be a positive response from the other KTO's. The request to the former KTPs Company Partners was funnelled through their main Knowledge Base or University Knowledge exchange Office and reminders sent using a similar method. With this population and the response experienced by (Regeneris, 2010) the survey was sufficiently robust for quantitative analysis.

To facilitate contact with the selected companies, initial outreach was conducted through the respective local KTOs, who were asked to forward both the web-based survey link and the accompanying request for interview participation. The contact list was compiled by mapping closed KTP projects to their corresponding university KTOs, as detailed in Appendix 3. The search parameters used for this mapping exercise were

derived from the Innovate UK KTPs search portal (Innovate UK, 2015) and are summarised in Table 18. This search process yielded a total of 5,327 KTP partnerships that met the inclusion criteria for this study.

Table 18 Search parameters for completed partnerships.

Completed Partnership Search KTP Online 23 Oct 2015	
Partnership information section to search for specific projects – current or recently completed - by industry type, region, or knowledge base partner.	
Results of your Search: **There are 5327 Partnerships that match the following criteria:**	
Partnership number	All
Search keywords	None
Knowledge/technology area of the Partnership	All
Area of the UK in which the Company Partner is located	All
Company size	All
Company Standard Industrial Classification	All
Knowledge Base Partner	All
Supported by: Technology Strategy Board	

Responses to the first round of emails ranged from positive and cooperative to dismissive or unresponsive. Undelivered emails were followed up by phone calls routed through university switchboards to locate updated contacts. Although the contact information is publicly available, KTOs were included in these communications out of courtesy and transparency. Several KTOs opted to release company contact information directly to the researcher. These details were compiled into a contact database including company names, email addresses, and associated academic supervisors. This enabled more targeted follow-up, particularly as many of the existing entries pointed to general or outdated email addresses. Some respondents also identified companies that had changed ownership or whose KTP contacts had moved on. One KTO requested a separate survey link for their partner companies, which was created using the Bristol Online Survey platform. The data from this link was later merged with the main survey dataset.

A second round of reminder emails was issued to non-respondents, encouraging participation, and reiterating the potential value of their input. To further incentivise responses, a sample KTP Impact Report, based on pilot data, was attached to show the type of feedback participants would receive. However, this measure did not result

in a significant increase in participation. Due to the low overall response rate, a revised distribution approach not using the HEI KTOs was developed and submitted for further ethics approval.

An initial review of the Innovate UK K KTP database, including data accessed through ktp.innovateuk.org (Innovate UK, 2015), provided summary insights into the status of KTP projects conducted between 1982 and October 2014. This dataset, illustrated in Figure 7, served as the foundation for defining the study's target population. The review identified a total of 5,346 completed KTP projects, representing a sufficiently large population to support robust sampling.

Completed and Ongoing KTP's (April 1982 - October 2014)				
Status	Projects	No. of Knowledge Bases	Grant	Projects with data
Current/Active Project	681	108	£60,997,956	681
Finished Project	5346	165	£406,818,225	5304
Finished Early	1232	111	£101,012,949	1231
Finished Very Early	153	65	£12,730,043	153
Total to date	**7412**	**176**	**£581,559,173**	**7369**

Figure 7 Recreated from Completed and Ongoing KTPs (April 1982 – October 2014) (Siora, et al., 2015, p. 9)

The original strategy to contact companies via their associated University KTOs proved insufficient for achieving the desired survey response rate. To address this, a revised plan was submitted and approved by the University Ethics Committee. This alternative approach involved mapping companies listed in the Innovate UK KTP database to current contact details available through the Financial Analysis Made Easy (FAME) database, see Appendix 2.

3.6.6 Main Survey distribution and collection

The approach to target SMEs that had participated in KTP projects completed more than four years prior to the survey in 2018 was followed. This timeframe was selected to allow sufficient time for post-project impacts to manifest while enhancing the relevance of the survey questions. Targeting this specific population also reduced variability and sampling error, thus strengthening the validity of the findings.

The revised strategy to approach businesses directly was implemented. The Ethics Committee requested reassurance from the FAME license holder to confirm that the planned use was within the scope of the university license. Contact was made on the behalf of the investigator and approval sought to be confirmed in writing. This was supported by the application/software license holder, and the permission was submitted to the committee for their consideration and approval was granted for this amendment.

Step 1: Survey Launch and Ethics Approval

Following formal ethics approval, an anonymous web-based survey was launched. Participant consent was explicitly requested on the survey's introductory page. The initial sample was drawn from the Innovate KTP database, comprising 2,786 closed KTP projects (2004–2015). This was refined to include only companies with fewer than 250 employees and removing businesses that had ceased trading yielding a final population of 1,902 eligible participants (Innovate UK, 2015).

Step 2: Survey Responses and Interview willingness

Analysis of responses included identifying companies that completed Question 10, an optional question inviting participants to provide contact details for a personalised KTP Impact Report. This also served as a means of expressing interest in a follow-up semi-structured interview.

Step 3: Result Compilation and Follow-Up

Survey responses were anonymised and compiled, including those from the Pilot Study, and returned to participants. Some respondents from KTP offices and company partners independently reached out to express interest in participating further. The survey included an option for participants to indicate their willingness to be contacted for interviews.

The final response set included:

- Three responses from the pilot study
- One response through the University of Brighton KTO
- Forty additional responses from the full email campaign

In total, forty-four responses were collected. Despite multiple attempts, only one company agreed to participate in a follow-up telephone interview, in addition to the three pilot-phase interviewees. A further SME, an active KTP partner at the University of Hertfordshire, initially declined to be a case study but later agreed to participate in both the survey and a telephone interview in January 2022 bringing the total to forty-five.

3.7 Criteria for analysis - Quantitative

A mixed methods approach was adopted, combining qualitative depth with the breadth of quantitative data. A quantitative approach facilitates the gathering of numerical data that can be systematically evaluated for reliability and validity. Its primary strengths include preserving participant anonymity and allowing for efficient, large-scale data analysis. The quantitative data was collected using a web-based survey. Where applicable a three-point ordinal was applied to categorise, the data obtained from the survey data. This ordinal was defined as 1. Impact; 2. No impact and 3. No entry, the latter to distinguish the participation levels for each category in the survey.

The preliminary analysis of the responses was structured into three distinct areas to enhance clarity. Responses falling within the Likert scale range of 3,4, and 5 (representing 0-5%, 6-10%, and >10%) were consolidated into the first column of each table for each of the six categories of Impact as shown below in Table 19.

Table 19 Survey main categories

Survey Main Categories
Operational Impact (OI)
Competitive position impact (CPI)
Leadership Impact (LI)
Knowledge Impact (KI)
Business Model Impact (BMI)

3.7.1 Criteria for Analysis (Research Objective 1)

Research Objective 1:
To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.

- RQ1: What are the organisational parameters and approaches that deliver long-term impact through knowledge exchange?

RQ1 primarily informs analysis of internal organisational and leadership-related quantitative factors that shape knowledge exchange capability. Leadership characteristics and strategic orientation are consistently identified as foundational, with studies highlighting how visionary, committed, and strategically clear leaders foster environments conducive to innovation, learning, and external collaboration (McMullen & Kier, 2016; Salavou, et al., 2004; Laforet & Tann, 2006). Leadership actions that range from the maintaining the status quo through to transformative demonstrating effective knowledge exchange are captured by the survey measurements based on SME size, turnover, KE engagement, leadership support and absorptive capacity. In the context of SMEs, the theoretical and other exploratory studies in the literature review support this analysis format. Various studies and papers support the survey metric selected (Al-Jabri & Al-Busaidi, 2018; Ates & Bititci, 2011; Calvo-Mora, et al., 2016; Desouza & Awazu, 2006).

- RQ3: What long-term impacts do SMEs achieve through collaboration with universities?

Patterns of engagement in knowledge exchange and varying levels of organisational readiness are analytically salient to both research questions, as they elucidate how internal organisational conditions within SMEs shape collaborative processes and mediate their subsequent impacts. Prior research demonstrates that absorptive capacity, structural alignment, and strategic orientation influence the effectiveness of inter-organisational knowledge transfer and its translation into organisational and business-level outcomes (Szulanski, 1996; Lindgren, 2012), while policy and empirical evidence further emphasise the centrality of organisational preparedness in realising

value from university–industry collaboration (BEIS, 2019; BEIS, 2021; GOV.UK, 2021).

Quantitative analysis will be structured around the following indicators:

- Leadership strategies and behaviours: transformational leadership, support for organisational learning, and strategic commitment to knowledge exchange.
- Operational structures and processes: process maturity, standardisation, and infrastructure supporting collaboration.
- Knowledge exchange mechanisms: frequency, depth, and form of interaction with university partners; transfer, co-creation, and trust-building practices.
- Organisational readiness and context: SME size, resource availability, absorptive capacity, and perceived barriers/enablers.

The analysis focuses on four interrelated dimensions that shape effective knowledge exchange and its organisational impacts. First, leadership strategies and behaviours are examined, including transformational leadership actions, support for organisational learning, and strategic commitment to knowledge exchange, all of which influence organisational culture and receptivity to external knowledge. Second, operational structures and processes are considered in terms of process maturity and standardisation, the presence of organisational routines that support knowledge flows, and the availability of infrastructure, such as systems, tools, and communication platforms, that enable collaboration. Third, knowledge exchange mechanisms are analysed, encompassing the processes used for knowledge transfer, co-creation, and collaborative problem-solving, as well as the frequency and depth of interactions with university partners and the presence of reciprocity and trust-building mechanisms.

Finally, organisational context and readiness are explored through SME size, resource availability, and structural characteristics, alongside levels of absorptive capacity and the identification of barriers and enablers affecting engagement in knowledge exchange. Together, these dimensions provide an integrated framework for understanding how organisational conditions and practices underpin effective and sustainable knowledge exchange.

3.7.2 Criteria for Analysis (Research Objective 2)

Research Objective 2:
To explore the long-term impacts of embedding knowledge within business processes.

Relevant Research Questions:

- RQ2: What is the effect of embedding knowledge on organisational learning and entrepreneurial leadership?
- RQ4: Through what processes do SMEs embed knowledge gained via university-industry collaboration?

Quantitative analysis will be structured around the following indicators:

Knowledge Internalisation Processes: Mechanisms of codification (documents, systems, SOPs). Integration into routines and workflows. Formation of new organisational competencies.

Learning Culture Development: Emergence of reflective learning practices. Continuous improvement behaviours. Capability development and upskilling of staff.

Leadership Evolution: Shifts in strategic thinking and decision-making. Development of entrepreneurial orientation. Increased strategic agility and opportunity recognition.

Process Integration and Operational Change: Alignment of new knowledge with existing processes. Structural adjustments (roles, responsibilities, reporting lines). Technology adoption and digitalisation influences.

Research Objective 2 focuses on exploring the long-term impacts of embedding knowledge within business processes, directly responding to RQ2 and RQ4 supported by previous studies (Alunurm, et al., 2020; Barham, et al., 2020; Terziovski, 2010; Schofield, 2013; Rosli, et al., 2018). The analysis operationalises knowledge embedding through measures of process integration, including the number of new processes formalised within the organisation, the degree to which these processes are documented and standardised, as captured through survey Likert scales, and the adoption of new digital tools or technologies. These indicators capture the extent to

which knowledge transferred during the KTP becomes structurally embedded into organisational routines. Quantitative assessments of workflow efficiency, such as reductions in cycle time or increases in throughput, provide a measurable indication of operational improvement attributable to knowledge integration.

Organisational learning is evaluated through indicators of training intensity, survey scores related to reflective practice and experimentation, and the number of internal knowledge-sharing events conducted. These measures allow the study to assess whether embedding knowledge contributes to the development of a sustained learning culture. Additionally, entrepreneurial leadership development is captured through survey-based assessments of risk orientation, strategic agility, and the number of new strategic initiatives launched following the KTP intervention. These indicators reflect behavioural and cognitive changes among organisational leaders, which represent critical outcomes of university–industry collaboration building on previous surveys (BEIS, 2020; BEIS, 2022).

Finally, internal knowledge retention is assessed through metrics describing staff continuity in innovation critical roles, the volume of codified outputs such as standard operating procedures or frameworks, and the utilisation of internal knowledge repositories. Together, these quantitative measures enable a structured evaluation of both the processes through which knowledge becomes embedded and the long-term organisational impacts of that embedding. Data for this component of the analysis are sourced from KTP final reports Appendix 17, Innovate UK records (Innovate_UK, 2022), survey datasets (Innovate UK, 2015; Office for National Statistics, 2022), and quantified coding of interview transcripts Appendix 8.

3.7.3 Criteria for Analysis (Research Objective 3)

Research Objective 3:
To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

Relevant Research Questions:

- RQ3: What long-term impacts do SMEs achieve through collaboration with universities?

The theoretical foundations demonstrating types of impacts identifies the impact on productivity (OECD, 2024; Office for National Statistics, 2022; Van Reenen & Xuyi, 2024), and further studies provide guidance on the impact if there is a change made to the business model such that value is captured (Johnson, et al., 2008; Zott, et al., 2011; Teece, 2017).

- RQ5: Why and how does embedded knowledge lead to sustainable change and value capture within business models?

Quantitative analysis will be structured around the following indicators:

Innovation Outcomes: New products, services, or processes. Degree of novelty vs. incremental improvement. Speed and efficiency of implementation.

Organisational Performance and Productivity: Measurable efficiency gains. Cost reductions or resource optimisation. Quality improvements.

Value Capture Mechanisms: Competitive advantage gained from embedded knowledge. Commercialisation of innovation. Market expansion or diversification.

Sustainability and Long-Term Impact: Endurance of new routines or systems over time. Improved resilience to external shocks. Continuous capacity for innovation and learning.

Addressing Research Objective 3, which seeks to identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs, requires quantitative evaluation of innovation outputs, performance improvements, and long-term organisational resilience. This objective aligns with RQ3 and RQ5 and focuses on identifying measurable outcomes achieved through collaboration with universities (Rybnicek & Konigsgruber, 2019; Etzkowitz & Chunyan, 2017). Innovation outputs are captured through data on the number of new products or services launched, the level of novelty assigned to each innovation, as assessed

through survey scales, and formal intellectual property activity such as patents, trademarks, or registered designs. These indicators provide a quantitative basis for assessing the direct innovation consequences of knowledge exchange.

Business performance metrics further strengthen the analysis by providing evidence of measurable change. These include revenue growth percentages over a three to five-year period following the KTP, productivity improvements measured as output per employee, and any documented expansion into new markets or export growth (Office for National Statistics, 2021; Office for National Statistics, 2022). These variables enable a longitudinal assessment of value capture beyond the life of the knowledge exchange intervention. In addition, the study quantifies value capture through profitability changes, cost savings identified in KTP reports, and calculated return on investment (ROI) from the collaboration. Such financial indicators demonstrate whether knowledge exchange generates tangible economic benefits for SMEs.

The final category of quantitative criteria focuses on sustainability and long-term impact, incorporating measures such as continuation of innovation activity beyond the project period, the number of follow-on projects initiated with the same university partner, survey-based resilience indicators, and staff continuity within key innovation roles. These metrics provide insight into whether knowledge exchange becomes an enduring organisational capability rather than a one-off event. The analysis draws on Innovate UK performance dashboards, ONS economic data, KTP final reports, survey responses, and quantified interview data to deliver a comprehensive and evidence-based evaluation of sustainable value creation.

3.7.4 Summary of quantitative criteria for analysis

This study adopts a positivist, deductive quantitative approach to examine relationships between organisational conditions, knowledge exchange practices, and long-term business impacts. Primary quantitative data were collected via a web-based survey using validated and widely adopted instruments drawn from prior innovation and KTP related studies. Likert-scale and categorical measures enable numerical representation of perceptions and outcomes, supporting descriptive and inferential

statistical analysis, including correlation, regression, and comparative analyses across firm characteristics, industry sectors, and time since KTP completion.

Collectively, these quantitative criteria provide a coherent and replicable framework for assessing how knowledge exchange influences organisational capability, performance, and sustainable value creation within SMEs, and enable triangulation with qualitative findings to strengthen validity and explanatory depth.

The impact domains for the survey measurements are categorised below to allow structured quantitative analysis around these five overarching impacts:

- Operational Impact (OI)
- Competitive Position Impact (CPI)
- Leadership Impact (LI)
- Knowledge Impact (KI)
- Business Model Impact (BMI)

Responses on ordinal Likert scales (1–5) are consolidated into meaningful groupings to distinguish positive impact, no impact, and non-response, facilitating robust comparison and pattern identification.

Quantitative analysis will be structured around the following indicators:

- Leadership strategies and behaviours: transformational leadership, support for organisational learning, and strategic commitment to knowledge exchange.
- Operational structures and processes: process maturity, standardisation, and infrastructure supporting collaboration.
- Knowledge exchange mechanisms: frequency, depth, and form of interaction with university partners; transfer, co-creation, and trust-building practices.
- Organisational readiness and context: SME size, resource availability, absorptive capacity, and perceived barriers/enablers.
- Knowledge Internalisation Processes: Mechanisms of codification (documents, systems, SOPs). Integration into routines and workflows. Formation of new organisational competencies.

- Learning Culture Development: Emergence of reflective learning practices. Continuous improvement behaviours. Capability development and upskilling of staff.
- Leadership Evolution: Shifts in strategic thinking and decision-making. Development of entrepreneurial orientation. Increased strategic agility and opportunity recognition.
- Process Integration and Operational Change: Alignment of new knowledge with existing processes. Structural adjustments (roles, responsibilities, reporting lines). Technology adoption and digitalisation influences.
- Innovation Outcomes: New products, services, or processes. Degree of novelty vs. incremental improvement. Speed and efficiency of implementation.
- Organisational Performance and Productivity: Measurable efficiency gains. Cost reductions or resource optimisation. Quality improvements.
- Value Capture Mechanisms: Competitive advantage gained from embedded knowledge. Commercialisation of innovation. Market expansion or diversification.
- Sustainability and Long-Term Impact: Endurance of new routines or systems over time. Improved resilience to external shocks. Continuous capacity for innovation and learning.

Collectively, these quantitative criteria provide a coherent and replicable framework for assessing how knowledge exchange influences organisational capability, performance, and sustainable value creation within SMEs, and enable triangulation with qualitative findings to strengthen validity and explanatory depth.

3.8 Data Analysis approach - Quantitative

The process of designing the main survey and its integration into the research design occurred concurrently, with ongoing analysis informing improvements to the survey. Survey responses are to be exported from the Jisc Online Surveys (formerly BOS) platform into Excel and statistical software for analysis. Data cleaning includes checks for duplicate entries, missing values, outliers, and inconsistent responses. Ordinal Likert-scale items (1–5) are retained in their original form for statistical testing but are also consolidated into analytically meaningful groupings to facilitate interpretation:

- Positive impact (scores 3–5)
- No or low impact (scores 1–2)
- No response / missing

Categorical variables (e.g., industry sector, firm size, time since KTP completion) are coded numerically to support cross-tabulation and comparative analysis. Reliability of multi-item constructs (e.g., leadership impact, knowledge embedding, business model impact) is assessed using Cronbach's alpha, with $\alpha \geq 0.70$ considered acceptable for internal consistency. Where necessary, composite indices are created by averaging constituent items within each impact domain.

The first three questions identified categories and included the industry sector based on the UK SIC 2007 IDBR ONS (ONS, 2015), number of employees and the year completed. The scaled responses areas for measuring Growth Impact (GI) and the Business Model Impact (BMI) as shown in Table 20 below had a Likert scale defined as 1 for declined in growth and 5 representing >10% growth. The Growth Impact (GI) was a single category, and the BMI measured covered six categories' Sales, Market share, Efficiency gains, Turnover, Cost savings, Margins.

Table 20 Likert Scale categories GI and BMI

Measure	Likert scale
Decline	1
Same	2
0-5%	3
6-10%	4
>10%	5

The other categories identified for survey from SMEs included Competitive Position Impact (CPI), the Knowledge Impact (KI), Leadership Impact (LI) and the Operational Impact (OI) and shown in the Table 21 below these had a scale defined as 1 for no impact to 5 denoting a significant impact.

Table 21 Likert Scale categories CPI, KI, LI, and OI

Measure	Likert scale
None	1
A little	2
Some extent	3
Quite a lot	4
Significant	5

Similarly, when evaluating the Business Model Impact, six response categories were incorporated. The subsequent set of questions aimed to categorise the impact across operational, competitive, knowledge exchange and leadership aspects. Respondents expressed their assessment using a Likert Scale ranging from “None” to “Significant”, again corresponding to values for 0 to 5. To comprehensively measure the impact on the operational and competitive positions, a grid function was employed, offering eight areas for responses. For assessing knowledge and leadership impacts, four and five response areas were provided, facilitating a nuanced understanding of these dimensions.

The discrete variables or categories will be applied to both qualitative and quantitative data analysis. The mapping below illustrates the linking of the applicable Conceptual Framework categories to the survey sections linking the empirical contribution in Table 22 below.

Table 22 Alignment of conceptual framework and survey sections

Conceptual Framework Categories	**Description / Focus**	**Main Survey Section(s)**
Sector and Size Demographics	Organisational context and scale	1. Industry sector; 2. No. of employees
Leadership Characteristics	Leadership practices supporting KE and innovation	9. Leadership Impact
Knowledge Exchange Activities & KTPs (UIC)	Nature and scope of collaboration and KE mechanisms	3. KTP (Year finished); 7. Knowledge Impact
Knowledge Exchange (KE) Barriers	Constraints to effective KE	7. Knowledge Impact; 8. Operational Impact
Knowledge Embedding & Organisational Learning	Absorptive capacity and internalisation of knowledge	7. Knowledge Impact; 8. Operational Impact
Evidence of Absorptive Capacity	Ability to recognise, assimilate, and apply knowledge	7. Knowledge Impact; 8. Operational Impact

Entrepreneurial Leadership and Innovation	Strategic and innovation-oriented leadership behaviours	9. Leadership Impact; 8. Operational Impact
Barriers, Context, and SME Characteristics	Organisational enablers and constraints	1. Industry sector; 2. No. of employees; 8. Operational Impact
Long-Term Sustainability Outcomes	Business performance and value capture	4. Level of growth; 5. Competitive Position Impact; 6. Business Model Impact

Criteria for interpretation linking to Research Objective 1:
Evidence of statistically significant and practically meaningful relationships between leadership, operations, and knowledge impacts supports the proposition that organisational strategies underpin effective knowledge exchange.

Criteria for interpretation linking to Research Objective 2:
Consistent positive relationships between knowledge embedding and operational/leadership outcomes indicate that embedding knowledge contributes to sustained organisational learning and leadership evolution.

Criteria for interpretation linking to Research Objective 3:
Statistically significant associations between knowledge impact and business model/competitive outcomes provide quantitative evidence that knowledge exchange contributes to sustainable value creation.

In social and research, the Pearson correlation coefficient (r) is used to measure the strength and direction of the relationship between two variables that are related linearly (Ratner, 2009). The correlation coefficient ranges from -1 to +1 where +1 indicates a perfect positive correlation whereas one variable increases, the other increases proportionally and a value of zero indicates no linear correlation summarised in Table 23 below. Correlations of 0.5 or higher suggest a meaningful relationship between the paired factors. This means that changes in one factor are reasonable associated with changes in the other. For businesses, such correlations can highlight key areas where efforts can be focused. There is no prediction associated with this measurement hence cannot imply causation and further research would be required to determine causation relationships, if any.

Table 23 Ranges of correlation coefficients

Weak correlation	0 to ± 0.3
Moderate correlation	0.3 to ± 0.5
Strong correlation	0.5 to ± 0.7
Very strong correlation	0.7 to ± 1.0

Overall, the quantitative analysis employs a structured, objective, and replicable approach to examine how organisational conditions and knowledge exchange practices relate to long-term SME outcomes. Through descriptive, relational, and predictive analyses aligned with Research Objectives 1, 2 and 3, the study provides empirical evidence of:

- The organisational foundations of effective knowledge exchange
- The role of knowledge embedding in shaping learning and leadership
- The contribution of knowledge exchange to sustainable business change and value capture

This approach supports robust theory testing and complements qualitative insights, strengthening the explanatory power and credibility of the research.

3.9 Summary

This chapter examined the suitability of various research methods in relation to the study's aims and justified the methodological approach adopted for this thesis. A critical discussion of the primary philosophical paradigms that inform methodological choices was presented, with key elements summarised in tabular form for clarity.

The research adopts a mixed-methods approach, integrating both qualitative and quantitative methodologies. Data sources include primary and secondary materials, with the core methods comprising case studies and a complementary survey. The survey was employed to quantify the relative impact and significance of variables within key thematic categories for impact on the businesses, thereby enhancing and informing the interpretation of qualitative findings. Figure 8 below is the summary of the overall research approach.

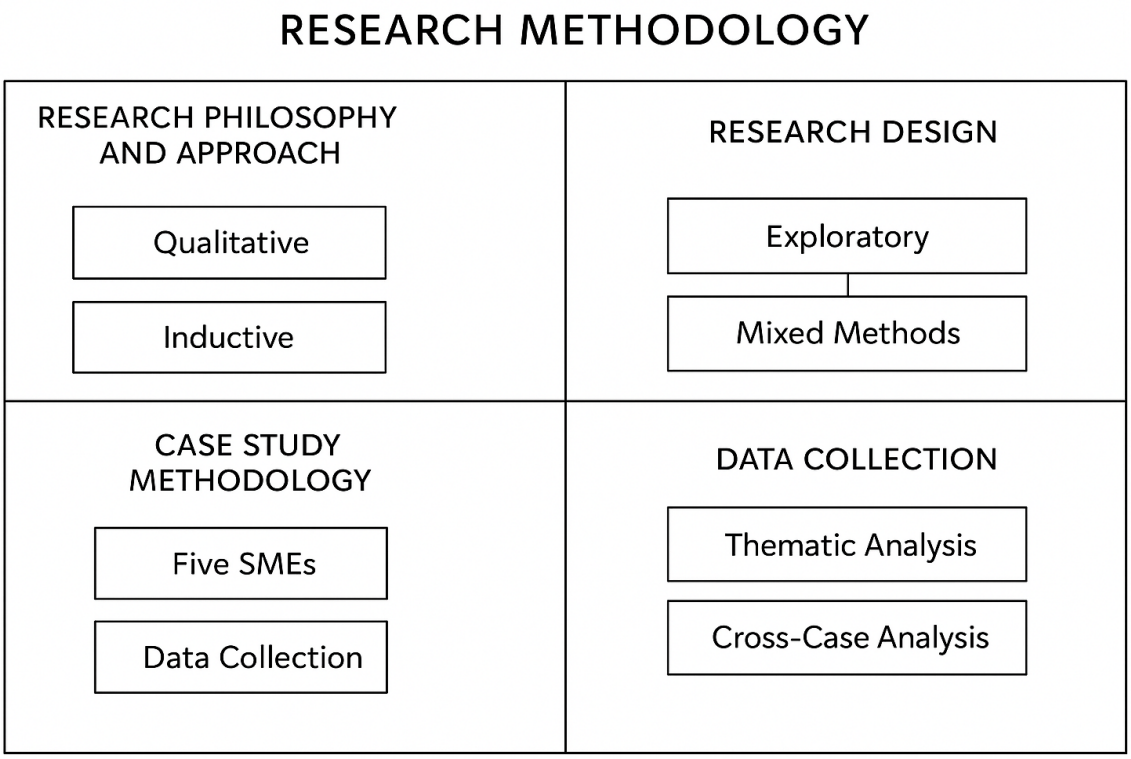

Figure 8 Summary of research approach

Several methodological limitations should be acknowledged. First, access constraints within certain SMEs restricted the extent of observational data that could be collected, thereby limiting opportunities for prolonged or repeated on-site engagement. Second, the study relies in part on self-reported interview data, which may be subject to recall bias or socially desirable responses. Third, isolating and attributing long-term organisational change exclusively to knowledge exchange remains inherently challenging, given the presence of multiple, interacting internal and external influences. Finally, while the number of case studies is relatively small, this is mitigated by the depth of analysis and the use of data triangulation across interviews, documents, and survey findings. Collectively, despite these constraints, the methodological approach provides a robust and appropriate foundation for examining the impact of knowledge exchange within SMEs.

The methodological framework established in this chapter provides a robust foundation for addressing the research questions. Different stages of the research were presented, and emphasis was placed on the methods used and the selection of the triangulation approach as a means of increasing the reliability of the survey's results. The survey's reliability and validity were also addressed together with the

design and the methods used in collecting the appropriate amount of data (primary and secondary). The statistical analysis methods used were also presented, leading to the analysis of the results derived that will be presented in the next chapter.

Chapter 4 Results Analysis

This chapter presents a comprehensive analysis of the empirical data introduced in the preceding chapter. It offers a structured examination of both qualitative and quantitative evidence obtained through semi-structured interviews, case studies, surveys, and a review of secondary documentation. The analysis is framed by the central research aim:

To what extent does the impact of knowledge exchange deliver sustainable change to businesses?

This chapter presents findings based on a comprehensive data collection strategy incorporating surveys, case studies, and qualitative interviews. The structure of the chapter is divided into two sections: the first provides an analysis of the qualitative data, and the second focuses on the quantitative findings, including the main survey results.

The following seven sections provides a thorough analysis of both qualitative and quantitative findings, based on the data collected through the research methodology employed in this study. The final section allows for a rigorous presentation of the emergent themes.

4.1 Analytical Approach

Qualitative research necessitates a systematic and transparent approach to data collection, coding, and interpretation. Foundational work by (Glaser, 1967; Corbin & Strauss, 2015) underscore the importance of deriving theory through methodologically rigorous coding strategies. In line with these principles, this study adopts a thematic analysis framework, drawing on both primary and secondary sources. These include semi-structured interview transcripts, KTP project documentation, and KTP Impact Reports.

Primary data was collected through semi-structured interviews with SME senior managers, and KTP partners. The interview design was informed by prior research focused on KTP implementation and outcomes (Ternouth, et al., 2012; Siora, et al.,

2015), which emphasised the value of capturing the perspectives of all core participants in the knowledge exchange process.

Secondary data was incorporated to strengthen the depth and reliability of the analysis through triangulation. There is established precedent for the integration of longitudinal and retrospective datasets to assess impact, particularly where changes can be observed over time or following significant policy shifts. For example, (Audretsch & Belitski, 2021) utilised SME data spanning 2010–2020 to examine knowledge complexity and business performance. Similarly, (Rentocchini & Rizzo, 2023) employed UK Research and Innovation (UKRI) data from 2006–2013 to explore the impact of changes to higher education funding on the development of entrepreneurial universities.

4.2 Qualitative Results

The qualitative analysis is grounded in in-depth interviews with KTP participants all senior managers, KTP project documentation and reports supported by secondary evidence such as UKRI datasets and longitudinal case materials from 2012 to 2022. Use of the Conceptual Framework allows the linking of the data analysis to allow comparisons to be made, insights to be revealed and emergent themes identified. This combination of sources allows for the triangulation of data, enhancing the reliability and robustness of findings and enabling a more comprehensive assessment of the long-term impact of knowledge exchange activities. To facilitate a rigorous interpretation of the qualitative data a case study analysis was carried out using pattern matching, explanation building, and cross-case techniques.

The study uses a structured cross-case analysis of five KTP case studies, supported by a heatmap matrix to compare the relative intensity of key organisational and knowledge exchange dimensions. Owing to the absence of an established evaluative framework for KTP dynamics, a bespoke three-point scale (Low, Medium, High) was developed to capture observable variation in areas such as leadership support, knowledge exchange barriers, absorptive capacity, knowledge embedding, innovation outcomes, and sustainability.

4.2.1 Sector and size

The sector and size category is summarised in Table 24, with key observations summarised and mapped to RQ1 for impact in the final column. This analysis partly addresses Research Objective 1 by examining patterns across all the organisations in line with Research Question 1, drawing on KTP applications, interim and final reports, and semi-structured interview data. By comparing these sources, the study identifies how organisational parameters related to sector and size influence operational characteristics and strategies that underpin effective knowledge exchange, highlighting consistent trends and contextual factors that contribute to long-term impact.

Table 24 Sector and size category

Case	Sector	Size	Observations	RQ1 Impact
CSA	Charity	Medium	Medium-sized charity sector; growth driven by service expansion and strategic collaborations.	H
CSB	Manufacturing	Micro	Micro-manufacturer: stable sales with incremental innovation focused on design.	M
CSC	Manufacturing	Medium	Medium manufacturing firm: operational improvements and certifications enhanced competitive position.	H
CSD	Health sector supplier	Micro → Medium	Micro-sized but high growth; multiple KTPs enabled technological expansion and global reach.	H
CSE	Manufacturing	Micro → Medium	Micro expanding to medium; focused on disciplined innovation, R&D, and global market positioning.	H

Legend for impact:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

The analysis indicates that both micro and medium-sized firms derived substantial value from KTPs; however, important variations emerge in the ways organisational size and sectoral context shape engagement with, and outcomes from, university–industry collaboration. Micro enterprises (CSB, CSD, and CSE) demonstrate a greater dependence on structured support mechanisms and external expertise to facilitate accelerated growth, whereas medium-sized organisations exhibit comparatively more established internal capabilities to absorb and operationalise external knowledge. Sectoral context further conditions the nature of knowledge exchange, with the charity organisation (CSA) primarily engaging in operational and strategic knowledge development, while firms operating within manufacturing and health related supply chains concentrate on product, process, and technological innovation.

In relation to Research Question 1, the case studies therefore demonstrate varying but generally strong contributions to understanding foundational organisational parameters and approaches shaping engagement with collaboration. CSA, CSC, CSD, and CSE exhibit high relevance, reflecting clear evidence of strategic leadership orientation, organisational structuring, and proactive engagement with knowledge exchange activities that have underpinned growth, operational improvement, and innovation-led development. CSD and CSE illustrate how micro firms transitioning towards medium-sized enterprises leverage multiple KTPs, disciplined R&D practices, and external partnerships to reconfigure organisational processes and extend market reach, while CSC highlights the role of operational maturity and formal certifications in strengthening competitive positioning. By contrast, CSB demonstrates a more moderate contribution, characterised by stable operations and incremental, design-focused innovation, with comparatively limited formalisation of organisational structures and strategic knowledge exchange. Collectively, these cases reinforce the importance of leadership orientation, organisational readiness, and structural capacity as critical antecedents for effective engagement in knowledge exchange, directly addressing RQ1.

4.2.2 Leadership strategies

Comparison of the emerging leadership strategies and traits; impact on KE success; and the role of entrepreneurial leadership is summarised in Table 25 from the evidence, with key observations and impact related to RQ1 summarised in the final column partly addressing Research Objective 1. The impact of RQ3 on research objective 1 for these criteria was low (L)

Table 25 Comparison of Leadership characteristics

Case	Leadership Traits	Observations	RQ1 Impact
CSA	Strategic, clear objectives	Enabled knowledge absorption, operational improvements, and long-term financial growth.	H
CSB	Stable, slow innovation	Limited organisational learning beyond product development; relied on hires from KTP.	M
CSC	Risk-averse, reluctant ownership	Process improvements adopted but culture limited broader innovation uptake.	M
CSD	Supportive, entrepreneurial	High engagement with multiple KTPs; embedded innovation culture.	H
CSE	Supportive, ambitious, entrepreneurial	Facilitated disciplined innovation, R&D adoption, and global expansion.	H

Legend for impact:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

The analysis of leadership traits partly addresses RQ1 by demonstrating how a key organisational parameter, leadership orientation, influences the capacity of firms to engage with KE and KTPs. Cases coded as High (H) demonstrate leadership that plays a central and proactive role in shaping strategic engagement with knowledge exchange activities and structuring organisational processes to support collaboration, as evidenced in CSA, CSD, and CSE. In contrast, cases coded as Medium (M) reflect leadership that enables engagement with knowledge exchange in a more partial or constrained manner, as observed in CSB and CSC, where strategic intent and organisational structuring are less fully developed. No case is coded as Low (L), as all

organisations provide at least some empirical insight into leadership as a foundational organisational parameter influencing knowledge transfer.

These findings indicate that organisational leadership is pivotal in determining both the depth and sustainability of knowledge transfer outcomes.

Case Study D: "The KTP structure was a good focus for the company and alongside strong leadership and good partners this all contributed to the continued success and ultimately the right people are paramount to success."

Supportive and visionary leadership approaches, exemplified by CSD and CSE, were associated with more effective knowledge embedding and the continuation of innovation activities beyond the formal project timeline. By contrast, leadership characterised by risk aversion or a focus on operational stability, as seen in CSB and CSC, tended to constrain knowledge absorption to the immediate project scope, limiting longer-term organisational learning. In CSA, strong strategic clarity enabled the organisation to leverage transferred knowledge to strengthen internal capabilities and operational effectiveness, even though the emphasis was less on product innovation. Collectively, these cases underscore the critical influence of leadership orientation on the capacity of organisations to engage meaningfully with knowledge exchange and to translate external inputs into sustained organisational development.

4.2.3 Organisational characteristics

In review of the data patterns of innovation adoption were sought and evidence used of capability development with associated links from and to the leadership engagement. Key prompts from the evidence are the clear distinctions between high and low absorptive capability; identification of enabling conditions such as leadership, culture and resources are noted for each Case Study below, Table 26. Fully addressing Research Question 2 and Research Question 4.

Table 26 Evidence matching of Absorptive Capacity

Case	Evidence	Notes	RQ2 Impact	RQ4 Impact
CSA	Cultural shift to continuous improvement; operational efficiency	Broad organisational capability development: knowledge retained post-KTP.	H	H
CSB	Product-focused innovation, limited knowledge base impact	High product impact but minimal process or organisational learning.	M	L
CSC	SPC adoption, R&D emphasis	Process reliability increased; innovation adoption limited by culture.	M	M
CSD	Expansion and integration of R&D and KE processes	High absorptive capacity: multiple knowledge domains engaged.	H	H
CSE	Tools for project planning, disciplined innovation	High internalization of knowledge; structured decision-making and process improvements.	H	H

Legend for impact:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

The cross-case analysis reveals clear variation in the extent to which KTPs contribute to organisational learning and the embedding of knowledge. Cases coded as High (H), CSA, CSD, and CSE, exhibit strong evidence of sustained learning cultures and deeply embedded knowledge, characterised by the internalisation of new routines, the expansion of R&D and knowledge exchange processes, and the routinisation of structured decision-making.

Case Study A: "Consortium membership led to a very large collaboration project and more partnership opportunities are being explored externally."

Medium (M) cases reflect more partial or selective patterns of learning and embedding, as observed in CSC and, with respect to organisational learning, CSB, where improvements are largely confined to specific processes or technical domains rather than extending across the organisation. In contrast, CSB is coded Low (L) for

knowledge embedding (RQ4), as there is limited evidence that transferred knowledge becomes institutionalised beyond immediate technical or product-related outputs. Collectively, these findings address Research Question 2 by demonstrating how KTPs shape organisational learning cultures, leadership-supported learning, and entrepreneurial behaviours across different organisational contexts. They address Research Question 4 by evidencing systematic variation in the ways knowledge is embedded within organisational routines, systems, and decision-making processes, thereby clarifying the mechanisms through which external knowledge is transformed into enduring organisational capability.

The findings suggest that absorptive capacity is most pronounced in organisations characterised by supportive leadership, structured innovation processes, and repeated engagement in KTPs, as exemplified in CSD and CSE. In contrast, single, narrowly focused KTPs, such as those observed in CSB, tend to generate only localized or short-term gains. Multi-stage or R&D intensive KTPs, however, provide a framework for sustained learning, enabling organisations to consolidate knowledge and translate it into long term capability development.

The evidence was reviewed to identify patterns of innovation adoption, differences in capability development and links to leadership engagement summarised in Table 27 below:

Table 27 Innovation and organisational outcomes observations

Case	Innovation / Outcomes	Observations	RQ2 Impact	RQ4 Impact
CSA	Service expansion, collaborative projects, improved funding applications	Operational and strategic outcomes dominate over product innovation.	H	H
CSB	Product development via CAD; moderate revenue growth	Incremental innovation; growth largely through external knowledge acquisition.	M	L
CSC	Quality certifications (AS9000, ISO14001), process improvements	Process and compliance innovation; moderate financial gains.	M	M

CSD	Technical capability expansion, product diversification, global presence	Multi-faceted innovation; strong organisational and market impact.	H	H
CSE	Product, process, and material innovation; disciplined innovation	High internal capability and market competitiveness; robust revenue growth.	H	H

Legend for impact:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

The cross-case analysis reveals marked variation in the extent to which innovation outcomes are underpinned by organisational learning and embedded knowledge. Cases coded as High (H), CSA, CSD, and CSE, demonstrate that innovation and performance outcomes are grounded in strong learning cultures, leadership-supported experimentation, and the routinisation of new practices, indicating that knowledge generated through collaboration has been internalised and sustained within the organisation.

Case Study D: "New product development department and project management team established."

Case Study D: "R & D continued with further research at other locations…Cardiff University…Yorkshire …China."

Case Study E: "The KTPs activity in the project added discipline to the innovation."

Medium (M) cases exhibit evidence of learning and knowledge embedding; however, these processes remain selective or constrained, as observed in CSC and, with respect to organisational learning, CSB, where improvements are largely confined to specific operational or technical domains. By contrast, CSB is coded Low (L) for knowledge embedding (RQ4), reflecting limited evidence that outcomes are supported by institutionalised knowledge extending beyond immediate technical application. Collectively, these patterns highlight the importance of learning-oriented leadership

and embedded routines in transforming collaborative knowledge into durable organisational capability and performance gains.

4.2.4 Knowledge Exchange

Identification of the common KE mechanisms and the barriers was carried out to identify for quantitative analysis based on joint problem solving, engagement patterns and indicators of success and inefficiencies. The relationship of how the barriers correlated with KE outcomes are listed in the observations, Table 28 below.

Table 28 Knowledge Exchange Observations

Case	KE Barriers	Observations	RQ2 impact	RQ4 impact
CSA	Competitive funding in charity sector	Knowledge adoption focused on operational and strategic resilience.	H	H
CSB	Need for faster innovation	External knowledge increasingly used; constrained by slow market adoption.	M	L
CSC	Lack of embedded knowledge, limited expertise	KTP addressed skill gaps and process control, but culture limited broad adoption.	M	M
CSD	Minimal; strategic growth wait times	KTPs were well-integrated, enabling progressive scaling.	H	H
CSE	None	Highly receptive environment allowed maximal benefits from KTP.	H	H

Legend for impact:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

The cross-case analysis of KE barriers and associated organisational responses provides further insight into how KTPs shape organisational learning and the embedding of knowledge. Cases coded as High (H), CSA, CSD, and CSE, demonstrate that, despite contextual constraints such as competitive funding environments or strategic growth pacing, organisations with receptive cultures and supportive leadership can translate KTP engagement into strong learning outcomes and deeply embedded knowledge. In these cases, external knowledge is internalised

across multiple functional domains and integrated into organisational routines, systems, and decision-making processes.

Case Study D: "Products underwent a portfolio review, and two premier ranges were identified as top sellers and a declared unique USP. All KTP partners benefited employees received more training, UH publications and the KTP Associates PhD research utilised the project. A further four KTP projects were successfully applied for."

Medium (M) cases, including CSC and, with respect to organisational learning, CSB, reveal more selective patterns of learning and embedding, where KTPs address specific skill gaps and process control issues but cultural and market constraints limit broader organisational diffusion.

Case Study C: "The knowledge bank improved by employing apprentices and external partnerships with specialist knowledge and expertise."

By contrast, CSB is coded Low (L) for knowledge embedding (RQ4), reflecting limited evidence that externally sourced knowledge becomes institutionalised beyond immediate technical application. Collectively, these findings fully address Research Question 2 by demonstrating how organisational learning and leadership-supported receptivity condition the extent to which firms derive developmental benefits from KTPs, and Research Question 4 by evidencing systematic variation in the processes through which external knowledge becomes embedded within organisational routines and practices.

Mapping the knowledge exchange activities against the lens of the KTP type allowed the following observations to be collated in Table 29.

Table 29 KTP Type and Knowledge-Exchange Activities observations

Case	KTP Type / UIC Form	Key KE Activities	Observations
CSA	Enhance IT capacity (KTP funded)	Associate knowledge transfer, staff absorption, operational systems, marketing	Knowledge transfer targeted organisational capabilities rather than products.
CSB	Short KTP	CAD software implementation, staff training	Highly focused, project-specific, limited spillover to other areas.
CSC	KTP Associate	Employee creativity, project management, R&D	Emphasized process and quality improvement; moderate innovation across operations.
CSD	Multi-stage KTPs	Product development, R&D, market expansion	Successive KTPs enabled incremental, integrated growth and global market reach.
CSE	KTP Associates, Process and R&D	Product development, process refinement, materials research	Structured innovation practices and disciplined internal knowledge embedding.

The findings reveal that single-project KTPs (CSB, CSC) primarily generated focused, project-specific innovation, while multi-project or extended KTP engagements (CSD, CSE) supported cumulative, longer-term learning that contributed to broader organisational transformation. Cross-sectoral variation was also evident. Within the charity sector (CSA), KTPs were leveraged to strengthen internal capabilities and improve operational efficiency, whereas firms in the manufacturing and health sectors employed KTPs predominantly to advance technical innovation and pursue market expansion.

4.2.5 Knowledge Embedding

Analysis of the Knowledge Embedding and the Organisational learning activities was supported by the premise of establishing the extent knowledge became institutionalised, taking variations in learning culture into account and the mechanisms that facilitated embedding. There was work done to establish in the analysis clear distinctions between high and low absorptive capability and identification of enablers such as leadership, culture and resources where possible as summarised in Table 30.

Table 30 Summary of Knowledge Embedding observations

Case	Knowledge Embedding	Observations	RQ2 impact	RQ4 impact
CSA	High operational and strategic impact	Multi-dimensional embedding across marketing, IT, staff skills.	H	H
CSB	Limited beyond product innovation	Mainly through hires and CAD usage.	M	L
CSC	Structured project management, quality focus	Adoption of new processes but culture limited spread.	M	M
CSD	Widespread integration into systems and practices	Knowledge embedded across R&D, marketing, and operations.	H	H
CSE	Disciplined innovation practices, project planning	Continuous knowledge retention, evidenced by sustained process improvements.	H	H

Legend for impact:
H (High): Strong relevance / primary mapping
M (Medium): Moderate relevance / secondary mapping
L (Low): Limited relevance / minor mapping

The cross-case analysis identifies clear differentiation in the extent to which organisational learning and knowledge embedding are realised across the cases. Organisations coded as High (H), CSA, CSD, and CSE, exhibit strong learning cultures and deeply embedded routines that support sustained capability development, evidenced by the internalisation of new practices, the routinisation of decision-making processes, and the integration of knowledge across multiple functional areas.

Case Study E: "A benefit realised by participating in the various funded KTPs and collaboration funded projects and investigations initially meant that new products were robustly verified to a greater degree before launch to customers. Knowledge and skills were improved, and new ideas were developed using a more rigorous academic approach to verify and repeat data."

Medium (M) cases reflect more partial or selective patterns of learning and embedding, as observed in CSC and, with respect to organisational learning, CSB, where improvements tend to be confined to specific technical or operational domains rather than diffusing across the organisation. By contrast, CSB is coded Low (L) for knowledge embedding (RQ4), indicating limited institutionalisation of knowledge beyond technical artefacts and immediate project outputs. Collectively, these patterns underscore the importance of learning-oriented cultures and embedded routines in transforming externally sourced knowledge into enduring organisational capabilities. Effective knowledge embedding necessitates not only strong leadership support but also the implementation of systematic organisational processes. While the presence of absorptive capacity is important, it alone is insufficient to ensure that knowledge is retained and leveraged; deliberate mechanisms for embedding knowledge are essential to translate acquired insights into sustained organisational capability.

4.2.6 Sustainable business change and value capture

This section of the analysis sought key evidence of sustained impact, establishing differences between short-term change e.g. First KTP final reports versus genuine transformation. The other key area used to analyse and establish outcomes was identification of value capture pathways, Table 31.

Table 31 Sustainability Outcomes and observations

Case	Outcomes	Observations
CSA	Financial growth (£1.8M → £2.236M), sustained knowledge impact	Demonstrates long-term benefits in operational capabilities.
CSB	Turnover increase (£632k → £855k), revenue growth 30–40%	Financial growth achieved; reliance on external knowledge sources.
CSC	Turnover growth (£11.565M → £14M), stable profits	Sustained commercial performance despite market challenges.
CSD	Global expansion, 40-country presence, competitive portfolio	Long-term innovation adoption and strategic market positioning.
CSE	Global R&D, gross profits £6.7M → £15M, improved supply chain	Sustained technological leadership and market growth.

The findings indicate that long-term sustainability outcomes are strongly associated with repeated or multi-stage KTPs, as observed in CSD and CSE cases.

Case Study D: "with first KTP had 15-20 people by 2018 this had grown to 150 people".

Case Study E: "A micro company that grew to a small then a medium sized enterprise with a succession of funded projects including KTPs from 2011".

These extended engagements enable the development of embedded knowledge practices that continue to shape organisational processes beyond the formal project period. Moreover, sustained strategic leadership involvement emerges as a critical mechanism through which these practices are legitimised and integrated into wider organisational decision-making structures. Financial performance improvements are also more substantial when innovation activities and knowledge-embedding efforts are pursued holistically, as demonstrated in CSD and CSE, rather than being narrowly targeted or operationally isolated, as in the CSB case.

The long-term impacts revealed in this data highlights the influence of sustainable business practices for long term success. In terms of use of KTPs the case studies and interviews gave a wide range of circumstances of the levels of quantifiable success where CSD and CSE are highly successful. This is demonstrated by their growth in numbers of employees. Company A, a charity could not demonstrate high scores on the BMI and growth in the traditional terminology as their main objective is related to the number of customers, they can reach. However, they did have success in increasing their grant-based income. The business CSD started their journey with a KTP project in 2012 and continued this work with three further KTPs projects. Both businesses CSD and CEE grew from a micro sized company to medium sized companies. The micro sized business CSB grew by 40% in employees hence progressing from micro to small from 9 to 12 employees between 2010 and 2016. Post KTP the businesses behind CSA and CSC did not increase staff levels significantly but added new skill areas and expanded internal knowledge.

Responses highlighted that income did grow, more staff were employed, and businesses growth achieved from micro to small then medium sized business see Table 32 below, based on the company journey from initial KTP analysis to the interview.

Table 32 Case study Growth values if available rated at interview.

Value Capture				
	Start KTP	**End KTP**	**Interview**	**Growth**
Company A	£958,000	£1,845,000	£2,236,000	>10%
Company B	£632,000	£855,000		6 to 10%
Company C	£9,874,000	£11,656,000	£14,000,000	0 to 5%
Company D	not avail	not avail	not avail	>10%
Company E	£5,300,000	£6,700,000	£15,000,000	>10%

4.3 Cross-Case Analysis

This study employed a structured cross-case analytical within the protocol to compare five KTP case studies (CSA to CSE). A heatmap matrix is utilised as a decision-support tool to systematically evaluate and visualise the relative intensity of key organisational and knowledge exchange dimensions across the cases.

As no established measurement scale or evaluative framework exists in the literature for assessing the relative intensity and impact of KTP dynamics across multiple organisational contexts, it was necessary to develop a bespoke analytical scale to support the cross-case analysis. The scale used in the heatmap, Low (L), Medium (M), and High (H), was designed specifically to capture observable variation in key dimensions relevant to KTP performance, including leadership support, knowledge exchange barriers, absorptive capacity, knowledge embedding, innovation outcomes, and long-term sustainability.

Its creation followed a transparent, iterative process guided by qualitative pattern recognition and theoretical sensitivity emerging from the case data rather than any pre-existing instrument. Each level of the scale was defined operationally based on consistent indicators observed across the five cases; for example, “High” reflects strong or sustained evidence of the construct in question, “Medium” denotes moderate or partial evidence, and “Low” indicates limited or inconsistent evidence. These classifications were derived from triangulated data sources, including interview transcripts, project documents, observational notes, and outcome reports, to reduce subjective bias and ensure internal coherence. Although the scale is novel, its structured application across cases provides a systematic basis for comparing heterogeneous organisations while preserving the contextual richness of each case.

By making the criteria explicit and applying them consistently, the scale enhances analytic transparency and contributes a pragmatic methodological tool suitable for exploratory, multi-case KTP research.

The application of a three-point ordinal scale; Low (L), Medium (M), and High (H); represents the relative strength, impact, or level of engagement within each category. This approach enables consistent comparative judgement while accommodating qualitative variation across organisational contexts. The resulting heatmap provides a condensed representation of cross-case performance and enables pattern recognition across cases. It supports analytical decisions by highlighting convergences and divergences in organisational capability, leadership engagement, and long-term impact resulting from KTP participation.

Below is a derived heatmap, Table 33, for the cross-case analysis of the five KTP case studies (CSA–CSE). The heatmap uses a scale from Low (L), Medium (M), High (H) to represent the intensity/impact in each category.

Table 33 Cross-Case Heatmap Matrix (CSA–CSE)

Case	Sector	Size	Leadership Support	KE Barriers	Absorptive Capacity	Knowledge Embedding	Innovation Outcomes	Long-Term Sustainability
CSA	Charity	Medium	H	M	H	H	H	H
CSB	Manufacturing	Micro	M	M	M	L	M	M
CSC	Manufacturing	Medium	L	M	M	M	M	M
CSD	Health	Micro→Medium	H	L	H	H	H	H
CSE	Manufacturing	Micro→Medium	H	L	H	H	H	H

L: Low impact or engagement; M: Medium impact or engagement; H: High impact or engagement

The heatmap analysis reveals a clear pattern across cases, whereby strong leadership support and low knowledge exchange barriers are associated with high levels of absorptive capacity, knowledge embedding, innovation outcomes, and long-term sustainability, as observed in CSD, CSE, and CSA. In contrast, cases characterised by single, narrowly scoped KTP interventions (CSB and CSC) exhibit only medium or low levels of impact, particularly with respect to knowledge embedding and sustainability. Moreover, organisations operating in sectors that have engaged in

repeated KTP interventions (notably CSD and CSE) demonstrate consistently high performance across all dimensions, suggesting the cumulative benefits of sustained engagement. Overall, the heatmap provides an effective visual means of comparing organisational outcomes and identifying systematic relationships between leadership, absorptive capacity, and long-term impact. The matrix that maps the impact attributed guided by the conceptual framework and its indicators for the qualitative criteria for each research question (RQ1–RQ5) using High (H), Medium (M), and Low (L) relevance is shown in Table 34 below.

Table 34 Level of Impact Mapping of Qualitative Data Against Conceptual Framework Categories and Research Questions

Conceptual Framework Category	Primary Qualitative Indicators	RQ1	RQ2	RQ3	RQ4	RQ5
Size & Demographics	Organisational size, maturity, sector, growth stage	H	M	M	M	M
Leadership Characteristics	Leadership vision, commitment, strategic orientation	H	H	L	M	M
	Senior management involvement & influence	H	H	L	M	M
Knowledge Exchange Activities & KTPs	Quality and depth of UIC / KE engagement	H	M	H	H	M
	Evidence of co-creation & collaborative problem-solving	H	M	H	H	M
	KE barriers and facilitators	M	M	H	H	M
Knowledge Embedding & Organisational Learning	Knowledge embedding processes	M	M	M	H	H
	Evidence of absorptive capacity	M	M	M	H	H
	Organisational learning & cultural development	M	H	H	M	M
Entrepreneurial Leadership & Innovation	Evolution of entrepreneurial leadership	M	H	H	M	M
	Innovation & organisational outcomes	M	M	H	M	M
	Capability development & organisational transformation	M	M	M	M	H
Barriers, Context & SME Characteristics	Organisational readiness & contextual factors	M	M	H	H	M
	Operational characteristics & organisational structures	H	M	M	M	M
Long-Term Sustainability Outcomes	Value capture & business sustainability	M	M	H	M	H
	Sustainability of knowledge & processes beyond project	M	M	M	M	H

H (High): Strong relevance / primary mapping; M (Medium): Moderate relevance / secondary mapping; L (Low): Limited relevance / minor mapping

Collectively, the mapping of qualitative indicators to the research questions illustrates a deliberate analytical progression across levels of organisational inquiry. RQ1 foregrounds the foundational organisational conditions that shape engagement with university–industry collaboration, with particular emphasis on leadership orientation, organisational structures, and patterns of knowledge exchange. Building on this, RQ2 centres on the development of organisational learning cultures and the evolution of entrepreneurial leadership, capturing how engagement with external knowledge influences internal sensemaking, behaviours, and capabilities. RQ3 extends the analysis to longer-term organisational consequences, focusing on innovation outcomes, value capture, and broader organisational performance associated with sustained collaboration. RQ4 then shifts attention to the micro-level processes through which knowledge becomes embedded within organisational routines, highlighting the central role of absorptive capacity in translating external inputs into usable organisational knowledge. Finally, RQ5 integrates these strands by examining how embedded knowledge contributes to enduring organisational transformation, sustained change, and long-term value creation, thereby linking process-oriented insights with strategic and sustainability-oriented outcomes.

The next section continues the analysis based on the quantitative data.

4.4 Quantitative Results

Within the quantitative strand of the study, absorptive capacity is modelled as a mediating variable linking knowledge exchange, university–industry collaboration, and KTP engagement to innovation and organisational performance outcomes. The embedding of knowledge within organisational processes is conceptualised as a downstream mediating mechanism through which learning and knowledge management practices translate into longer-term organisational effects. This construct is examined quantitatively in relation to competitiveness, sustainability, and performance, while qualitative inquiry provides insight into how embedded knowledge reshapes routines, decision-making practices, and strategic orientation over time.
Entrepreneurial leadership development is likewise positioned as a central mediating construct, elucidating how engagement in knowledge exchange initiatives fosters adaptive capacity and innovation, particularly within SME contexts. Its mediating role

between knowledge exchange and innovation capability is assessed through quantitative analysis.

Primary data for this research was collected through a web-based survey, and the design drew heavily from the Innovation Survey (BEIS, 2020), a well-established methodology that has been previously validated. The survey was sent to a population of 1902 individual companies and responses totalled forty-one businesses completing the survey and sixteen confirmed that they would be able to give further support and could be contacted to be interviewed. Previous survey structures were used to ensure there was some validity to the structure and questions posed. To provide generalisation a total of ninety-five responses would be required to reach a 95% confidence interval however a response rate of just over 2% from 41 businesses was recorded

Of the forty-five companies surveyed 13% micro size, 49% small and 38% medium sized, 60% of them declared a growth pattern of greater than 6% in the intervening period between the end of their KTPs project and the survey in 2018. An additional noteworthy result is that, collectively, 45% of the surveyed SMEs reported a growth of exceeding 10%. A high proportion 64% to 68% indicated an impact in the eight categories summarised as the Competitive Position Impact (CPI) and similarly there was 60% to 67% declared an impact in the eight categories that were used to measure the Operational Impact (OI). In the category of Knowledge Impact (KI) 73% to 78% were found to have an impact in the individual areas in this category for skills training and external collaboration. The Leadership Impact (LI) measure showed over 50% of the companies registered an impact in four of the five individual areas and the fifth area had a measure of 49%. The Business Model Impact (BMI) results highlighted high levels of impact in sales, market share, turnover, and margins all above 62%. Smaller impacts levels were recorded for the other two areas in this category cost savings and efficiency gains.

4.4.1 Sector and size

Forty-one companies responded to the main survey and from the population of 1902 a response rate of 2.1% with two repeat requests sent using the mail merge function

to create the email request. The pilot study survey results from the businesses were added to this data set and the one business who completed the survey during the interview. Of the forty-five surveyed companies including the pilot study businesses there was seventeen medium-sized with 50-249 employees 38% of the total, twenty-two small size businesses 49%, with 10 to 49 employees and six micro sized businesses, 13%, with 1 to 9 employees.

4.4.2 Leadership strategies

From the survey half the business surveyed reported an impact of 50% and over for four of the categories used to measure the leadership impact of the KTPs after the project ended more than four years previously. This was the lowest impact range of all the six categories. The Project Champion did not have a distinguishing impact for 50% of the businesses so SMEs slow to continue what was successful in the KTPs Project implementation by having a KTP Associate and the leadership providing the Project Champion aspect within the business, summarised Table 35. This has a high relevance to RQ1, RQ2 and RQ5. The survey measurement category for leadership impact used the following subcategories:

- Company results and actions communicated
- KPI reporting
- Project planning
- Project Champion
- Communication notices

Table 35 Leadership Impact across forty-five surveyed businesses

Leadership Impact	Impact	No impact	No entry
Company results and actions communicated	56%	44%	0%
KPI reporting	51%	49%	0%
Project planning	64%	36%	0%
Project Champion	49%	51%	0%
Communication notices	64%	36%	0%

4.4.3 Organisational characteristics

Comparing the outcomes from measures of the Operational Impact is shown in Table 36 below. Five of the eight variables recorded 60% to 67% of the surveyed businesses had impact from the KTPs project in their operational activities from processes to communications and over 49% had impact on marketing, information systems and knowledge bank. In terms of Operational Impact category 'Products' and 'People' were key impact areas in this category impacted in this area for 67% and 64% respectively of the businesses measured.

Table 36 Operational Impact across forty-five surveyed businesses

Operational Impact	Impact	No impact	No entry
Processes	62%	38%	0%
Knowledge bank	58%	42%	0%
Products	67%	33%	0%
Information Systems	53%	47%	0%
Communication	60%	40%	0%
People	64%	36%	0%
Marketing	49%	51%	0%
Leadership and strategy	62%	38%	0%

4.4.4 Knowledge Exchange

The survey results indicate that 73% of the businesses surveyed registered an impact on the skill straining as part of the category knowledge impact. The survey results of each of the Case Studies highlighted that the Knowledge Impact category recorded that CSB had the lowest value of impact measured at 8 while CSA and CSC had a maximum of 20 out of a possible 20 and CSD and CSE had 19 and 17 respectively. CSA declared in 2016 that internal knowledge and skills were significantly impacted and continue to be so after 4 years since the end of the KTP.

4.4.5 Knowledge Embedding

Table 37 indicates that 73% to 78% of the businesses surveyed responded that they had experienced impact on the knowledge impact categories of skills training and external collaboration. The other indicators show over half the businesses reported impact in the research and development and market research in this category of knowledge impact.

Table 37 Knowledge Impact across forty-five surveyed businesses

Knowledge Impact	Impact	No impact	No entry
Res & Dev	62%	38%	0%
Ext. collaboration	78%	22%	0%
Skills training	73%	27%	0%
Market research	51%	49%	0%

The Competitive Position Impact is shown in Table 38 below. The survey data showed that 64% to 69% of businesses experienced or declared an impact on the competitive position in six out of eight of the categories of the CPI from increased product types to improved customer service provision. The highest no impact recorded was 60% of all the businesses did not record any impact from any activity that would have been related to reducing the selling costs. Process efficiency activity shows almost half of the businesses declaring activity and the other half no impact the remainder did not record any response. The survey data showed that 64% to 69% of businesses experienced or declared an impact on the competitive position in six out of eight of the categories of the CPI from increased product types to improved customer service provision.

Table 38 Competitive Position Impact across forty-five surveyed businesses

Competitive Position Impact	Impact	No impact	No entry
Increased product types	69%	29%	2%
Increased customers	69%	29%	2%
Increased sales	67%	33%	0%
Improved process efficiency	49%	47%	4%

Prod spec improvements	64%	36%	0%
Improved customer service provision	64%	31%	4%
Increased speed of NP to market	67%	31%	2%
Reduce selling costs	36%	60%	4%

4.4.6 Sustainable business change and value capture

Analysis of the declared growth pattern after the KTP from the forty-five respondents indicated that 60% declared greater than 6% growth, twenty-seven of the forty-five surveyed, fifteen or 33% declared up to 5% growth and 7% reported decline see Figure 9. The highest growth declared ≥ 10% was 47% and the mode or most frequent value for this measurement of growth of the surveyed businesses is those that declared greater than >10% growth.

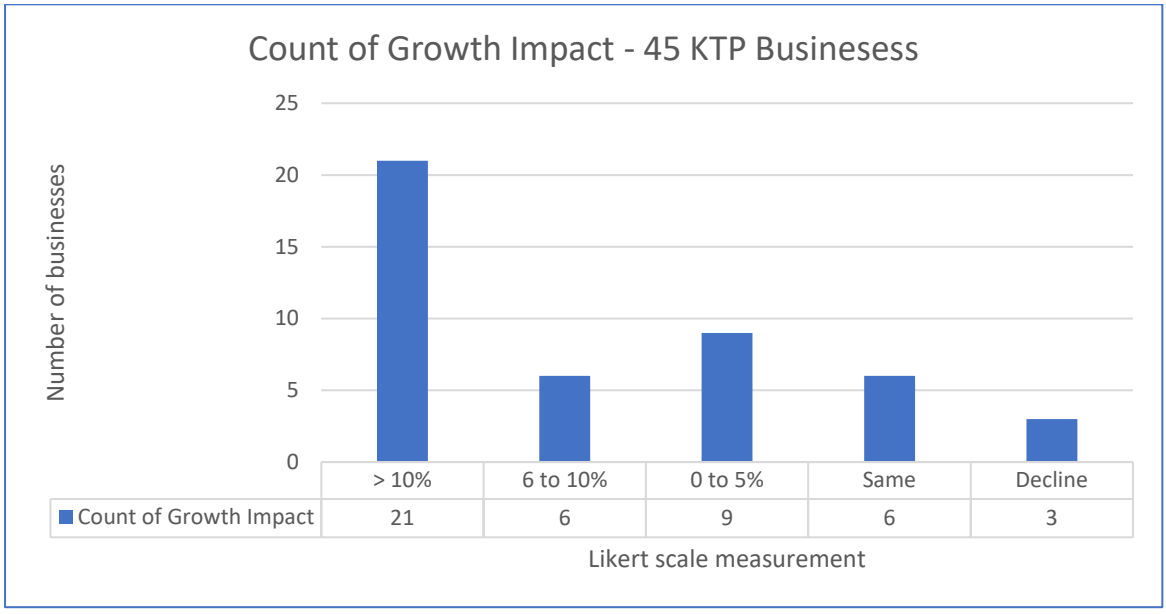

Figure 9 Reported Growth Impact after KTP completed for four or more years.

The responses indicating no impact are listed in the second column and the final column lists the percentage of responses that did not provide an entry for that area of the Impact categories. Table 39 shown below is the first category of impact, Growth, and highlights that 80% of the forty-five businesses surveyed had impact in growth.

Table 39 Growth Impact across forty-five surveyed businesses

	Impact	No impact	No entry
Growth Impact	80%	13%	7%

Table 40 below shows the impact across the forty-five businesses surveyed in relation to the business model impact. This indicates that 82% of the businesses had an impact in sales, 78% in market share 69% in turnover and 62% impact in margins.

Table 40 Business Model Impact across forty-five surveyed businesses

Business Model Impact	Impact	No impact	No entry
Sales	82%	18%	0%
Turnover	69%	27%	4%
Margins	62%	38%	0%
Market share	78%	20%	2%
Cost savings	47%	47%	7%
Efficiency gains	53%	47%	0%

The findings of this survey indicate that among the surveyed SME businesses, not all declared growth, with some reporting a decline. It is recognised that external global financial issues had affected these businesses, hence derailing the intended improvement actions that would have embedded the improvements into the business and its products and processes. Others quoted the relationship issues and the quality of the external personnel including the KTP Associate and the Knowledge Base or University. The survey question 7 asked “Since the KTP project ended has there been a change in the areas below to ensure knowledge gain is part of the strategy?” out of the forty-five businesses, five responded “Not at all”. However, all the SMEs surveyed demonstrated an impact to varying degrees in most areas supporting the use of alignment of their actions with indicators that contribute to value creation.

The next section now moves to linking the conceptual framework and indicators mapping to the research questions.

4.5 Conceptual framework, indicators mapping to Research Questions

Table 41 below, provides a mapping where the quantitative survey data are systematically aligned to Research Questions RQ1 to RQ5 through the conceptual framework categories, indicating the relative strength of contribution (high, medium, or low) of each category to addressing specific aspects of the study. Categories directly measured through Likert-scale items and validated survey constructs, such as leadership characteristics, knowledge exchange activities, knowledge embedding, entrepreneurial leadership, and long-term sustainability outcomes, demonstrate high levels of contribution across multiple research questions. In contrast, size demographics and contextual barriers primarily provide explanatory and segmentation value, supporting interpretation rather than acting as direct measures of impact.

The table demonstrates that RQ1 and RQ4 are strongly supported by quantitative evidence relating to leadership, operational context, and knowledge exchange mechanisms, while RQ2 and RQ5 are primarily addressed through measures of knowledge embedding, absorptive capacity, and entrepreneurial leadership. RQ3 is most strongly informed by knowledge exchange activities and long-term sustainability outcomes.

Overall, the mapping demonstrates that the quantitative instrument is appropriately structured to test relationships between organisational characteristics, knowledge exchange processes, embedded knowledge, and long-term outcomes, thereby supporting theory testing and explanation building. There is overlap across both the qualitative and quantitative indicators especially those areas with high ratings of impact and relevance. The conceptual framework may be too linear and not representative of the processes and how they are implemented based on the sequence of patters shown in Table 41 and the research questions developed by the conceptual framework indicate overlap.

Table 41 Level of Impact Mapping of Quantitative Data Against Conceptual Framework Categories and Research Questions

Conceptual Framework Category	Primary Quantitative Indicators	RQ1	RQ2	RQ3	RQ4	RQ5	Overall Impact Level	Rationale
Size Demographics	Firm size, sector, growth band	M	L	M	L	L	Medium	Provides segmentation and contextual baseline for interpreting impacts.
Leadership Characteristics	Leadership & external knowledge use; strategic orientation	H	H	M	M	H	High	Central to organisational approaches, learning effects, and sustainable change.
Knowledge Exchange Activities & KTPs	KTP influence; external interaction	H	M	H	H	H	High	Core to explaining mechanisms and long-term collaborative impact.
• UIC	Value of university collaboration	H	M	H	H	H	High	Direct proxy for collaborative knowledge exchange.
• KE Barriers	Perceived obstacles	M	L	M	H	M	Medium	Identifies constraints on embedding and sustainability.
Knowledge Embedding & Organisational Learning	Embedding knowledge; internal use; skills/R&D	M	H	H	H	H	High	Central construct for organisational learning and sustainable outcomes.
• Evidence of Absorptive Capacity	Internal capability & skills	M	H	M	H	H	High	Indicates ability to recognise, assimilate, and apply knowledge.
Entrepreneurial Leadership and Innovation	Innovation behaviour; business model evolution	M	H	H	M	H	High	Links leadership, learning, and long-term value creation.
Barriers, Context and SME Characteristics	Time, resources, structure	M	L	M	M	M	Medium	Contextualises variations in outcomes.
Long-Term Sustainability Outcomes	Growth, competitiveness, business model performance	M	M	H	M	H	High	Direct measures of long-term impact and value creation.

L: Low impact or engagement; M: Medium impact or engagement; H: High impact or engagement

4.6 Survey reliability

Internal consistency checks were carried out to ensure there was reliability of the measures constructed for this method and approach to measure impact. The variables applied in each category were to allow for gathering of data and had been developed after a Pilot Study. The testing of the internal consistency using Cronbach's alpha tests (Cronbach, 1951) is pertinent as it is commonly used to assess if the multiple-question Likert scale surveys are reliable. Using this method, it measures for any undetected variables which are difficult to ascertain and measure. Cronbach's alpha indicates how closely related a set of test variables are as a group. The variables from this method were collated into categories and tested using Cronbach's alpha test (Cronbach, 1951) and all were positive and as the data is ordinal data based on using Likert Scales this gives a measure of the strength of the relationship see Table 42. This measure identifies how closely related a set of test items are as a group and in general, a score of more than 0.7 is thought acceptable. Some authors do suggest higher values of 0.90 to 0.95 as being more acceptable and further assured especially in critical uses such as personnel selection and argue that a reliability value of 0.95 or higher is necessary (Nunnally & Bernstein, 1994, p. 265).

Table 42 Reliability values for the survey categories

Measure Category	No of variables	α
Operational Impact (OI)	8	0.92176
Competitive position impact (CPI)	8	0.90597
Leadership Impact (LI)	5	0.87043
Knowledge Impact (KI)	4	0.84148
Business Model Impact (BMI)	6	0.86110

Comparing alpha (α) results and the internal consistency ratings with Cronbach's alpha results chart (Glen, 2023) we can state that the internal consistency or reliability is rated good for LI, KI and BMI as $0.9 > \alpha \geq 0.8$ and rated as excellent for CPI and OI categories in the survey as $\alpha \geq 0.9$.

The next step in the analysis of the survey data was to assess the relationship, if any, of the data sets based on the ordinal data. The analyse data add option in was used

on the Excel spreadsheet survey results Appendix 12 to produce scatterplots and assess for correlation Appendix 13 and some data was returned but as this is ordinal data nonparametric tests are required. The correlation coefficient an excel worksheet function (CORREL) is applied to each pair of measurement variables This is a measurement of the extent to which two variables vary together, and it is a scaled measurement. This scaling means the value in the result is independent of the units that the two variables are stated in.

A correlation coefficient value is shown between -1 and +1 inclusively. Examining each pair of measurements variables to determine the association of the variables to each other or an indicator of their correlation. If large values of one variable tends to be associated with the large value of the other a positive correlation can be declared. Alternatively, if small values of one variable tend to be associated to large values of another variable this would be a negative correlation. If both values attend to be unrelated, then this is described as correlation near zero. The resulting coefficient closer to either -1 or +1, the stronger the correlation. The CORREL function uses the arguments Array1 (required argument), this is the set of independent variables. It is a cell range of values. Array2 (required argument) this is the set of dependent variables and is the second cell range of values.

For this correlation activity the outputs showed that there were several positive relationships and no negative relationships. This level of positive correlation on this size of data set is encouraging for prompting for further study in this context using this measurement system to provide the generalisability that would give statistical confidence. The highest correlation is in ranking order first the Knowledge Impact (KI) at 0.757 with the Operational Impact (OI), second the Leadership Impact (KI) with the Operational Impact (OI) at 0.755 and thirdly the correlation of the Knowledge Impact (KI) and the Leadership Impact (LI) at 0.744. Using the data analysis functionality on the excel spreadsheet several scatter plots were automatically produced, and these indicated there was high correlation between the OI and KI Figure 10, the OI and the LI see Figure 11 and the LI and KI Figure 12 below.

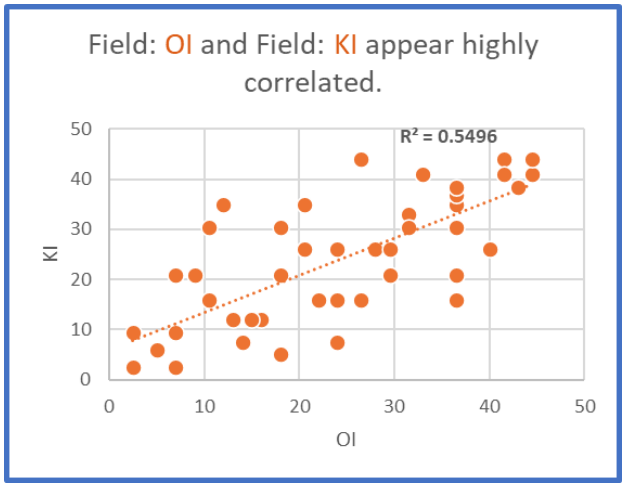

Figure 10 Highly Correlated OI and KII

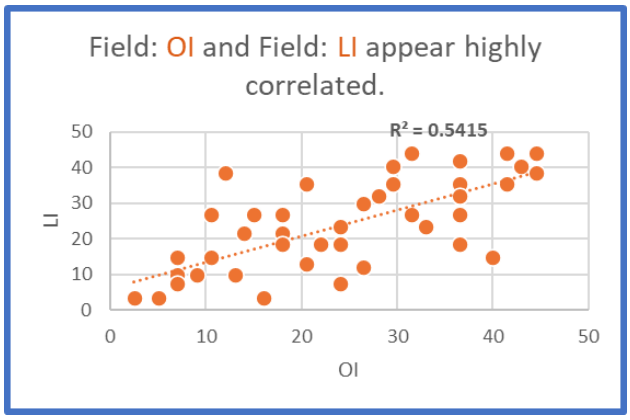

Figure 11 Highly Correlated OI and LI

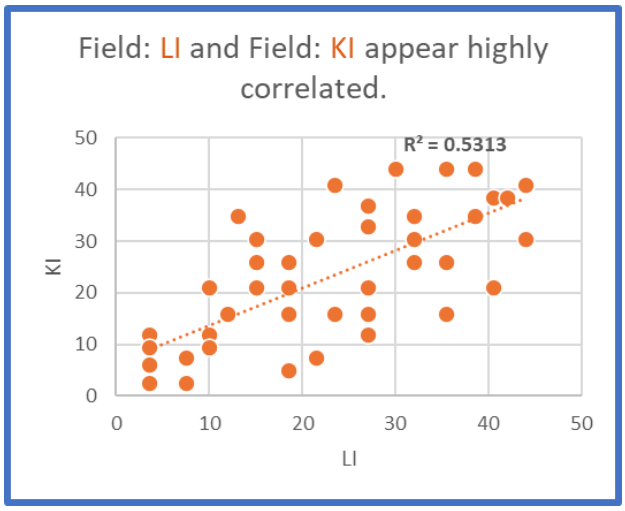

Figure 12 Highly Correlated LI and KI

The other sets of data correlation levels shown in the summary Table 43 below were the OI and the KI and LI correlations and the LI and KI correlation as shown.

Table 43 Impact measures correlation table

Factor	F1: Competitive Position Impact (CPI)	F2: Operational Impact (OI)	F3: Leadership Impact (LI)	F4: Knowledge Impact	F5: Growth Impact (GI)	F6: Business Model impact (BMI)
F1: Competitive Position Impact (CPI)	1					
F2: Operational Impact (OI)	0.756	1				
F3: Leadership Impact (LI)	0.856	0.712	1			
F4: Knowledge Impact (KI)	0.569	0.618	0.638	1		
F5: Growth Impact (GI)	0.322	0.311	0.376	-0.123	1	
F6: Business Model impact (BMI)	0.396	0.069	0.334	-0.347	0.654	1

The correlation coefficient, when applied to ordinal data such as that derived from Likert-scale survey responses, does not provide information about the magnitude of change in one variable relative to another. This limitation arises from the fact that ordinal data represent ranked categories rather than precise numerical intervals. Consequently, while correlation based on ranked data (e.g., Spearman's rho) can offer an indication of the strength and direction of association between variables, it does not imply a measurable rate of change. The analysis, therefore, was intended to assess the strength and direction of the relationship between variables, acknowledging that while one variable may tend to increase or decrease in relation to the other, the specific rate of change cannot be inferred. Nonetheless, the trendline direction, positive or negative, provides insight into the general nature of the association.

Spearman’s rho analysis based on ranked data was used to measure the monotonicity of relationships as the direction is indicated but the variables do not change at the same rate as they are not parametric. Indeed, the positive monotonic relationship exists when one variable increases, the other also increases, the negative monotonic relationship indicates that when one variable increases the other decreases. At this point it was prudent to run the analysis using the Spearman rho calculations to provide the scatter plots for the ordinal data and to identify the strength of the relationships between the categories to assess if there was a clear indication of cause and effect.

The Spearman rank correlation measures both the strength and the direction of the data and if closer to the absolute value of 1 on a scale of -1 to 1 then the stronger the relationship. The relationships identified as having a higher correlation using the Data analysis function on the excel spreadsheet were then examined using the coefficient of correlation of the ranked data and the coefficient increased from 0.4746 to 0.5069 for BMI and CPI relationship and from 0.5327 to 0.5381 for the OI and CPI relationship. The others for the OI and KI, OI, and Li and finally the LI and KI all decreased. All the coefficients were >0.5 coefficients which is indicative of some relationship, and the positive direction indicates a change in one variable will mean a change in the other variable but not in a linear fashion. The quantitative data does not give a representative sample of the broader population, and this limits the generalisability of the survey outcomes but the statistical analysis highlights patterns.

The strength of the correlation for the paired factors the OI and KI, OI, and Li and finally the LI and KI were all greater than or equal to 0.5. This indicates that there was some relationship and hence some co-dependency but as this not in a linear fashion hence difficulties in discerning where to apply actions to get improvements. The relationship or connection of the CPI with the OI is higher than that for the CPI with the BMI which was the dependant variable to measure value creation and value capture.

4.7 Emergent Themes and their contribution to the Research Questions

This section synthesises the emergent qualitative and quantitative themes and explicitly demonstrates how they address the study's research questions RQ1 to RQ5. Collectively, the themes illuminate the organisational parameters, processes, and contextual conditions through which knowledge exchange operates, becomes embedded, and generates sustainable business change and value capture within SMEs.

4.7.1 Leadership, Strategy, and Organisational Parameters Enabling Long-Term Impact

Addressing RQ1 and RQ2:

RQ1 asks what organisational parameters and approaches deliver long-term impact through knowledge exchange, while RQ2 explores the effect of embedding knowledge on organisational learning and entrepreneurial leadership.

Across the qualitative case studies, leadership emerged as a foundational organisational parameter shaping the effectiveness of KTPs. Supportive and strategically oriented leaders were shown to influence not only the selection and direction of KTP projects but also the extent to which learning, experimentation, and organisational development were encouraged. Where leaders actively promoted reflective practice and capability building, KTP derived knowledge was more likely to be embedded within routines and used as a basis for ongoing innovation. Conversely, limited or reactive leadership engagement constrained knowledge utilisation and reduced long-term impact.

Quantitative results reinforce this finding. Strong positive associations between Knowledge Impact (KI), Leadership Impact (LI), and Operational Impact (OI) indicate that firms reporting higher levels of knowledge acquisition and embedding also experience stronger leadership and operational effects. These relationships demonstrate that leadership is both an outcome of knowledge exchange and a mechanism through which learning becomes institutionalised. Together, the qualitative and quantitative evidence shows that leadership capability and strategic orientation are central organisational parameters that underpin long-term impact through knowledge exchange and shape the development of entrepreneurial leadership.

4.7.2 Processes of Knowledge Embedding and Organisational Learning

Addressing RQ2 and RQ4:

RQ4 focuses on the processes through which SMEs embed knowledge gained via university industry collaboration, while RQ2 examines the effects of embedding knowledge on organisational learning and leadership.

Qualitative analysis indicates that knowledge is embedded through codification into procedures, integration into workflows, and the creation of new roles, routines, and competencies. Multi-stage or longitudinal KTPs were particularly effective in enabling

cumulative embedding, allowing organisations to build on earlier learning and progressively refine their processes. Repeated engagement in KTPs further strengthened absorptive capacity, creating familiarity with collaborative research and enhancing internal structures for knowledge utilisation.

Quantitatively, high proportions of respondents reported positive Knowledge Impact alongside improvements in skills development, use of external knowledge, and internal process change. Correlation analysis demonstrates that higher KI scores are associated with stronger OI and LI scores, suggesting that embedding knowledge contributes to both operational learning and leadership development. These patterns provide empirical evidence that knowledge embedding is not a single event but an iterative process that supports sustained organisational learning and capability building.

4.7.3 Long-Term Impacts of University–Industry Collaboration on SMEs

Addressing RQ3:

RQ3 asks what long-term impacts SMEs achieve through collaboration with universities.

Both qualitative and quantitative findings indicate that KTPs generate a wide range of long-term impacts extending beyond immediate project outcomes. Case study evidence highlights contributions to business growth, enhanced strategic capacity, product and process innovation, and, in some instances, international market positioning. These impacts were most evident in firms demonstrating a strong commitment to innovation and ongoing external collaboration.

Quantitative results corroborate these observations. A substantial proportion of surveyed SMEs reported growth exceeding 6 per cent, with nearly half reporting growth above 10 per cent following KTP completion. In addition, high levels of reported impact across Competitive Position Impact (CPI), Business Model Impact (BMI), and Operational Impact (OI) illustrate that KTPs influence both performance outcomes and organisational capability. Together, these findings demonstrate that university–industry collaboration can generate enduring economic and strategic benefits for SMEs.

4.7.4 Embedded Knowledge as a Driver of Sustainable Change and Value Capture

Addressing RQ5:

RQ5 seeks to explain why and how embedded knowledge leads to sustainable change and value capture within business models.

Qualitative evidence shows that sustainability of outcomes depends less on the scale of the initial KTP investment and more on whether knowledge becomes integrated into organisational routines and strategic decision-making. Firms that embedded KTP-derived knowledge within their business models were able to continuously reconfigure resources, pursue new opportunities, and adapt to changing market conditions.

Quantitative analysis supports this interpretation. High Business Model Impact (BMI) scores were associated primarily with revenue-generating outcomes such as sales growth, market share, and margin improvements, rather than cost reduction alone. This indicates that embedded knowledge contributes to value capture by enabling SMEs to create new value propositions and access new markets. Furthermore, free-text responses stratified by BMI reveal that higher-performing firms emphasised embedded capabilities and strategic benefits, whereas lower-performing firms cited contextual constraints and misalignment. These findings explain how embedded knowledge translates into sustainable change by reshaping both strategic orientation and value creation mechanisms.

4.7.5 Contextual Contingencies and Heterogeneity of Outcomes

Cross-cutting: Addressing RQ1 to RQ5:

Across all research questions, the findings highlight the importance of organisational and environmental context. Sectoral differences influence the focus of KTP activity, while external economic conditions, organisational relationships, and personnel changes shape the extent to which benefits are realised and sustained. These contingencies explain why similar KTP interventions can produce divergent outcomes across SMEs.

This cross-cutting theme demonstrates that while certain organisational parameters and processes are consistently associated with positive impact, knowledge exchange operates within open systems. Sustainable outcomes therefore arise from the interaction between KTP inputs and firm-specific contexts.

4.7.6 Summary

Taken together, the emergent qualitative and quantitative themes provide integrated answers to the research questions by demonstrating:

- Which organisational parameters enable long-term impact (RQ1)
- How knowledge embedding shapes learning and leadership (RQ2)
- What long-term impacts SMEs achieve through collaboration (RQ3)
- Through which processes knowledge becomes embedded (RQ4)
- Why and how embedded knowledge leads to sustainable change and value capture (RQ5)

These findings as well as establishing a coherent empirical foundation alongside thematic patterns provides a foundation for the synthesis and discussion presented in Chapter 5, where implications for SME policy, the organisation learning strategies, and suggested directions for future academic research are examined.

Chapter 5 Discussion

In this chapter, the results of the research and any findings will be discussed to address the research questions and clarify the contribution to theory and practice. The data analysis and the discussion will support the thesis findings responding to the research question, the sub-questions, and the overall aim of the research.

5.1 Introduction

The primary aim of this research was to examine the extent to which KE contributed to sustainable change within businesses, with a particular emphasis on its role in fostering enduring organisational transformation. Specifically, the study investigated how effectively the transfer and embedding of knowledge influenced long-term enhancements in business practices, innovation capacity, and overall economic resilience. This study is situated within the broader national agenda that emphasises productivity growth and recognises UIC as a critical driver of innovation and economic development. By investigating the structures, processes, and outcomes associated with UIC and KE practices, the research aimed to uncover the mechanisms through which businesses, particularly SMEs, achieve sustainable transformation. The conceptual framework identified the key moderators and mediators as well as structure for the research.

An in depth understanding of KE, its characteristics, implementation outcomes and its impact on businesses has gained increasing importance for scholars, policymakers, and practitioners. An exploratory, inductive approach underpins the research, utilising a mixed-methods design. The mixed-methods design enables both the testing of theoretically specified mediating and moderating relationships, and the in-depth exploration of how these mechanisms unfold within SMEs over time. The methodological framework comprised of five in-depth case studies, supported by a complementary survey, allowing for both detailed and wide-ranging analysis of KE dynamics.

5.2 Leadership, Strategy, and Organisational Parameters Enabling Long-Term Impact

Research Objective 1: To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange was to be addressed by the following research questions:

RQ1: What are the organisational parameters and approaches that deliver long-term impact through knowledge exchange?
RQ2: What is the effect of embedding knowledge on organisational learning and the development of entrepreneurial leadership?

The literature review underscored that knowledge exchange is a non-linear, often challenging process (Korayim, et al., 2024; Koryak, et al., 2015), heavily shaped by leadership capability (Salavou, et al., 2004; Shepherd, et al., 2010; McMullen & Kier, 2016), entrepreneurial orientation (Leitch & Volery, 2017; Batra, 2017), and organisational learning (Szulanski, 2000; Garg & Rastogi, 2006). These factors are not merely influential but are identified as critical enablers of sustained innovation within firms. This study therefore sought to examine how these dynamics operate within post-KTP environments to drive business model transformation (Chesbrough, 2007; Chesbrough, 2010; Johnson, et al., 2008; Johnson, 2010), enhance absorptive capacity (Cohen & Levinthal, 1990), and support long-term innovation within SMEs. While the broader literature has extensively examined entrepreneurial leadership in large or high-growth firms, studies focused on SMEs provide a more nuanced understanding of the unique challenges and opportunities these enterprises face.

The pilot study confirmed the relevant types of impact for both the survey and the interviews used to provide more depth to the case study material. The types of impact were identified as Operational Impact (OI), Competitive Position Impact (CPI), Leadership Impact (LI), Knowledge Impact (KI) and the Business Model Impact (BMI).

The survey was implemented once the validity was tested by a Pilot Study and this was designed to confirm the impact types, identify associations through correlation and characteristics that to be investigated further in the qualitative study. The semi structured interview with the leaders in the business, the KTPs initial and final reports

and access to the UK Innovate database for funded projects allowed for five curated case studies to contribute to the exploration of the data and results to provide analysis supporting further discussion. The case study analysis allowed categorisation of the reality of the actions taken after the KTP

The analysis compares KTP applications, interim and final reports, and semi-structured interview data to identify how organisational parameters associated with sector and size shape operational characteristics and strategic approaches to knowledge exchange. This cross-source comparison reveals recurring patterns and contextual influences that help explain how particular organisational configurations are associated with the achievement of long-term impact through knowledge exchange addressing RQ1.

The five case studies reveal a significant finding: training all staff, across both operational and support functions, in the new offering introduced through the KTP project was crucial to its success. This finding directly informs Research Question 2, which seeks to identify key attributes contributing to successful outcomes. Organisational learning emerged as a critical success factor, as evidenced in the case studies. Case Studies D and E illustrate how the effective implementation and embedding of this learning enabled meaningful value capture. These examples underscore the importance of not only initiating organisational learning but also ensuring it is systematically embedded to realise its full potential. These findings address RQ1 by demonstrating which approaches such as organisation wide training enable lasting impact.

Correlation analysis demonstrated statistically significant positive associations among Knowledge Impact, Operational Impact, and Leadership Impact, with correlation coefficients equal to or exceeding 0.5. These findings suggest a degree of interdependence across these domains. However, the observed relationships exhibit non-linear characteristics, indicating a complex interplay wherein enhancements in one domain do not translate into straightforward or proportional improvements in others. This complexity underscores the difficulty of identifying precise leverage points for interventions aimed at optimising overall business performance. However, this evaluation addresses RQ2 as there is quantitative evidence that embedding

knowledge is associated with enhanced organisational learning and leadership outcomes.

The literature indicated that SMEs reactions are not positive where there are direct comparisons in the belief that SMEs can be viewed and discussed as if they were a single homogenous group. The BEIS report gathered responses that SME leaders declare some topics are “pie in the sky” as they are not deemed relevant or applicable to them as individual businesses and this underscores the heterogeneous nature of SMEs (BEIS, 2019). Hence this strand supports RQ1 as it identified structural and cultural parameters that either enable or constrain long term knowledge exchange.

Analysis of the data measuring Leadership Impact revealed strong correlations with both Knowledge Exchange Impact and Operational Impact, despite the demographic breakdown indicating a uniform 50% impact across each leadership sub-category. This suggests that while the overall levels of impact appear evenly distributed, the qualitative influence of leadership can vary significantly depending on its nature and application. In particular, the entrepreneurial orientation demonstrated by leadership in Case Studies D and E exemplifies the positive role leadership can play in amplifying impact across other domains. In contrast, Case Study C exhibited a more hierarchical leadership style, which appeared to impede the pace at which knowledge exchange processes, central to the KTP project, were embedded within the organisation.

When benchmarked against the average Leadership Impact scores of the forty-five participating businesses, Case Studies CSA, CSC, CSD, and CSE all performed above average. However, qualitative findings from CSC indicate that despite its higher score, the organisation experienced a notable lack of sustained leadership support and championing during and after the KTP project, which may have limited its longer-term impact. The leadership and its approach are the main outcomes at this point of the discussion, and the entrepreneurial leader approach certainly impacts on the business and its growth to some effect partly satisfying RQ1 and RQ2.

The literature review surmised that the existing research remains fragmented on ascertaining the sustained impact of entrepreneurial leadership on organisational performance. Furthermore, there is a tendency to generalise leadership characteristics without adequately accounting for contextual factors such as sector-

specific constraints, institutional environments, or the maturity of the SME. As such, there remains a critical research gap in understanding how entrepreneurial leadership functions dynamically within the complex and resource-constrained environments typical of SMEs, particularly in a changing environment which consists of global challenges and rapid technological change.

Generational or evolutionary changes, such as technology advancements in hardware and software, acted as catalysts for change when recognised. However, cultural aspects of the business and its leadership significantly influenced whether these opportunities were seized. This reflected an issue raised in the literature review where some SMEs viewed KTP projects as rapid problem-solving actions, after which the ceased further collaboration or innovation efforts. This section highlights the impact the barrier of cultural status may impose but the catalysts for change are recognised hence partial answer elicited for RQ1 with caveats.

Previous research expressed concerns that SMEs operated in an unstructured and reactive manner when innovation in the business model was required (Lindgren, 2012, p. 58 & 59). This study found that SMEs were often limited in their use of information technology, required top management support to implement new initiatives successfully, needed to cultivate culture of knowledge sharing, and lacked appropriate award mechanisms for employees. The potential for innovation was frequently underutilised, and there was a general shortage of the necessary to support business model innovation. The analysis revealed that 51% of the SMEs examined concentrated primarily on their value proposition and target customer, reflecting a traditional, and arguably limited strategic focus. This approach could be partially attributed to the inherently risky environments in which SMEs operate, where immediate operational demands often take precedence over long-term strategic planning. Limited resources further constrains their ability to explore and implement innovative business strategies. This evaluation recognises the reality in practice but now summarised may be useful for university practitioners in the business development field to reflect on RQ1.

Learning within SMEs has traditionally been constrained by structural limitations, such as flatter hierarchies and ineffective internal knowledge dissemination. These factors

can hinder the development of organisational learning and the ability to absorb and apply new knowledge effectively. The concept of absorptive capacity is particularly relevant here, as it encompasses not only the acquisition but also the assimilation and exploitation of external knowledge. In the case of Company D, the successful outcomes were closely tied to the recognition that additional knowledge was required across multiple operational areas, necessitating comprehensive training for all staff. A similar approach was adopted by Company C, a medium-sized enterprise at the time of the KTP project, which also implemented organisation-wide training initiatives. These cases illustrate the importance of enhancing absorptive capacity through deliberate, inclusive learning strategies within SME contexts. This partly answers RQ1 on approaches that would deliver long-term impact through knowledge exchange.

An insight from CSB is that there is recognition of a prevailing problem-solving only aspect as an existing situation in businesses (Abreu, et al., 2008, p. 38). The solution was found and solved by the KTP project and was based on gaining in house expertise and skills and this was repeated by employing the Associate and subsequently university placement students over the intervening period. The investment in research and development was focused on design innovation and speed rather than research, so a high impact recorded and little or no impact on the other areas related to knowledge impact. There was an indication that external collaboration had been explored in the 12 months prior to the interview in 2016 so this could indicate that a cautious approach is being adopted. The interview corroborated there had been no more changes so little or no impact on people, processes, marketing, leadership, strategy, and communications. This approach when applied with the other identified approaches partly answers RQ1 on what a successful approach with sufficient impact is to gain success in embedding knowledge.

Case Study D and E indicate by their continued activities and their growth from small to medium sized enterprises that relevant activities used to further progress will require parallel development of the business model. The lack of this type of progress is prevalent in Case Studies A and B as their initial objectives were achieved but no further development into overseas markets or change of products to service models. Case Study B still sells through third parties as it did in 2010 and continues the same practice some 6 years later when interviewed. The intervention of owner/manager and

associated detractions and lack of inclination to innovate due to costs in the main were raised in Case Study C.
Organisational learning must be stimulated, and this is reflected in CSD and CSE as they both went forward and CSE at the end of their second KTP installed R&D facilities in house and CSD had reached that as a conclusion for their next step at the time of the interview. Comparison of the distinctive two case studies CSD and CSE who continued to apply for receive funding and change hence advancing innovation gives evidence that the drive for success utilising innovation harnessed their entrepreneurial attitudes and behaviours to drive the business to success.

Organisational learning surfaced as a critical mechanism for value capture where case study analysis findings illustrated that operational learning and absorptive capacity are essential for embedding knowledge sustainably. In gaining improvements including using knowledge, skills, and expertise the leadership and management approaches can have an impact on the success and failure of the actions taking to take advantage of any improvements. The display of entrepreneurship was of a benefit to company D and E with the leadership required to drive the continued efforts. Company C there was successes but the difficulties with the leadership continued after the end of the KTP projects.

The acknowledgement that a key strategic asset lies in the utilisation of knowledge management “intellectual capital” means that SMEs need to consider changes to the strategic culture and the human factors alongside the necessary technological structure, mainly formed around information technologies (Meso & Smith, 2000, p. 233). Developing competitive advantage as a goal is supported by focusing attention on the factors that would harness the intellectual capital and the people who hold that. SMEs typically engage in knowledge management and exchange but in a more informal manner. Formalising these processes could potentially give greater influence in addressing cultural obstacles and gains made in competitive advantages.

RQ1 and RQ2 provided focus for the initial research objective by investigating the internal organisational factors and strategic behaviours that influence the effectiveness of KE. The effectiveness of knowledge transfer was significantly

amplified when integrated into the organisation's strategic framework, thereby generating long-term benefits that persisted beyond the formal duration of the KTP.

The survey question 7 asked "Since the KTP project ended has there been a change in the areas below to ensure knowledge gain is part of the strategy?" out of the forty-five businesses, five responded "Not at all". However, all the SMEs surveyed demonstrated an impact to varying degrees in most areas supporting the use of alignment of their actions with indicators that contribute to value creation. These indicators such as operational impact (OI) with their competitive position impact (CPI) and the relationship to the business model impact (BMI) all demonstrated high correlation.

5.3 Knowledge embedding and organisational

The mixed method approach to the data collection and the subsequent data analysis took direction from the research objectives and the subsidiary research questions. Now to discuss the outcomes and the impact on the research objective 2 we will discuss using the lens of addressing research questions 3, 4 and 5 in this and the next section.

Research Objective 2: To explore the long-term impacts of embedding knowledge within business processes.

RQ3: What long-term impacts SMEs achieve through collaboration with universities?
RQ4: Through what processes do SMEs embed knowledge gained via university-industry collaboration?

The literature on sustainable business models highlights a strong interdependence between long-term corporate sustainability and the sustainability of the underlying business model itself (Schaltegger, et al., 2016). Business model innovation is positioned not as a substitute for product or process innovation, but as a complementary mechanism that enhances a firm's capacity to create, deliver, and capture value over time (Amit & Zott, 2015). To support comparative and analytical purposes, scholars have developed a range of business model frameworks that

provide high-level representations across sectors and organisational contexts. Three dominant strands were identified (Zott, et al., 2011) in the evolution of business model research: technology-enabled and e-business models, performance-oriented models focused on competitive advantage, and innovation- and technology-management perspectives. Together, these strands reinforce the role of the business model as a valuable analytical lens for examining strategic renewal and innovation, particularly within dynamic and resource-constrained environments such as SMEs (Teece, 2017).

The increasing pressure to sustain competitive advantage within compressed innovation cycles highlights the growing importance of accessing external knowledge and expertise to support strategic business model innovation. As firms are required to adapt more rapidly, internal capabilities alone are often insufficient to deliver the scope and pace of change required. Consequently, the integration of external expertise becomes a critical mechanism for informing and shaping business model direction. This is particularly evident in relation to technological and strategic knowledge that enhances resource efficiency, where firms must not only acquire new capabilities but also develop a clear business case to justify investment and implementation (Adams & Comber, 2013; Hooker & Achur, 2014).

Although technological advancement and globalisation create substantial opportunities for SMEs to enhance competitiveness and pursue growth (Ahmad & Schroeder, 2011; Itami & Nishino, 2010), they simultaneously introduce significant strategic, operational, and resource-related challenges (Agyapong, et al., 2017; Bakhtiari, 2020; Bigliardi & Galati, 2013; Dubouloz, et al., 2021). While the effective integration of technology and strategy is widely recognised as essential for sustained performance, for many SMEs this remains more aspirational than realised, constrained by limited resources, capability gaps, and the competing demands of short-term operational priorities.

Collaboration represented a foundational step across all participating organisations, with each having engaged as a KTP partner, either currently or in the past. This initial engagement with external collaboration provided access to specialist knowledge, skills, and resources that were not readily available internally, and served as a catalyst for organisational learning and capability development. However, while participation in

a KTP established a shared starting point, the extent to which collaboration was subsequently embedded and leveraged varied considerably across firms, influencing the depth and durability of impact achieved beyond the formal life of the partnership. The empirical evidence supports the broader adoption of innovation led strategies among SMEs. By adopting a business-centric lens, the research focused on how knowledge is absorbed, embedded, and operationalised within SMEs beyond the formal KTP evaluation period. This enterprise-level focus enhances the relevance of the KTP mechanism for stakeholders and practitioners involved in daily management and strategic planning one of the long-term impacts achieved in collaboration with universities addressing RQ3.

Both Case Study D and E identified business model changes, and this was not envisaged at the start of the first KTP but was identified after some time and with the success of the KTP projects and securing further funding. Both these case studies, D and E, expanded collaboration and other global markets through export and expansion, respectively. An observation from Case Study E is that the SME benefited from the sustained presence of the resources and the discipline applied though application of project management approaches and this reduced their tendency to not 'waste' time as they saw it and abandon projects quickly moving on to another avenue. This is a demonstration of the sought-after long-term impacts in response to RQ3.

Owner/manager hierarchies had an impact in Case Study C where the funding smoothed the path to implementation and participation in the KTP project but a reluctance to push beyond that window was ever present. No money for investment was quoted as the reason. Similarly, no people or restricted on time as a resource but they did employ the KTP Associate. In Case Study A and B there was no ambition shown to go through any more change over and above achieving the objectives of the KTP and both did employ the KTP Associate. Case Study A was included in the context of the period but as a charity the value chain is a different measure and not linked to profits and growth through financial gain. Their achievements or impact is linked to their increased availability of their services to the focused population for the charity, 16 to 21 years old in this case. The evidence discussed here answers RQ3 and RQ4 in line with Research Objective 2 where this data exploration highlights the

long-terms impacts. RQ3 focused on the collaboration with universities and RQ4 focussed on the processes used by SMEs to embed knowledge.

Although government policy initiatives such as Help to Grow (GOV.UK, 2021) continue to promote best practice adoption, persistent resistance among SMEs (BEIS, 2019) highlights the need for a deeper understanding of leadership behaviours, organisational culture, and decision-making practices in relation to knowledge exchange. This research addresses this by examining leadership and business model decisions from the perspective of SME participants, thereby providing insight into the impact of embedding knowledge in practice. This reflects the premise of RQ4 leading to identification of a relevant process to embed knowledge.

The comparison of case studies provides actionable strategies related to value creation for other SMEs and this strongly impacts where there is innovation and entrepreneurship and that this is cycled continuously. Case Study D and E exemplify this both having a record of multiple further funding initiatives including KTPs in completely different industrial sectors supports this best practice. Case studies A and B reflect the outcomes from a KTPs project where the objectives were the goal and changes put in place immediately grew in impact over the intervening period when surveyed and interviewed. Case study B reflects the owner/manager limiting the entrepreneurial ambition as there was more focus on having achieved the objective and the operation continued better than before with skilled staff as the Associate had been employed in the business. There was recognition of the benefits achieved with skilled staff from the initial KTPs project and consequently industrial placements offered to university graduates to continue that practice. Again, the evidence in practice from the KTP case studies highlights the impact of the university-industry collaboration and how knowledge is embedded contributing to answering RQ3 and RQ4.

Of the forty-five companies surveyed 60% of them reported a growth pattern of greater than 6% in the period between the completion of their KTP projects and the survey in 2018. An additional noteworthy result is that, collectively, 45% of the surveyed SMEs reported a growth of exceeding 10%. Case study analysis supported these figures, with two companies growing from micro to medium sized, financial data from

interviews confirmed the growth trajectory. This highlights a positive economic impact of KTP participation for many businesses, though some reported stagnation or decline, influenced by external economic factors and internal organisational challenges. A high proportion of respondents (64% to 68%) reported impacts across eight categories summarised as the Competitive Position Impact (CPI). Similarly, high proportions (60% to 67%) declared impacts within eight categories measuring the Operational Impact (OI). The case studies corroborated similar improvements in these impact areas. Growth is the focus of this section, and the long-term impacts are demonstrated and is in line with achieving Research Objective 2.

For HEIs including the authors own it is anticipated that the analysis completed in this work and the report outcomes can be used as a case study not only for the discussions with potential SME partners but for bringing into the classroom to show how research can have an impact. The employment of recent graduates is always supported by HEIs and is a key outcome for KTPs to integrate the knowledge exchange, skills, and expertise into any business specifically SMEs as they have restrictions in employing suitably skilled personnel. Previous work has shown that the employment of KTP Associates, as shown in the case study data, into the KTP company after the project has concluded aligned with continued successive success. The case study data highlights that the participation of the KTP Associate in the project and potential employment can lead to innovation and change on many more levels and areas than a single new product initiative supporting previous review outcomes (Siora, et al., 2015).

KTP outcomes are positioned in this research as a central mechanism for enabling enduring organisational change in UK SMEs. While national level evaluations offer broad insights into SME performance, innovation, and investment trends, this study narrows its focus to the specific context of KTPs as a particularly impactful form of university–industry collaboration.

5.4 Long-Term Impacts of University–Industry Collaboration on SMEs

Research objective 3: To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

To achieve this research objective three research question five was linked in the as the prime inquiry to achieve that outcome. Research question five focuses on the outcomes of sustainable change and the mechanisms through which businesses integrate knowledge to generate and capture long-term value.

RQ3: What long-term impacts do SMEs achieve through collaboration with universities?
RQ5: Why and how does this embedded knowledge lead to sustainable change and value capture within business models?

The difficulties with knowledge exchange are complex as it is linked to the size of the company, motivation of the leadership, motivation of the employees, differences in culture if external to the business, non-engagement, and a lack of understanding of the benefits. A number of studies supports this (McGuinness, et al., 2013; van Wijk, et al., 2008; Hansen, 1999; Easterby-Smith, et al., 2008; Inkpen & Pien, 2006; Inkpen & Tsang, 2005) A recommendation from other work is that knowledge exchange or transfer should be viewed as a process rather than a single act and there can be overcomplication increasing the level of difficulty (Szulanski, 2000). The review of the existing literature in section 2.1 supports that effective knowledge exchange, has a long-term impact and contributes to sustaining a business, required for national productivity benefits (Van Reenen & Xuyi, 2024; Criscuolo & Lalanne, 2024) and economic growth (OECD, 2024, p. 21).

Exploring the existing literature on organisational learning culminated in the following proposition: Effective organisational learning facilitates absorption of knowledge across the business, enhancing the organisation's ability to remain competitive in a constantly evolving market environment. Across the five case studies, a clear theme emerged highlighting the importance of comprehensive training for all staff, in adopting the new offering introduced through the KTP project. This widespread engagement with organisational learning proved essential to achieving successful outcome. Notably, Case Studies D and E illustrate how the effective embedding of this learning within organisational practices enabled significant value capture. These findings underscore that initiating organisational learning alone is insufficient; its systematic

integration is crucial to unlocking its full potential. This supports the answering of RQ5 and partial support for Research Objective three.

The literature review explored the current body of knowledge within the context of SMEs across leadership, knowledge management and exchange, innovation and competitiveness. Several key findings emerged, firstly it is essential for SMEs, particularly their leadership teams, to actively engage in benchmarking against comparable successful businesses. Such strategic engagement represents a crucial pathway to cultivating effective entrepreneurial leadership (BEIS, 2019). A second finding was that the UK's innovation policy framework often overestimates the strategic readiness and absorptive capacity of SMEs. Current policies, while valuable, must be refined to address the varied capacities of SMEs, the complexities of innovation uptake, and regional inequalities in institutional support. A third finding was that sustainable competitive advantage is closely tied to the capacity for successful knowledge exchange and one of the greatest challenges in broadening the knowledge exchange policy agenda concerns the absorbing and embedding knowledge across businesses. These findings add support to answering RQ5 to ascertain that embedding knowledge leads to sustainable change and value capture within business models.

Knowledge exchange in the reviewed in the existing literature highlighted the tacit and explicit knowledge are recognised as being required across all parts of the business from software use, IT skills and expertise, Customer Relationship Management, accounts management to problem solving and project management. The use of external skills is not widely supported by SMEs, but they cannot attract the same calibre of people as large companies with the necessary skills and expertise as they do not and cannot support higher wage brackets. Implementing Knowledge Exchange in most cases, including KTPs requires justification and expected returns to be calculated, and the funding provided by the KTP forms part of that attraction to entice SMEs to adopt. A similarity for SME businesses in that the business case has extra weighting on cost savings over time versus investment potential. At the end point of the KTP project the project management discipline, in the experience of the author, which was perceived as being embedded during the KTP project immediately regresses back to individuals making decisions based on their sphere of influence.

This discussion area goes some way to showing some barriers that were elicited exploring with research question five to achieve research objective three.

Case studies A to E highlight the impact of the process of knowledge exchange and this was acknowledged in all interviews. There was recognition of more being achieved than what was originally forecasted, and this was reflected in the reported Sales Turnover figures supplied for CSA – CSC and CSE. CSA and CSD did gain awards that were part of the long-term objectives and for CSA that improved their standing in their sector and led to collaborations and joining with a consortium and for CSD it gave them access to customers in another industry sector. Qualitative data together with the quantitative data supports positively research objective three that to some extent there are patterns and relationships that contribute to the creation of value propositions after completion of a KTP project and the results are sustainable if certain other factors are in place.

The identification of factors that encourage proactive consideration rather than perceiving the business model as an unpredictable result has been demonstrated by Case Studies CSD and CSE. Deliberate actions and structured planning developing strategic actions in shaping the business model have been highlighted. Still unresolved is the statistical confidence which could be developed by further work in responses from SMEs involved in the KTPs approach. Previous KTPs studies (Ternouth, et al., 2012) and (Siora, et al., 2015) focused on a mixed representation for the feedback to build their constructs and measurements leading to generalisation, but this work has a single type of respondent that of the SME business not the Knowledge Base or the Associates. The focus on the SMEs that are KTPs partner should be one mainstay of an improved survey catchment as it supports the SMEs to believe or trust as it represents them and their story which they have a predilection for and can believe in.

The case studies reviewed in this research provide clear evidence of successful outcomes where effective change management processes were implemented with careful planning and oversight. These findings suggest that structured and disciplined approaches to change can significantly enhance the likelihood of achieving intended objectives. A particularly illustrative example is found in the case of CSE, where adherence to a systematic and well-supervised KTP process facilitated the

development of critical knowledge and understanding. Prior to this, the organisation tended to abandon experimental initiatives prematurely in favour of alternative ideas. The introduction of academic rigour, combined with structured project planning and continuous monitoring, had a transformative impact on CSE's innovation process. This case underscores the value of integrating academic frameworks and disciplined project governance in fostering sustained innovation within SMEs. Hence this evaluation of the qualitative analysis presents on the 'how' of research question 5 illustrating the impact of embedding knowledge into a business and achieving sustainable change in the business.

A key finding emerging is that the two case study organisations that engaged in multiple funding rounds, including successive KTPs and collaborative R&D initiatives, were able to identify and develop distinct unique selling propositions (USPs). These were realised either through the creation of new products or through enhanced understanding of the strategic importance of protecting specific innovations to maintain ownership and manage the resulting impact on their business models. Another notable outcome was the retention of KTP Associates beyond the formal completion of the projects, even if only for a short period. This continuity played a crucial role in sustaining the momentum of innovation and ensuring the ongoing progression of the initial KTP initiatives. The exception was CSE, where the Associate transitioned to employment elsewhere. However, in subsequent KTPs and other funded collaborations, the academic researcher originally involved in the project was retained by CSE in a supervisory and managerial capacity, thereby preserving a link to the knowledge and practices developed through the initial engagement. Some correlation discussed here supports the impact of embedding knowledge through knowledge exchange by the KTP mechanism and the KTP Associate hence achievement of research objective three.

The need to exploit technology is a theme in relevant sector literature (Cerchione & Esposito, 2017, p. 1561) and especially so for SMEs however they may not be aware of the significance to not only adopt but to maintain knowledge management practices leading to embedded practices that bring benefits. To capitalise on the opportunities for change and innovation it cannot be a onetime event but must be driven and be repeated continually. The capacity to absorb new knowledge must be supported and

the culture changes, strategic and operational, must be in synergy with the strategic actions so that it is implicit that this action will bring benefits to the business. The literature review identified three elements for learning-based strategy that if aligned would significantly influence and enhance the business competitiveness (Ahmad & Schroeder, 2011, p. 20) and this supports the exploitation of technology and supports the 'why' section of RQ5.

Within the Knowledge Impact category, CSB recorded the lowest impact score at 8, whereas CSA and CSC achieved the maximum score of 20 out of a possible 20. CSD and CSE followed closely with scores of 19 and 17, respectively. CSA reported in 2016 that internal knowledge and skills had been significantly enhanced because of the KTP and that these improvements continued to be evident four years after the project's conclusion. The impact of knowledge exchange across the participating businesses was multifaceted, encompassing enhancements in employee capability, the development of internal competencies, the initiation of further research and development activities, and the establishment of new or strengthened external collaborations. These outcomes collectively reflect the broader organisational benefits derived from effective knowledge transfer processes contributing to adresssing RQ5.

This study explored contemporary activities and research findings related to business models and subsequently refined these insights by incorporating key factors to develop a BMI measure. Analysis identified critical competitive strategy elements including the articulation of unique selling points (USPs), leveraging of strengths within the knowledge economy, promotion of patented intellectual property, and identifying distinctive organisational competencies. These elements collectively contributed to the formation of effective business strategies. The findings indicated that, to fully exploit innovative technological research in a sustainable manner, a differentiated business model and recruitment of skills was essential for capturing value. As new ideas and technologies were commercialised, value creation and value capture were achieved through the strategic deployment of tailored business models alongside the employment of KTP Associates.

In practice there is impact that continues after the KTP concludes and the KTP Associate is the epicentre for that change. In personal experience the use of the KTP

Associate IT skills and expertise can prompt improvements in the fundamental operations of the business around data collection and analysis and realise benefits not previously thought about. Unsuccessful KTPs include bad partnerships of the associates and or the academics but the grip of the owner /manager if they do not totally agree with proposed actions for improvements that can provide insurmountable barriers to the KTP project objectives. Case study C has an example of this and in the author's experience the owner /manager in one past KTP was determined to develop the IT of the company but resistance from employee relations proved insurmountable and the project did not complete.

All the Case Studies offered employment to the KTP Associate only Case Study E did not achieve that but actively employed more skilled and knowledgeable staff for subsequent funded research projects and continued with KTP projects and employing the KTP associates. They continued to recruit and used the knowledge base developing the relationship with the University KTP partner and gaining access to research equipment and skills. These situations should prompt for more to be done at the start up or initial communication and currently there are some initiatives around this including the new Accelerated Knowledge Transfer to Innovate (AKT2I) Pilot Scheme and the KTP Capacity Building Competition for Knowledge Bases which both focus on start and trust building on KTP application.

The case studies provided clear evidence of enhanced competitive positioning across the participating organisations, as demonstrated through revenue growth, international expansion, and strengthened external collaboration. Company A reported a revenue increase of over 10%, rising from £1.8 million in 2012 to £2.236 million by 2015, while Company B achieved a 33% increase in turnover, reaching £855,000 in 2015. Company C experienced substantial growth, with revenue rising from £11.565 million in 2011 to £14 million in 2015, surpassing initial projections. Company D expanded its international presence significantly, successfully entering 40 overseas markets. The most notable growth was observed in Company E, where revenue more than doubled from £6.7 million in 2013 to £15 million in 2021, ultimately leading to the company's acquisition and reflecting a marked increase in market value.

External collaboration also played a pivotal role in shaping competitive positioning. Company A enhanced its influence within the public sector through active participation in a consortium, while Company C leveraged external partnerships to support market research and product quality improvements, though internal resistance limited the full impact. Companies D and E proactively engaged in government initiatives, international trade missions, and global R&D collaborations, which contributed to their strategic positioning and long-term competitiveness. These findings underscore that competitive advantage was driven not only by internal innovation capacity but also by the ability to navigate, build, and sustain external networks and partnerships. This affirms the contribution of embedding knowledge exchange to achieve sustainability and drive value capture by SMEs and the associated impacts.

The analysis of the survey data provided a clear indication of the key relationships and their alignment with the actions that contributed to success within the Business Model Impact (BMI) framework, as well as with activities that demonstrated the presence of embedded knowledge. The achievements of the KTP projects were evident, particularly when project objectives were met, and financial outcomes were summarised and assessed in the final KTP reports.

Survey comparisons revealed that the Growth Indicator (GI) enabled differentiation among cases and allowed meaningful comparisons to be drawn. While there emerged a perspective that GI could function as a standalone metric, the analysis suggested that incorporating a broader view across the entire value chain could yield greater insight and benefits. SMEs tended to align themselves within peer groupings, and the use of multiple impact factors offered a more comprehensive explanation of success, not solely in terms of whether growth was achieved, but in terms of how it was accomplished. This aspect of the quantitative data supports answering research question five.

The long-term impacts identified in this study from case study analysis underscore the significance of sustainable business practices as a critical factor for enduring organisational success. In the context of KTPs, the case studies and interview data revealed a wide spectrum of quantifiable outcomes. Notably, Case Studies CSD and CSE demonstrated high levels of success, as evidenced by substantial growth in employee numbers. CSD, for example, began its engagement with KTP in 2012 and

subsequently undertook three additional KTP projects, contributing to its transition from a micro to a medium-sized enterprise. Similarly, CSE followed a comparable growth trajectory. Case Study CSB, while remaining smaller in scale, exhibited a 40% increase in employee numbers, growing from 9 to 12 staff between 2010 and 2016, thus moving from micro to small enterprise status. In contrast, Company A, a charitable organisation, did not register high scores on traditional business model innovation (BMI) or growth metrics. However, success for this organisation was reflected in the expansion of its customer reach and a significant increase in grant-based income, aligning with its social mission rather than commercial growth indicators. For CSA and CSC, post-KTP outcomes did not include marked staff increases, but both demonstrated advancement through the acquisition of new skills and the internal expansion of organisational knowledge. These varied outcomes highlight the importance of aligning success metrics with organisational purpose and sector-specific definitions of impact. Fully in line with satisfying research objective three and research question five.

The survey analysis did build a relationship between value creation activity and the business model impact (BMI). The uniqueness of each SME and its operation did not allow for direct comparison, and the number of responses did not deliver a considerable proportion of the available population for statistical analysis to ensure contribution to generalisability of the outcomes from the analysis. The impact reports developed allow for the individuality of each business to be measured and compared to a common set of factors with the Business Model Impact as summation of the performance. The resulting impact reports, exemplified in Appendix 15, provide an adaptable tool for assessing and communicating KTP outcomes, particularly in the SME context where impacts are often highly individualised yet strategically meaningful.

5.5 Barriers and challenges

Over the past decade, independent evaluations of KTPs have consistently examined their structure, implementation, and outcomes, with particular emphasis on identifying critical success factors and assessing their financial and strategic contributions to

long-term economic sustainability in the UK (Technology Strategy Board, 2012; Innovate UK, 2013; Innovate UK, 2014; Siora, et al., 2015; Ternouth, et al., 2012). KTPs relationship models have the intention and history where they support and guide to success but add structure and discipline that may not always be present in SMEs in normal day to day operations. Academic engagement has been shown to generate significant economic value for both universities and industry partners by facilitating knowledge transfer, strengthening collaborative relationships, and enhancing innovation capacity, often delivering broader and more sustained benefits than formal commercialisation alone (Cohen, et al., 2002). Within this context, the triple helix model reinforces the strategic alignment between universities, industry, and government, positioning collaborative knowledge exchange as a central mechanism for innovation and economic growth, an impact increasingly captured through transformative engagement metrics within the Knowledge Exchange Framework (Etzkowitz & Chunyan, 2017; Johnson, 2022). The contexts in which the knowledge exchange is applied can be complex due to people's behaviour in their environment; the competitive environment and other internal characteristics hence not one size fits all.

The literature review considered aspects of knowledge exchange on SMEs including the impact if realised by referring to previous success and the longevity of the KTPs approach. Lack of resources in SMEs are one of the main barriers raised in debates and that is where the KTP increases that resource with the addition of a funded KTP Associate and a free access to the university partner and their knowledge. The lack of resources cannot be minimised for SMEs as they can have a focus on the preservation of profits and do not willingly see the desired outcome if they invest. Others suggest that the resource constraints traditionally associated with small sized business in comparison to the medium sized businesses do not inhibit innovation but may dictate how it is pursued (Saunila & Ukko, 2014).

In summary, while technological advancement and globalisation offer unprecedented opportunities for SMEs, these same forces present significant challenges. Effective strategy technology integration is essential but often remains aspirational due to the resource and capability constraints SMEs face. Current policies and support programmes must therefore be reoriented to reflect the heterogeneous nature of

SMEs, offering more customised, scalable, and accessible pathways for innovation-led growth.

Reflecting on the summaries of both the quantitative and qualitative criteria for analysis it is prudent to acknowledge the impact levels mapped to the indicators

5.6 Summary of major insights in relation to research objectives.

To achieve the aim of this research three research objectives with associated subsidiary research questions were formulated. This study contributes incrementally to the academic literature by integrating theoretical and empirical insights within a real-world, practice-based context.

Government policy initiatives promote best practice adoption, but a persistent resistance among SMEs (BEIS, 2019) highlights the need for a deeper understanding of leadership behaviours, organisational culture, and decision-making practices in relation to knowledge exchange. This research explored leadership and business model decisions from the perspective of SME participants, thereby providing insight into the impact of embedding knowledge in practice achieving Research Objective 1 through addressing RQ1 and RQ2.

Entrepreneurial leadership, their capabilities and organisational learning are isolated as critical enablers for innovation in SMEs and embedding knowledge within their businesses impacting the bottom line (Shepherd, et al., 2010; Mole, 2021). Industry stakeholders are often persuaded by empirical evidence of bottom-line benefits and data presented provides the real-life data for practitioners within HEIs and SMEs. As one of the emergent themes indicated the lack of heterogeneity of the SME is a stumbling block but perhaps this work can be a springboard for policymakers to recognise and address.

The survey patterns analysis heavily supported addressing RQ2, RQ3 and RQ4 quantitatively such as “how many” but the qualitative analysis provided the nuances that shaped the “how” aspect of this research. The patterns discerned from the five case studies indicated that the more entrepreneurial the activity by a business

including the continued seeking of more funding correlated with greater growth, value capture and opportunities for innovation and change, including business model transformation. Case Study D and E exemplified this trend. The qualitative data identified three overarching themes: (1) learning culture and operational transformation, (2) strategic leadership and entrepreneurial orientation, and (3) knowledge exchange and business model innovation. The correlations outcomes from the quantitative data analysis support this theme where OI, KI and LI are related and the research indicated that their application supports success and effective impacts in embedding knowledge.

Building on the premise that economic profit derives from control over scarce resources, this dissertation positions skill acquisition, knowledge management, and the cultivation of organisational learning as critical strategic imperatives. Across all case studies, there is consistent evidence of positive value capture, encompassing both immediate financial returns and longer-term strategic outcomes, directly addressing RQ3 and RQ5. Specifically, organisations exhibit revenue growth, the development of strategic capabilities, and the potential for sustained advantage. Firms demonstrating larger innovation outputs, such as CSD and CSE, report transformational impacts, as evidenced in interview data highlighting significant organisational and market benefits, aligning with RQ3's focus on long-term impacts and RQ5's emphasis on how embedded knowledge generates enduring value. Conversely, smaller firms, including CSA and CSB, experience proportionally sharper percentage gains, reflecting the role of KTPs in accelerating capability development relative to baseline size. Collectively, the cross-case evidence demonstrates that KTPs contribute not only to immediate operational and financial improvements but also to the embedding of knowledge that supports sustainable organisational change and strategic value capture, with the degree and nature of impact shaped by firm size, absorptive capacity, and innovation trajectory.

The mapping of the relevance of the qualitative and quantitative criteria indicated matching levels of impact, H/High, M/Medium and L/Low, for the research questions. This is evidenced in the impact or relevance for each case study in the analysis of the results for the qualitative data. Hence the original conceptual model is insufficient as it does not reflect the actual processes as we have determined it is not linear and a

systematic effect in one partnership but a cumulative effect. There is evidence and the analysis suggests that the size of the business has an effect, as does the sector and the start point. Table 33, Table 34 and Table 41 when illustrate the impact and relevance across the quantitative and qualitative indicators. Additionally, the case studies narrative gave verification to the capturing of the dynamic nature of the processes involved and the refinement of the conceptual framework will reflect that.

The next chapter presents the conclusions drawn from this thesis.

Chapter 6.0 Conclusions

This section concludes the thesis. The chapter will concisely reiterate the aim of the research and how that and the objectives were accomplished. The main conclusions will be presented. Other significant and impact of findings in the context of the literature will be presented. Contributions to knowledge will be included, an indication of the future research and limitations. In summary, this research delves into the impact of knowledge exchange on UK SMEs, focussing on the embedding of knowledge and its resultant effects. This research examined knowledge exchange and its impact on driving sustainable change, with focus on the business. The areas being explored impact of knowledge absorption, impact on the business leadership, characteristics used in practice and the eventual value capture for sustainable impact on the business model. The key aim was to gain knowledge and understanding of the extent the impact of knowledge exchange delivered sustainable change to businesses.

The research adopted an iterative, mixed methods design grounded in social research traditions, integrating both qualitative and quantitative data to generate and refine emerging theoretical insights. Through the examination of five case studies and survey responses from forty-five companies, there has been success in mapping the attributes that contributed to value capture and the impact within the selected specific categories. The findings not only contribute to the existing knowledge base but also highlight practical implications and actionable strategies for sustained and significant value creation. The research had three clear objectives:

- To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.
- To explore the long-term impacts of embedding knowledge within business processes.
- To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

The analysis of the qualitative data identified three overarching themes: (1) learning culture and operational transformation, (2) strategic leadership and entrepreneurial orientation, and (3) knowledge exchange and business model innovation. The findings

support the proposition that KTPs, when underpinned by strong leadership, an open organisational culture, and a clear strategic vision, can significantly enhance innovation, organisational growth, and the embedding of knowledge within firms.

6.1 Research Objective 1

To examine the operational characteristics and organisational strategies that underpin effective knowledge exchange.

This research reinforces that experiential and organisational learning, deeply rooted in human development theory, are essential to driving innovation and long-term success in SMEs. While existing literature highlights the importance of continuous feedback, adaptive learning cultures, and the processes of creating, retaining, and transferring knowledge, this study focused on whether these practices were genuinely embedded within SME contexts. Despite recognised benefits, research also cautions that success is not guaranteed without appropriate organisational support.

The literature review highlighted the emergence of Entrepreneurial Leadership as a vital enabler across business types, shaping innovation, adaptability, and talent strategies. However, SMEs continue to face persistent barriers such as limited access to finance, skilled labour, and markets, alongside cultural resistance to strategies perceived as suited only to larger enterprises. Government and academic initiatives increasingly promote open innovation and knowledge exchange, aiming to enhance competitiveness and support value capture through commercialisation. The findings suggest that collaborative R&D, when effectively integrated into business strategy, can have long-term, system-wide impacts. Ultimately, the ability of SMEs to adopt ambidextrous organisational designs, balancing exploration and exploitation, is key to sustaining growth and innovation. Rather than representing discrete effects, these domains operate as a mutually reinforcing system of capability development, strategic transformation, and value creation.

The findings identified the operational characteristics and organisational strategies that underpin effective knowledge exchange. This study confirms that KE within SMEs is a complex, non-linear process shaped fundamentally by entrepreneurial leadership,

absorptive capacity, and organisational learning. While these factors are well-theorised in the literature, their practical implementation varies significantly among SMEs due to leadership style, organisational culture, and strategic orientation. The research examined post-KTP environments, finding that sustained innovation and business model transformation coupled with leadership that actively supported learning and knowledge integration were most effective. Correlation analysis revealed strong interdependencies between knowledge, operational, and leadership impacts, though these relationships were not straightforward, reflecting the nuanced nature of change in SME contexts.

A key finding is that leadership style, particularly entrepreneurial orientation, played a crucial role in amplifying the impact of KTPs. Case studies D and E demonstrated continued innovation and growth through proactive knowledge embedding and business model adaptation, while more hierarchical or passive leadership in other cases limited long-term impact. The results underscore the importance of embedding organisational learning across all staff levels and institutionalising knowledge-sharing practices to ensure sustainability.

The study also highlights the heterogeneity of SMEs, challenging assumptions that one-size-fits-all approaches are effective. Cultural resistance, leadership inertia, and a focus on immediate operational needs often impeded innovation, even when external support mechanisms like KTPs were in place. Structural constraints, informal knowledge processes, limited access to finance, and underdeveloped technological infrastructures further limited SMEs' ability to fully exploit knowledge for competitive advantage.

A dominant theme across the literature is that KE generates long-term impact by strengthening firms' absorptive capacity, their ability to recognise, assimilate, transform, and exploit new knowledge (Nonaka & Teece, 2001; De Wit-de Vries et al., 2019). Absorptive capacity emerged as a vital capability, enabling firms to recognise, assimilate, and apply external knowledge. Where training and knowledge diffusion were inclusive and organisation-wide, impact was more profound. However, without strategic alignment and leadership endorsement, such efforts often failed to translate into lasting change for SMEs.

Innovation remains a central focus for government policymakers, who monitor it in ongoing cycles due to its critical role in driving economic growth. The open innovation paradigm highlights the importance of firms leveraging both internal and external ideas and pathways to market as they advance their technologies (Lopes & Carvalho, 2018, p. 296). Effective knowledge exchange and collaboration are essential to enhancing supply chains, boosting competitiveness, and fostering knowledge-based economies (Schofield, 2013, p. 52). Translating research and development into commercial value can generate significant returns rights (Oliver, 2020, p. 758). Moreover, academic engagement with SMEs can create long-term impacts that extend beyond immediate collaborators, influencing wider ecosystems of stakeholders (Rosli, et al., 2018, p. 419). To achieve such outcomes, firms must adopt ambidextrous organisational designs that balance exploration of new opportunities with the exploitation of existing capabilities (Tushman, et al., 2010, p. 1348).

Correlation analysis demonstrated statistically significant positive associations among Knowledge Impact, Operational Impact, and Leadership Impact, with correlation coefficients equal to or exceeding 0.5. The findings from the case studies demonstrated that the depth and sustainability of knowledge transfer outcomes is pivotal on the leadership actions. Leadership Impact revealed strong correlations with both Knowledge Exchange Impact and Operational Impact, despite the demographic breakdown indicating a uniform 50% impact across each leadership sub-category. This suggests that while the overall levels of impact appear evenly distributed, the qualitative influence of leadership can vary significantly depending on its nature and application.

While the overall levels of impact appear evenly distributed, the qualitative influence of leadership can vary significantly depending on its nature and application. In particular, the entrepreneurial orientation demonstrated by leadership in Case Studies D and E exemplifies the positive role leadership can play in amplifying impact across other domains. In contrast, Case Study C exhibited a more hierarchical leadership style, which appeared to impede the pace at which knowledge exchange processes were embedded within the organisation. When benchmarked against the average

Leadership Impact scores of the forty-five participating businesses, Case Studies CSA, CSC, CSD, and CSE all performed above average.

Theoretical Contribution

- Extends absorptive capacity theory by showing that leadership capability activates and sustains absorptive capacity in SMEs.
- Advances entrepreneurial leadership theory by evidencing leadership as both an antecedent and an outcome of KE.
- Refines organisational learning theory by demonstrating that learning generates impact only when deliberately embedded into routines and practices.

Addressing Research Question 1, the types of long-term impacts, the literature review identifies candidate impact types; the pilot confirms relevance; the survey corroborates these types and highlights associations with organisational characteristics for qualitative follow-up; the case studies then evidence how these types of impact manifest in practice.

Concluding that Research Objective 1 was met by this research and adds to the body of knowledge and advances the need to integrate enterprise-level focus findings and utilise them to direct the future theoretical research. There is some direction for the practitioners and government bodies that there should be increased focus on the pivotal aspect of the leadership and their entrepreneurial skills and knowledge. Case Study analysis supports that the practices and implementation of KTPs take cognizance and support embedding organisational learning across all staff.

6.2 Research Objective 2

To explore the long-term impacts of embedding knowledge within business processes.

To achieve this research objective the findings were based on the empirical findings to satisfy RQ3 and RQ4. RQ 3 explored the long-term impacts SMEs achieve through collaboration with universities. RQ4 explored the processes SMEs embed knowledge gained via university-industry collaboration.

Case studies provided depth to exploration in to support the activity to achieve research objective two. Showcasing all that those five cases achieved in growth from micro to small and further to medium-sized businesses. Two of these cases stood out as exemplars, characterised by constant investment, entrepreneurial approaches, and discernible changes in the business model. Others took a more cautious approach, but all benefited from, and embedded knowledge gained through KTP Associates, enhancing their internal knowledge base, and learning from the KTPs project.

The case studies further illustrated aspects of knowledge exchange in practice revealing that the impact extended into areas not initially considered at the project's inception. Successive project implementations served as a springboard for additional positive outcomes. The demonstration of success in securing further funding over an extended period coupled with the transformation from micro to medium sized enterprise as demonstrated in Case study D and E, is applicable across various industrial sectors.

While UK policy has made progress in recognising the role of SMEs in the innovation landscape, significant gaps persist between intention and impact. A more nuanced, accessible, and capability-sensitive approach is required, one that better bridges the academic-business divide and targets support where it is most needed.

Theoretical Contribution

- Advances process-based views of knowledge transfer by conceptualising embedding as iterative and cumulative.
- Extends dynamic capabilities theory by showing how SMEs develop sensing, seizing, and transforming capabilities through repeated KE engagements.

Addressing Research Question 2, processes through which impacts are achieved, the literature review motivates a process-oriented framework; the case studies trace sequences from initiation to co-production to routinisation, providing a more detailed qualitative account of how different routes produce distinct impact types.

KTP outcomes are positioned in this research as a central mechanism for enabling enduring organisational change in UK SMEs. While national-level evaluations offer broad insights into SME performance, innovation, and investment trends, this study narrows its focus to the specific context of KTPs as a particularly impactful form of university–industry collaboration providing insight into the impact of embedding knowledge in practice. This study adopted a longitudinal perspective to address the second core objective: to explore the enduring impacts of embedding knowledge within business processes.

6.3 Research Objective 3

To identify how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs.

Prior reviews and investigations into the attributes and impact of KTPs, conducted by UK Government's BEIS and Innovate UK, have identified the need for further exploration into the "how" aspect. These studies have revealed correlations between effective knowledge outcomes and measurable impacts. It is important to approach the findings with caution, but the research suggests significant impact on the SMEs participating in the studied categories. While not all SMEs experienced specific changes in their business models, they did demonstrate overall transformation during and after the KTPs project supporting the theoretical grounded studies and subsequent reviews.

The value created and captured through knowledge exchange is reflected in the measurements of growth, profitability, and improvements. Case studies D and E suggested that leveraging multiple KTPs for further development provided a strategic advantage, showcasing that a shift in the business model is necessary to accommodate and reflect the demonstrated changes. This shift has resulted in increased company size, enhanced local employment, and increased exports and international expansion. In conclusion, a dynamic Business Model that adapts to evolving business needs, changes due to innovation in products and practices as exemplified in Case Studies D and E, is essential for sustained growth and broader positive impacts.

The case studies reviewed in this research provide clear evidence of successful outcomes where effective change management processes were implemented with careful planning and oversight. These findings suggest that structured and disciplined approaches to change can significantly enhance the likelihood of achieving intended objectives. Semi-structured interviews, complemented by secondary data from publicly available sources such as Innovate UK (Innovate UK, 2022), yielded valuable insights into additional funding pathways exemplified by two of the five case studies. These findings illustrated concrete outcomes in innovation capability and competitive advantage.

The empirical evidence supports the broader adoption of innovation-led strategies among SMEs. By adopting a business-centric lens, the research focused on how knowledge is absorbed, embedded, and operationalised within SMEs beyond the formal KTP evaluation period. This enterprise level focus enhances the relevance of KTPs for stakeholders and practitioners involved in daily management and strategic planning, thereby addressing the final objective identifying how knowledge exchange contributes to sustainable business change and value capture, particularly within SMEs. Together, these findings demonstrate that university–industry collaboration can generate enduring economic and strategic benefits for SMEs.

Theoretical Contribution

- Extends business model innovation theory by empirically linking embedded knowledge to sustained value creation and capture in SMEs.
- Integrates knowledge-based theory of the firm with business model scholarship by positioning embedded knowledge as a strategic asset.

RQ3. What long-term impacts do SMEs achieve through collaboration with universities?
RQ5. Why and how does this embedded knowledge lead to sustainable change and value capture within business models?

Addressing Research Question 3 and 5, the long-term impacts addressed by RQ2 balanced against the UIC with HE and the value capture processes needed for SMEs,

the literature review provided the exploration and studies over the last two decades highlighting future national and international goals. The case studies and survey indicated that key characteristics are required for the leadership to gain success advocating a key item, Entrepreneurial Leadership. The qualitative data, corroborated by quantitative findings, provides robust insights into the characteristics and consequences under investigation. This research underscores that SMEs play a proactive role in fostering their own innovation and engaging in research and development activities to enhance their value creation, KTP is a vehicle for that. Recognising the importance of injecting new talent into their knowledge ecosystem, SMEs find it more attainable to attract individuals to their business when they establish a sustainable competitive advantage through successful knowledge exchange and tangible achievements. The case studies and surveyed businesses affirm that SMEs are supportive of this approach, with indications suggesting that KTP Associates play a pivotal role in driving knowledge acquisition and facilitating successful transformative changes.

6.4 Refined Conceptual Framework

The overall research aim:

To what extent does the impact of knowledge exchange deliver sustainable change to businesses?

Overall, the research addressed core questions: the conditions that underpin effective knowledge exchange and leads to long-term impact, and how entrepreneurial leadership shapes this process. It concludes that sustained knowledge utilisation in SMEs requires more than technical solutions, it demands strategic, cultural, and behavioural change, especially at the leadership level. These insights offer valuable implications for practitioners, policymakers, and academics engaged in SME development and knowledge exchange initiatives.

This body of findings implies that the original conceptual framework requires evolution from a relatively linear “knowledge exchange → impact” model into a more dynamic, capability-based, and leadership-mediated framework. This is shown as a shift from

linear causality to a dynamic, systemic model, shown below in Figure 13, where sustainable change emerges through iterative capability accumulation, not one-off knowledge transfer.

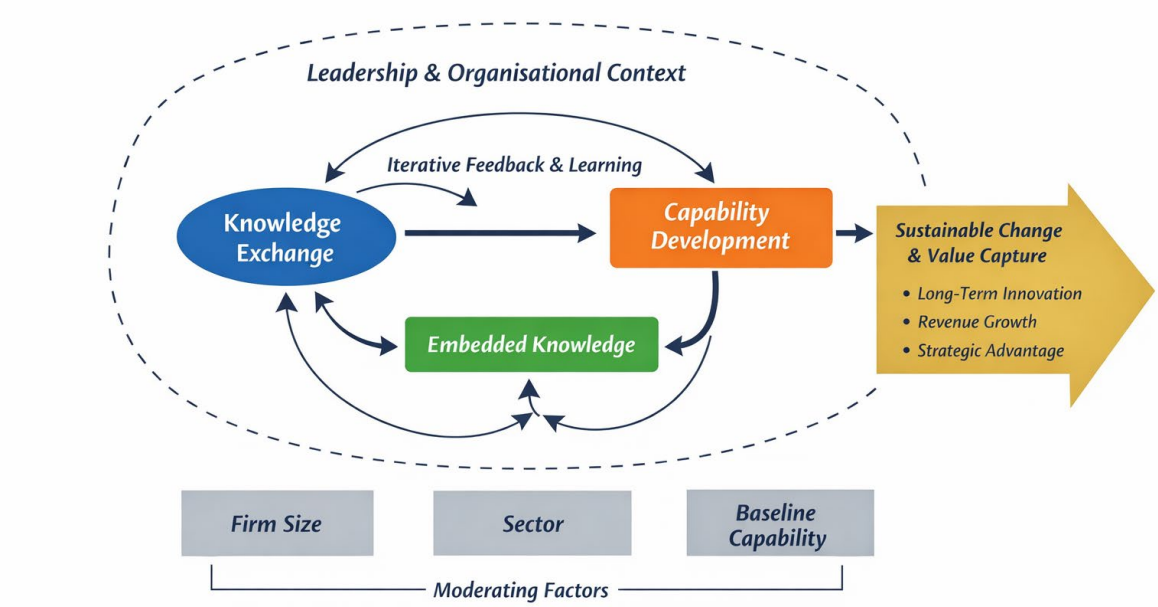

Figure 13 Refined Conceptual Framework

The survey findings affirm that there is indeed a tangible impact, as evidenced by the growth data, and this impact varies across categories, underscoring the distinctiveness of each SME. However, to draw generalised conclusions would necessitate additional research and contributions to the existing body of work. Such efforts could potentially pave the way for broader adoption by SMEs, as they unveil patterns and performance indicators derived from the diverse array of factors examined in this study. This activity would promote the mapping to specific actions, and the planned impact could be assured to a degree that may satisfy the traditionally sceptical SME businesses.

The outcomes of this study underscore the importance of knowledge exchange in driving the success of SME businesses. By demonstrating the link between successful knowledge transfer and tangible impacts, this research provides valuable insights that can support the expansion of KTP projects, particularly for potential partner SMEs and Higher Education Institutions (HEIs).

This research found that KTPs significantly contributed to business growth, particularly in firms with a strong innovation focus, as seen in Cases D and E. The impact of knowledge transfer was greatest when it was strategically embedded within the organisation, leading to long-term benefits beyond the KTP's formal timeframe. Organisational culture and leadership emerged as critical determinants of success, influencing both the implementation and outcomes of KTP activities. A consistent finding across all five case studies was the value of comprehensive staff training, which supported effective organisational learning. Furthermore, companies that maintained ongoing external collaborations experienced sustained improvements in market position and financial performance, highlighting the long-term value of open innovation and strategic partnerships.

Collectively, these findings enrich our knowledge and understanding by employing increased levels of distinction in the survey categories, enabling the identification of distinct outcomes and success areas for SMEs, not solely confined to financial impacts. This research reinforces the significance of the entrepreneurial traits in SME leaders, signalling their pivotal role in achieving the substantial growth required for transitioning from a micro or small to a medium sized business.

The study revealed that many SMEs experienced notable growth following their KTP engagement, with 60% reporting growth over 6% and 45% exceeding 10%, though some faced stagnation due to external and internal challenges. KTPs delivered multi-dimensional benefits across business functions, with improvements seen in competitive position, operations, knowledge, leadership, and business models. Strong, though non-linear, correlations among Knowledge, Operational, and Leadership Impacts suggest interdependence between these domains, highlighting the complexity of achieving sustained outcomes.

Leadership influence post-KTP varied, with mixed evidence of ongoing support and inconsistent roles of Project Champions. Business model impacts were most evident in sales, turnover, and market share, while cost savings were less frequently reported. External conditions, internal dynamics, and personnel changes also shaped the extent to which KTP benefits were embedded and sustained. Finally, the survey instrument

demonstrated strong reliability, reinforcing the validity of these findings, though limitations in data type restrict definitive conclusions about causality.

6.5 Future Research

The study highlights that the personalities in the business have a significant impact on the robustness or longevity of any of the implemented and absorbed successes from knowledge exchange. The relative category correlations showed that growth is a key impact on the Business Model Impact which captures created value, a key support for longevity. Leadership characteristics, decision makers and processes all have impact as do the traits that have been identified in the literature sections. The traits of the owner/managers and leadership of SMEs have a degree of commonality based on the literature review. The need for expanding SME networks has been supported by the case studies examined in this study as has the need to change the Business Model if there is to be impactful change in the business.

Correlation analysis was employed to examine the strength of the relationships between the identified categories, and all relationships were found to be positive, with no negative correlations observed. Although the results could not be generalised due to the limited sample size, which fell short of the threshold required for statistical confidence, the findings nonetheless offer preliminary support for further investigation. This work identified examples of SMEs showing capacity to absorb new knowledge and embed cultural change as shown in the case studies and adding to that would provide KTP practitioners, within universities, best practice examples.

In particular, the use of a survey to generate quantitative data may serve to substantiate and enrich the qualitative outcomes. For the future, if a sufficiently large dataset can be collected, it could advance the research agenda within this domain and provide valuable insights for programmes such as KTP and Innovate UK, potentially encouraging greater engagement from SMEs.

Contrastingly several SMEs still believe they are better on their own and did not benefit from any of the KTP activity and their influence on their fortunes are linked to raw material market status, financial market dips and rises and control/access to financial

support when required. This work provides insight and a springboard for further work to expand the data collection and hence support future generalisability of the data. Alongside this further work is required to expand the context areas or to provide a much more focused lens on small, or medium sized or micro sized businesses.

It is envisaged that further work in this research area with appropriate resources would drive some more generalisation that can be applied and provide recommendations with surety to those SMEs that are not engaging with the agenda related to productivity, innovation, and growth of SMEs. The results gathered from this study and the KTP impact measures support in this context the encouragement of the KTP SME to participate in research and development and innovative practices. This expansion of skills and expertise promotes the future sustainability of the SME and assist in overall premise of UK businesses gaining competitive advantage.

Further development and promotion of the KTP Impact report to similar businesses may persuade their adoption and allow spring boarding and acceptance of the KTPs approach. Development of this work resulted in a recommendation that businesses need to focus on the people and the knowledge that must be managed and processed. The overarching goal is to develop competitive advantage by focusing on the factors that would provide benefits and strategically using the intellectual capital and the people who hold that. SMEs do tend to operate with knowledge management but in a more informal manner and if that is formalised there is potential for further successes with examples that seeking of further funding assist in driving change.

In summary, this research advocates for a broader recognition and integration of knowledge exchange initiatives, emphasising their transformative potential for SMEs. The refined conceptual framework clarifies the relationships of the criteria, sectors and iterative nature of application for sustainability. This dynamic framework integrates more fully theory and practice and provides a foundation for future research. By addressing challenges and dispelling cultural hesitations, a path can be paved for heightened innovation, increased research, and development funding, fostering success utilising entrepreneurial leadership across the entire business spectrum.

This concludes the thesis by presenting an overview of the key findings, the contributions of the study, the implications, the limitations of the study and recommendations for future research.

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Appendices

Appendix 1 Ethics Approvals

Approval 2021 to 2022

University of Hertfordshire UH

HEALTH, SCIENCE, ENGINEERING AND TECHNOLOGY ECDA

ETHICS APPROVAL NOTIFICATION

TO Susan Murray

FROM Dr Simon Trainis, Health, Science, Engineering & Technology ECDA Chair

DATE 10/11/2021

Protocol number: aENT/SF/UH/02016(7)

Title of study: Impact of Knowledge Transfer on Business Models

Your application to modify and extend the existing protocol as detailed below has been accepted and approved by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

No additional workers named.

Modification: Extension to end date of study

General conditions of approval:

Ethics approval has been granted subject to the standard conditions below:

Original protocol: Any conditions relating to the original protocol approval remain and must be complied with.

Permissions: Any necessary permissions for the use of premises/location and accessing participants for your study must be obtained in writing prior to any data collection commencing. Failure to obtain adequate permissions may be considered a breach of this protocol.

External communications: Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Invasive procedures: If your research involves invasive procedures you are required to complete and submit an EC7 Protocol Monitoring Form, and copies of your completed consent paperwork to this ECDA once your study is complete.

Submission: Students must include this Approval Notification with their submission.

Validity:

This approval is valid: From:

10/11/2021 To: 30/06/2022

University of Hertfordshire UH

HEALTH, SCIENCE, ENGINEERING AND TECHNOLOGY ECDA

ETHICS APPROVAL NOTIFICATION

TO Susan Murray

CC Dr Rodney Day

FROM Dr Simon Trainis, Health, Science, Engineering & Technology ECDA Chair.

DATE 31/01/2020

Protocol number: **aENT/SF/UH/02016(6)**

Title of study: Impact of Knowledge Transfer on Business Models.

Your application to modify and extend the existing protocol as detailed below has been accepted and approved by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

no additional workers named Modification:

Extension of dates. **General conditions of approval:**

Ethics approval has been granted subject to the standard conditions below:

Original protocol: Any conditions relating to the original protocol approval remain and must be complied with.

Permissions: Any necessary permissions for the use of premises/location and accessing participants for your study must be obtained in writing prior to any data collection commencing. Failure to obtain adequate permissions may be considered a breach of this protocol.

External communications: Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Invasive procedures: If your research involves invasive procedures you are required to complete and submit an EC7 Protocol Monitoring Form, and copies of your completed consent paperwork to this ECDA once your study is complete.

Submission: Students must include this Approval Notification with their submission.

Validity:

This approval is valid: From:

31/01/2020 To: 30/06/2020

Approval May 2019 to Nov 2019

University of Hertfordshire UH

HEALTH SCIENCE ENGINEERING & TECHNOLOGY ECDA

ETHICS APPROVAL NOTIFICATION

TO Susan Murray

FROM Dr Rosemary Godbold, Health, Science, Engineering & Technology ECDA Vice Chair.

DATE 22/05/2019

Protocol number: **aENT/SF/UH/02016(5)**

Title of study: Impact of Knowledge Transfer on Business Models

Your application to modify and extend the existing protocol as detailed below has been accepted and approved by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

Modification: extension of study dates.

This approval is valid: From:

22/05/2019 To: 29/11/2019

Approval June 2018 to March 2019

University of Hertfordshire UH

HEALTH SCIENCE ENGINEERING & TECHNOLOGY ECDA

ETHICS APPROVAL NOTIFICATION

TO Susan Murray

CC Dr Chris Brown

FROM Dr Simon Trainis, Health, Science, Engineering & Technology ECDA Chair.

DATE 30/05/2018

Protocol number: aENT/SF/UH/02016(4)

Title of study: Impact of Knowledge Transfer on Business Models.

Your application to modify and extend the existing protocol as detailed below has been accepted and approved by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

Modification: Extension of dates

This approval is valid: From:

01/06/2018 To: 29/03/2019

Approval 2018

University of Hertfordshire UH

HEALTH SCIENCE ENGINEERING & TECHNOLOGY ECDA

ETHICS APPROVAL NOTIFICATION

TO Susan Murray

CC Dr George Haritos

FROM Dr Simon Trainis, Health, Science, Engineering and Technology ECDA Chair

DATE 20/02/2018

Protocol number: **aENT/PGR/UH/02016(3)**

Title of study: Impact of Knowledge Transfer on Business Models

Your application to modify and extend the existing protocol as detailed below has been accepted and approved by the ECDA for your School and includes work undertaken for this study by the named additional workers below:

Modification: Extension

This approval is valid: From:

20/02/2018 To: 30/03/2018

Approval 2017

University of Hertfordshire UH

UNIVERSITY OF HERTFORDSHIRE SCIENCE AND TECHNOLOGY

ETHICS APPROVAL NOTIFICATION

TO Susan Murray

CC Dr George Haritos

FROM Dr Simon Trainis, Science and Technology ECDA Chairman

DATE 3/8/16

Protocol number: **aENT/SF/UH/02016 (2)**

Title of study: Knowledge Transfer and the Business Model

Your application to modify and extend the existing protocol aENT/SF/UH/02016 (2) as detailed below has been accepted and approved by the ECDA for your School.

Modification: Alterations to the survey to reduce the number of questions and grouping of the questions to provide more focus.

A focus on the Manufacturing and Design for Manufacturing businesses rather than all sectors that have participated in KTP projects;

Main survey will be open for 1 year to allow the time for reaching the number of respondents required.

This approval is valid:

From: 5/8/16
To: 5/8/17

UNIVERSITY OF HERTFORDSHIRE
SCIENCE AND TECHNOLOGY

ETHICS APPROVAL NOTIFICATION

TO **Susan Murray**

CC **Dr George Haritos**

FROM **Dr Simon Trainis, Science and Technology ECDA Chairman**

DATE **21/04/2016**

Protocol number: aENT/SF/UH/02016(1)

Title of study: Impact of Knowledge Transfer on Business Models

Your application to extend and modify the existing protocol ENT/SF/UH/02016(1) as detailed below has been accepted and approved by the ECDA for your School.

Modification: Change of title This approval is valid:

From: 21/04/2016 To: 05/08/2016

Please note:

Any conditions relating to the original protocol approval remain and must be complied with.

Approval applies specifically to the research study/methodology and timings as detailed in your Form EC1 or as detailed in the EC2 request. Should you amend any further aspect of your research or wish to apply for an extension to your study, you will need your supervisor's approval and must complete and submit a further EC2 request. In cases where the amendments to the original study are deemed to be substantial, a new Form EC1 may need to be completed prior to the study being undertaken.

Should adverse circumstances arise during this study such as physical reaction/harm, mental/emotional harm, intrusion of privacy or breach of confidentiality this must be reported to the approving Committee immediately. Failure to report adverse circumstance/s would be considered misconduct.

Ensure you quote the UH protocol number and the name of the approving Committee on all paperwork, including recruitment advertisements/online requests, for this study.

Students must include this Approval Notification with their submission.

Appendix 2 FAME database selection

List export

Product name	Fame
Update number	8574
Software version	341
Data update	03/01/2018 (n° 8574)
Username	HertfordshireUni-29826
Export date	04/01/2018 3:39:17 PM

Search Strategy

Search step		Step result	Search result
All active companies (not in receivership nor dormant) and companies with unknown situation		4,001,859	4,001,859
All companies with a phone number at a registered office address		1,075,893	751,174
SME Companies		3,902,246	719,668
Country	Prim. trading address, R/O address: England	9,407,940	632,000
Boolean search	1 and 2 and 3 and 4		
TOTAL			632,000
Fiscal year end	31/12		

Definition of the Ultimate Owner

The minimum percentage of control in the path from a subject company to its Ultimate Owner must be: 50
A company is considered to be an Ultimate Owner(UO) if it has no identified shareholders or if it's shareholder's percentages are not known.

Appendix 3 List of UK Knowledge Partnership Offices contacts

University	Contact	email
Anglia Ruskin University (Cambridge Campus)	Simon Daly - 0845 196 3173 -	Simon simon.daly@anglia.ac.uk
Aston University	Martin May - 0121 204 4253	Martin m.r.may@aston.ac.uk
Bath, University of	Clive Bailey - 01225 385 201	Clive c.bailey@bath.ac.uk
Bedfordshire, University of	Dr. Imtiyaz Ahmed Ansari - 01582 743 261 –	imtiyaz.ansari@beds.ac.uk
Birkbeck, University of	Helen Lawrence - 0207 631 6676 –	h.lawrence@bbk.ac.uk
Birmingham City University	Natalie Lewis - 0121 331 5677 –	Natalie natalie.lewis@bcu.ac.uk
Birmingham, The University of	Katie Jermey - 0121 414 8246 –	k.jermey@bham.ac.uk
Bishop Burton College	Kevin Kendall - 01964 553 142 –	kevin.kendall@bishopburton.ac.uk
Bournemouth University	Rachel Clarke - 01202 961 347 –	clarker@bournemouth.ac.uk
Bradford, University of	Melanie Powell - 01274 236227 –	m.j.powell1@bradford.ac.uk
Brighton, University of	Shona Campbell - 01273 642 435 –	s.e.campbell@brighton.ac.uk
Bristol, University of	Frances Frith - 0117 928 8039 –	frances.frith@bristol.ac.uk
Brunel University	Rachel Burch - 01895 268 190 –	ktp@brunel.ac.uk
Buckinghamshire New University	Sue Wale - 01494 603 183 –	sue.wale@bucks.ac.uk
Cambridge, University of	Claire Higgitt - 01223 332 408 –	claire.higgitt@admin.cam.ac.uk
Canterbury Christ Church University	Amanda Hutson - 01843 609 135 –	amanda.hutson@canterbury.ac.uk
Chester, University of	Marie-Anne O'Neil - 01244 511 481 –	m.oneil@chester.ac.uk
Chichester, University of	Laura Wilson-Edwardes - 01243 812 051 –	l.wilson-edwardes@chi.ac.uk
City University	Amy Bilton - 0207 040 5145 –	amy.bilton.1@city.ac.uk
Cornwall College	Allyson Glover - 01209 617 664 –	a.glover@cornwall.ac.uk
Coventry University	Dean Stephenson - 02476 887 688 –	d.stephenson@coventry.ac.uk
Cranfield University	Ian Chapman - 01234 754 961 –	i.chapman@cranfield.ac.uk
Creative Arts, University for the	Clare Wunderly - 01227 817 432 –	cwunderly@ucreative.ac.uk
Cumbria, University of	Dr A J Stevenson - 01524 385 453 –	andrew.stevenson@cumbria.ac.uk
De Montfort University	Joanna Lawrence - 0116 250 6211 –	jlawrence@dmu.ac.uk
Derby, University of	Amanda Baxendale - 0800 678 331 –	a.baxendale@derby.ac.uk
Durham, University of	Richard Parker Smith - 01913 349 309 –	richard.parker-smith@durham.ac.uk
Essex, The University of	Jenny Young - 01206 874 076 –	jennyy@essex.ac.uk
Exeter, University of	Jane Pankhurst - 01392 725 457 –	jane.pankhurst@exeter.ac.uk
Gloucestershire, University of	Nathalie Dawson - 01242 714 114 –	ndawson@glos.ac.uk
Goldsmiths, University of London	Michael Metelits - 0207 919 7043 –	m.metelits@gold.ac.uk
Greenwich, University of	Lynda Hyder - 0208 331 8638 –	l.m.hyder@gre.ac.uk
Harper Adams University College	Andy Cobb - 01952 815 229 –	ahcobb@harper-adams.ac.uk
Hertfordshire, University of	Philip Fiddaman - 01707 284 117 –	p.j.fiddaman@herts.ac.uk
Huddersfield, University of	Susan Lipthorpe - 01484 472 049 –	s.k.lipthorpe@hud.ac.uk
Hull, The University of	Gill Sinclair - 01482 466 939 –	ktp-centre@hull.ac.uk
Imperial College London	Louise Chisholm - 0207 594 5755 –	l.chisholm@imperial.ac.uk
Keele University	Sharon Farn - 01782 584 491 –	info@keeleinbusiness.com
Kent, University of	Lesley Chater - 01227 823 802 –	l.e.chater@kent.ac.uk
King's College London	Anna Thornton - 0207 848 6754 –	anna.thornton@kcl.ac.uk
Kingston University	Cassie Talfourd-Rich - 0208 417 3198 –	c.talfourd-rich@kingston.ac.uk
Lancaster University	David Gregson - 01524 594 510 –	d.gregson@lancaster.ac.uk
Lancashire, University of Central	Ruth Slater - 01772 895 074 –	rhslater1@uclan.ac.uk
Leeds, University of	Paul Bell - 0113 343 2169 –	p.k.bell@leeds.ac.uk
Leicester, University of	Natalie Cozier - 0116 252 3630 –	nlc15@le.ac.uk
Leeds Beckett University	Janet Mulcrone - 01138 128 549 –	j.mulcrone@leedsmet.ac.uk
Lincoln, University of	Michelle Davis - 01522 837 832 –	mdavis@lincoln.ac.uk
Liverpool John Moore University	Estelle Hargraves - 0151 231 2384 –	e.s.hargraves@ljmu.ac.uk
Liverpool, The University of	Andy Jones - 0151 794 8026 –	andy.jones@liv.ac.uk
London Metropolitan University	Karen Samuel - 020 7320 1871 –	ktp@londonmet.ac.uk
London South Bank University	Martha Crawford - 0207 815 6922 –	martha.crawford@lsbu.ac.uk
London, University of the Arts	Alisdair Aldous - 0207 514 9366 –	a.aldous@arts.ac.uk
Loughborough University	Kathryn Burchell - 01509 228 493 –	k.d.burchell@lboro.ac.uk
Manchester, The University of	Mark Godber - 0161 306 6813 –	mark.godber@manchester.ac.uk
Manchester Metropolitan University, The	Ceri Carr - 0161 247 2441 –	c.carr@mmu.ac.uk
Middlesex University	Anna Pavlakos - 0208 411 6153 –	a.pavlakos@mdx.ac.uk

Newcastle University	Christine Younger - 0191 208 8784 –	christine.younger@ncl.ac.uk
Norwich School of Art & Design	Richard Denyer - 01603 756 241 –	r.denyer@nsad.ac.uk
Northampton, The University of	Karen Lewis - 01604 892 844 –	karen.lewis@northampton.ac.uk
Northumbria, University of (at Newcastle)	Hazel Juggins - 0191 243 7262 –	h.juggins@northumbria.ac.uk
Nottingham Trent University, The	Kirsty Holt - 0115 848 8815 –	kirsty.holt@ntu.ac.uk
	Sadaf Hussein - 0115 848 8173 -	sadaf.hussein@ntu.ac.uk
Nottingham, The University of	Paul Yeomans - 0115 (84) 68479 –	paul.yeomans@nottingham.ac.uk
Open University, The	Denise Pasquet - 01908 332 893 –	denise.pasquet@open.ac.uk
Oxford Brookes University	John Corlett - 01865 484 207 –	ktp@brookes.ac.uk
Oxford, University of	John McCormack - 01865 283 832 –	John.mccormack@mpls.ox.ac.uk
Pharmacy, The School of (University of London)	Chuck Obi - 0207 753 5983 –	chuck.obi@pharmacy.ac.uk
Plymouth, University of	Nicola Burton - 01752 588 910 –	nicola.burton@plymouth.ac.uk
Portsmouth, University of	Gill Prosser - 023 9284 2978 –	gill.prosser@port.ac.uk
Reading, The University of	Susan Matos - 0118 378 8214 –	s.t.matos@rdg.ac.uk
Reaseheath College	Louise Worthington - 01270 613 195 –	Louisew@reaseheath.ac.uk
Royal Agricultural College	Rebecca Harris - 01285 889 872 –	rharris@rac.ac.uk
	Susan Rabbich - 01285 889 872 –	srabbich@nationalrural.org
Royal College of Art - London	Jessica Rana - 020 7590 4126 –	jessica.rana@rca.ac.uk
Royal Holloway, University of London	David Wells - 01784 414 931 –	david.wells@rhul.ac.uk
Royal Veterinary College	Patricia Latter - 020 7691 2069 –	platter@rvc.ac.uk
Salford, University of	Janet Morana - 0161 295 2902 –	j.morana@salford.ac.uk
Sheffield Hallam University	Sarah Durkin - 0114 225 5000 –	s.durkin@shu.ac.uk
Sheffield, The University of	Email only –	ktp@sheffield.ac.uk
South Devon College	Adele Dawson - 01803 540 459 –	adele.dawson@southdevon.ac.uk
Southampton, University of	Phil Jewell - 0238 059 8568 –	pej@soton.ac.uk
Southampton Solent University	Bill Acharjee - 02380 319329 / 9011 –	bill.acharjee@solent.ac.uk
Staffordshire University	Susan Semple - 01785 353 498 –	s.semple@staffs.ac.uk
Sunderland, University of	Mark Donnelly - 0191 515 3365 –	mark.donnelly@sunderland.ac.uk
Surrey, University of	Dan Bance - 01483 682 050 –	ktp@surrey.ac.uk
Sussex, University of	Mike Wylde - 01273 877 858 –	mike.wylde@sussex.ac.uk
Teesside, University of	Gily Hall - 01642 384 406 –	ktp@tees.ac.uk
University College London	Claire Arbon - 020 3108 3290 –	ktp@ucl.ac.uk
University of Central England in Birmingham	Natalie Lewis - 0121 331 5677 –	
University of East London	Martin Longstaff - 020 8223 7646 –	m.longstaff@uel.ac.uk
University of the West of England	Clare Rowson - 0117 328 3676 –	clare.rowson@uwe.ac.uk
Warwick, University of	Diane Park - 0247 657 2589 –	diane.park@warwick.ac.uk
Westminster, University of	Sue Tuttlebury - 020 3506 6584 –	s.tuttlebury@westminster.ac.uk
Wolverhampton, University of	Marc Fleetham - 01902 824 128 –	m.j.fleetham@wlv.ac.uk
York, The University of	Rukmal Abeysekera - 01904 435 102 –	rma2@york.ac.uk
KTP regional offices - Wales		
Aberystwyth University	Sylwia Grzegorek - 01970 622 797 –	syg2@aber.ac.uk
Barry College	Phil Rees - 01446 719 821 –	philrees@barry.ac.uk
Cardiff University	Paul Thomas - 02920 875 882 –	ktp@cardiff.ac.uk
Deeside College	Barbara Nicholls - 01244 834 545 ext 4064 –	nicholb@deeside.ac.uk
University of South Wales	Alun Cox - 01443 482 234 –	alun.cox@southwales.ac.uk
Glyndwr University	Sam Clutton - 01978 293 183 –	s.clutton@glyndwr.ac.uk
alun.cox@southwales.ac.uk		
Gower College Swansea	Elaine McCallion - 01792 284 410 –	elaine.mccallion@gowercollegeswansea.ac.uk
Llandrillo, Coleg Cymru	Joyce Sneddon - 01492 546 666 ext 615 –	sneddo1j@landrillo.ac.uk
University of Wales Trinity Saint David	Lisa Lucas - 01792 481 199 –	lisa.lucas@sm.uwtsd.ac.uk
Swansea University	Dave Guite - 01792 295 291 –	d.r.guite@swansea.ac.uk
Cardiff Metropolitan University	Anne Barratt - 029 2041 6612 –	albarratt@uwic.ac.uk
Wrexham, Yale College of	Simon David Hughes - 01978 316 416 –	sdh@yale-wrexham.ac.uk
KTP regional offices - Scotland		
East of Scotland KTP Centre	Judy Brown - 0131 455 2686 –	judybrown@ktpcentre.com
North of Scotland KTP Centre	Robin Brown - 01224 262 278 –	r.d.brown@abdn.ac.uk

Tayside KTP Centre	Neil Stewart - 07887 528 999 –	nei1stewart@aol.com
West of Scotland KTP Centre	Elaine Wallace - 0141 548 4442 –	e.wallace@strath.ac.uk
KTP regional offices - Northern Ireland		
Belfast, Queen's University	Mary Flynn - 0289 097 5444 –	m.flynn@qub.ac.uk
Ulster, University of	Amanda Fullerton - 0287 137 5236 –	a.fullerton@ulster

Knowledge Transfer and the Business Model

Page 1: Welcome

This survey aims to gather responses about the longer-term effects of a Knowledge Transfer Partnership (KTP) project. You have been asked to participate as you have been a previous KTP Company partner with a University Knowledge Base under the funding programme from the Technology Strategy Board now Innovate UK.

The research is an opportunity to establish if the model of knowledge transfer through university – industry collaboration using the Knowledge Transfer Partnership project has developed the knowledge capital that can be accessed internally and externally and impacted the competitive advantage for the business. This will be explored to establish the effects by categories such as industry sector and business function on the business model innovation and the businesses strategic development.

You will not be identified in this survey by company name and the analysis will be based on business function and industrial sector.

The survey is completed anonymously, can be saved part way through.

Note that once you have clicked on the CONTINUE button at the bottom of each page you can not return to review or amend that page.

Page 2: Data Protection statement

All data collected in this survey will be held anonymously and securely. No personal data is asked for or retained.

Cookies, personal data stored by your Web browser, **are not used in this survey**.

Page 3: Business Function

1 Please select an appropriate Business Function from the list below *Required*

1.a If you selected Other, please specify:

Page 4: Industry Sector

2 Please select an appropriate Industry sector from the list *Required*

2.a If you selected Other, please specify:

3 Which year did your last KTP project finish? *Required*

- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- Earlier than 2004

4 Please indicate the impact on each of the listed areas affected by the KTP project(s). *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 8 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Products					
People					
Processes					
Marketing					

Information Systems	☐	☐	☐	☐	☐
Knowledge bank	☐	☐	☐	☐	☐
Leadership and strategy	☐	☐	☐	☐	☐
Communication	☐	☐	☐	☐	☐

5 Please indicate if there has been innovation in any of the areas listed since the KTP project. ☐ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Products	☐	☐	☐	☐	☐
People	☐	☐	☐	☐	☐
Processes	☐	☐	☐	☐	☐
Marketing	☐	☐	☐	☐	☐
Information Systems	☐	☐	☐	☐	☐
Knowledge bank	☐	☐	☐	☐	☐
Leadership and strategy	☐	☐	☐	☐	☐
Communication	☐	☐	☐	☐	☐

Page 6: Innovation

Incremental Innovation is defined as a series of improvements to an existing product or product line, that usually helps maintain or improve the competitive position of the firm.

6 Has there been incremental innovation using the definition above within your company since the KTP project completed? ☐ *Required*

7 Please indicate the effect on the operational areas where there has been incremental innovation to a product or product line. ☐ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Products	☐	☐	☐	☐	☐
People	☐	☐	☐	☐	☐
Processes	☐	☐	☐	☐	☐
Marketing	☐	☐	☐	☐	☐
Information Systems	☐	☐	☐	☐	☐
Knowledge bank	☐	☐	☐	☐	☐
Leadership and strategy	☐	☐	☐	☐	☐
Communication	☐	☐	☐	☐	☐

Radical innovation is defined as the process of developing new products or

services to replace existing products or services by a company in order to gain a competitive advantage.

8 Has there been radical innovation using the definition above within your company since the completion of the KTP project? *Required*

8.a Please indicate the effect on the operational areas where there has been radical innovation to the company's technology, products or services. *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 1 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Products					
People					
Processes					
Marketing					
Information Systems					
Knowledge bank					
Leadership and strategy					
Communication					

Page 7: Leadership and external knowledge

9 Does the company leadership use internal knowledge and skils? *Required*

- Ye
- s
- No
- Don't know

10 Does the company leadership more readily consider a number of external avenues when required to gather knowledge since the end of the KTP project? *Required*

- Ye
- s
- No
- Don't know

11 In the last twelve months, have you sought external advice or information on matters affecting your business? *Required*

- Ye
- s
- No
- Don't know

12 Was the information or advice that you sought from the public or private sector, or both? *Required*

- Public sector

- Private sector
- Both
- Neither

Page 8: Business Model

13 Has there been commercial impacts on the business since completion of the KTP?
Required

- Ye
- s
- No
- Don't know

14 Please select a response from the scale from Agree strongly to Disagree strongly
Required

Please don't select more than 1 answer(s) per row.

Please select at least 4 answer(s).

	Agree strongly	Agree slightly	Neither agree nor disagree	Disagree slightly	Disagree strongly
The sales revenue has increased since completing the KTP					
The market share has increased since completing the KTP					
Efficiency gains					

Cost savings have been maintained since completing the KTP	☐	☐	☐	☐	☐

15 What has happened with the business since the KTP project completed in terms of the business model? ☐ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 2 answer(s).

	Increased	Decreased	Stayed the same	Don't know
Turnover	☐	☐	☐	☐
Margins	☐	☐	☐	☐

16 In the business since the KTP project ended has there been a change to the operating business model to ensure knowledge gain is part of the strategy? ☐ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 4 answer(s).

	Increased	Decreased	Stayed the same	Don't know
Skills Training	☐	☐	☐	☐
Research and Development	☐	☐	☐	☐
Collaboration with external sources	☐	☐	☐	☐

17 Since the KTP project ended have the successful practices of embedding knowledge become part of the business? *Required*

Please don't select more than 1 answer(s) per row. Please select at least 5 answer(s).

	Increased	Decreased	Stayed the same	Don't know
Project planning and review	☐	☐	☐	☐
Project Champions appointed	☐			
Measure or Key Performance Indicator (KPI) reporting	☐	☐	☐	☐
Communication notices or boards	☐			
Company results and actions communicated to all	☐	☐	☐	☐

18 Has the company increased in competitive position in relation to its competitors since the KTP project ended? *Required*

Please don't select more than 1 answer(s) per row. Please select at least 5 answer(s).

	Increased	Decreased	Stayed the same	Don't know
Number of product types	☐	☐	☐	☐
Product specification	☐	☐	☐	☐
Added benefits to products	☐	☐	☐	☐

Improved process efficiency	☐	☐	☐	☐
Reduced selling costs	☐	☐	☐	☐

19 Over the next two to three years, do you aim to grow your business?

☐

Required

- ○ Yes
- ○ Consolidate current position Reduce
- ○

Page 9: Additional Comments

20 Enter here any further comments that will assist this study to identify changes made to the business model as a result of the KTP project. This may be related to products, processes, machinery & equipment, people, procedures or the strategy.

Page 10: Final Page

The FINAL page

Thank you for your contribution by completing this survey.

Respondents can now leave the survey Please follow this link to return to the: Bristol Online Surveys Homepage

bos

Knowledge Transfer and the Business Model

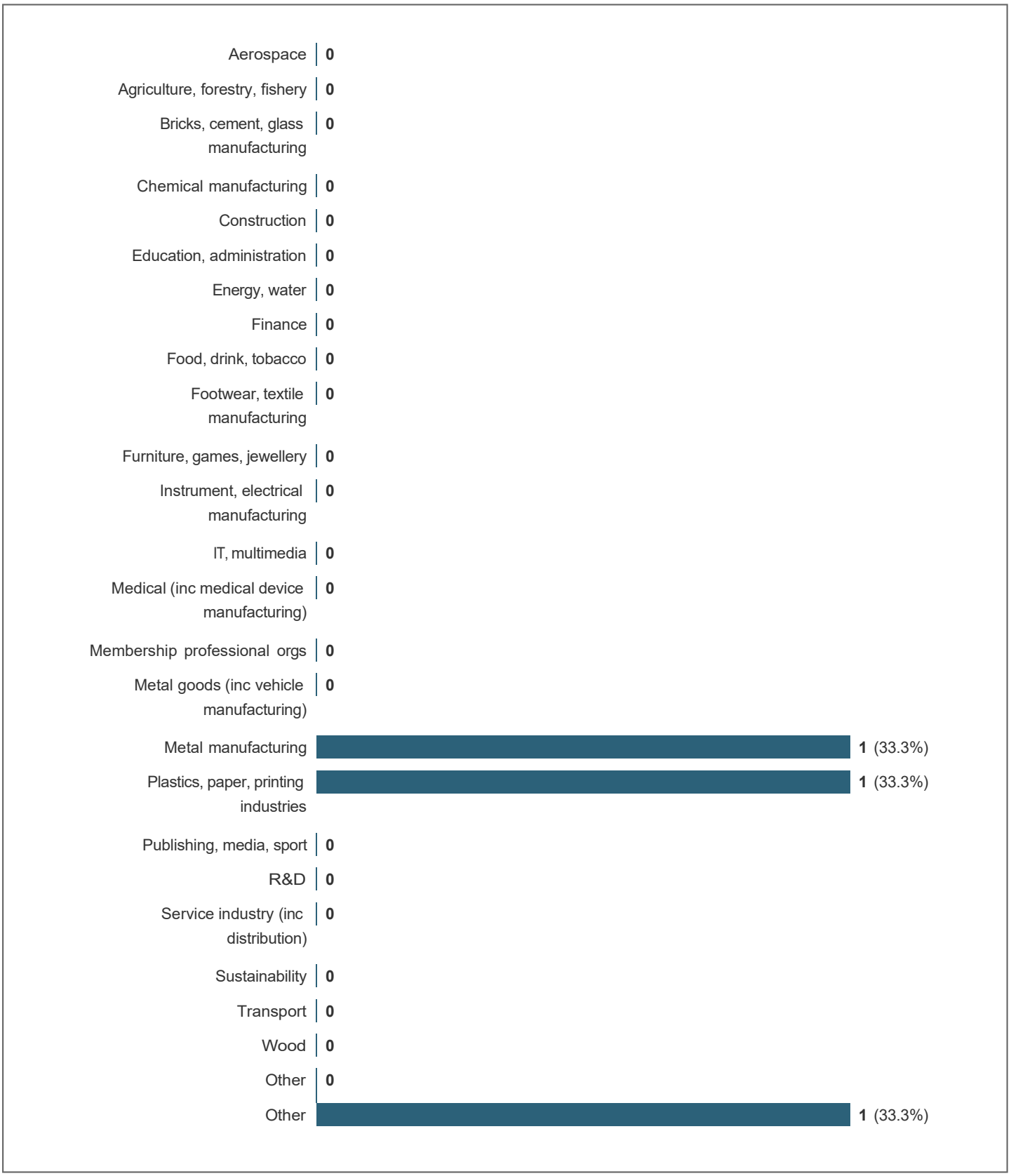
Showing 3 of 3 responses

Showing **all** responses Showing

all questions

Response rate: 6%

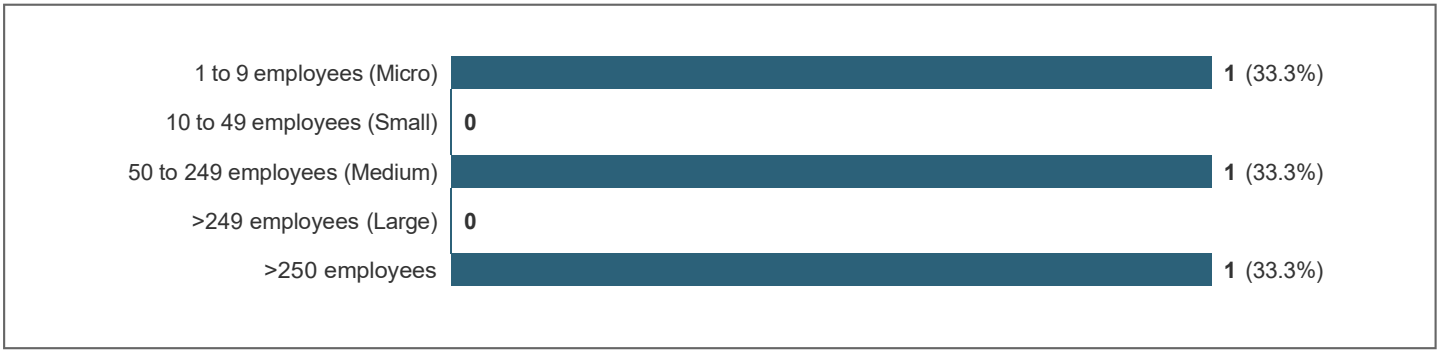
1 Please select an appropriate Industry sector from the list



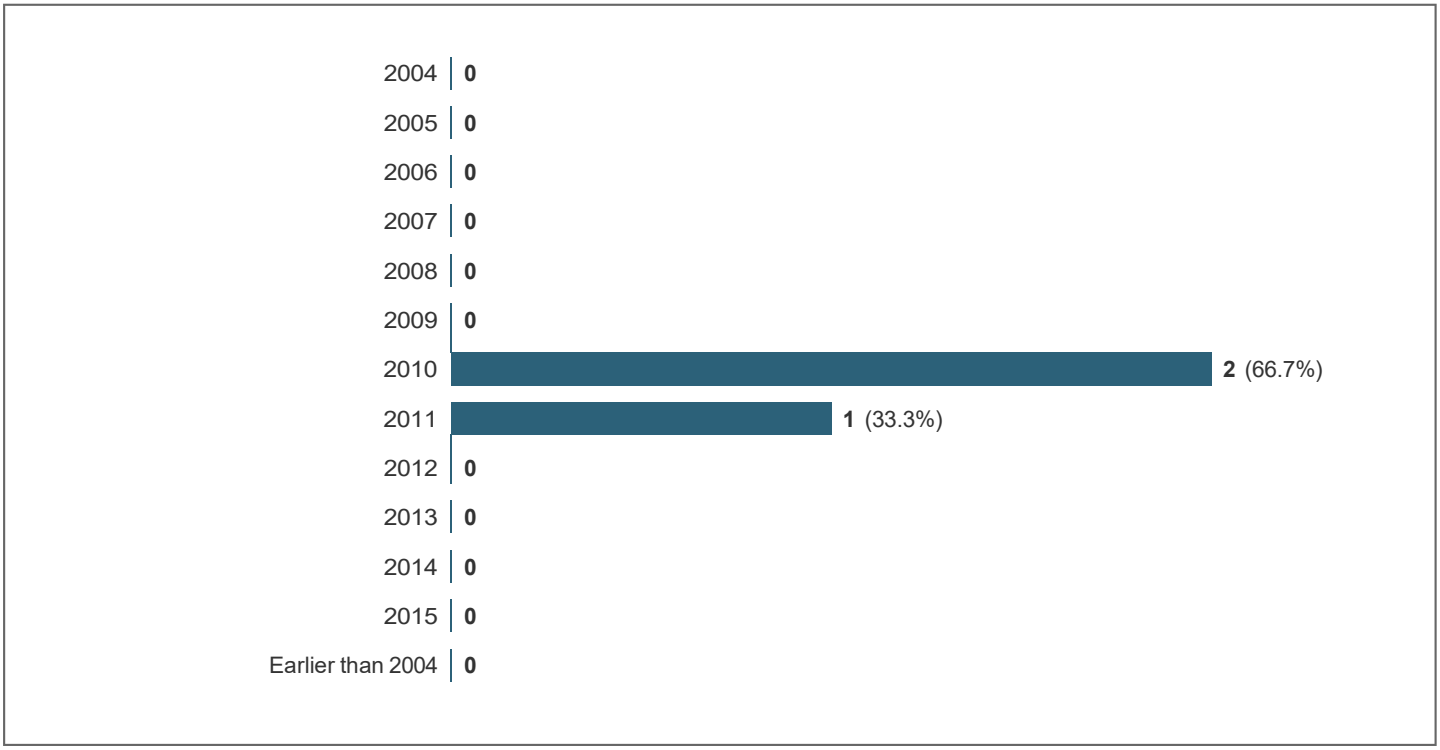
1.a If you selected Other, please specify:

Showing 1 response	
Charity	166201-166195-15534816

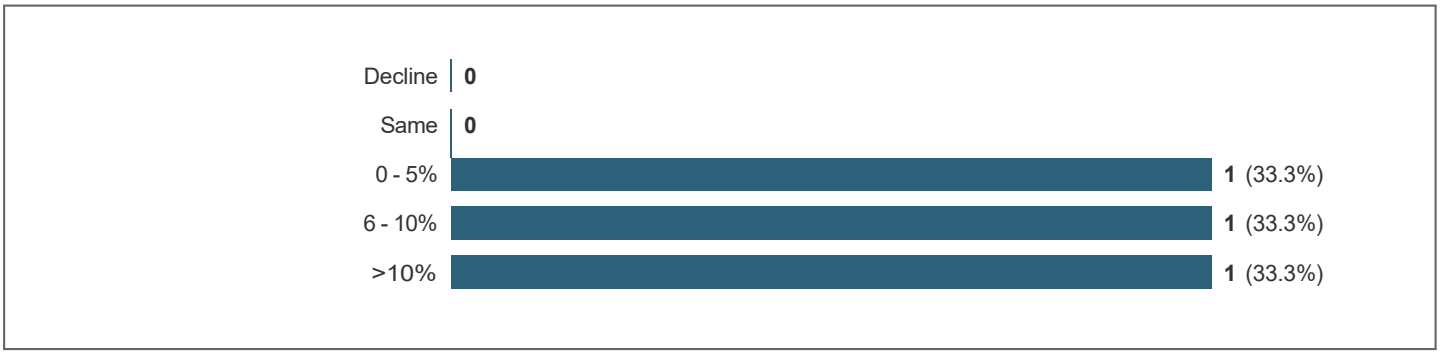
2 Please select the number of employees currently for your business



3 Which year did your last KTP project finish?

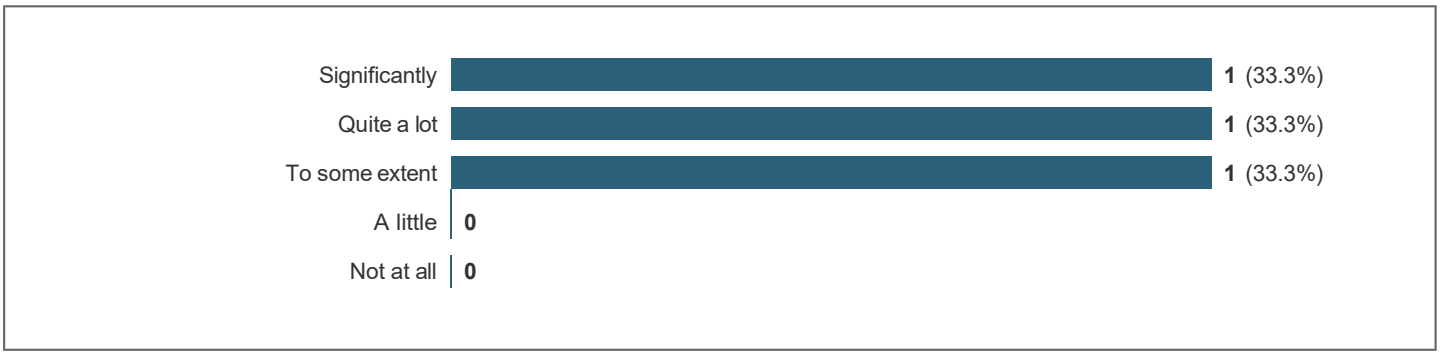


4 What level of growth for your business, if any, has there been since the KTP project?

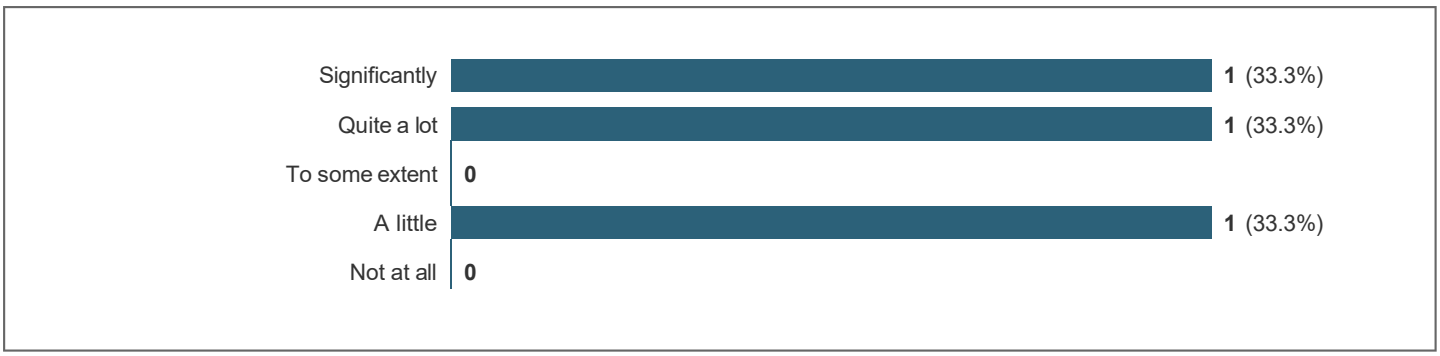


5 Please indicate the level of impact on each of the listed areas affected since the KTP project(s).

5.1 Products

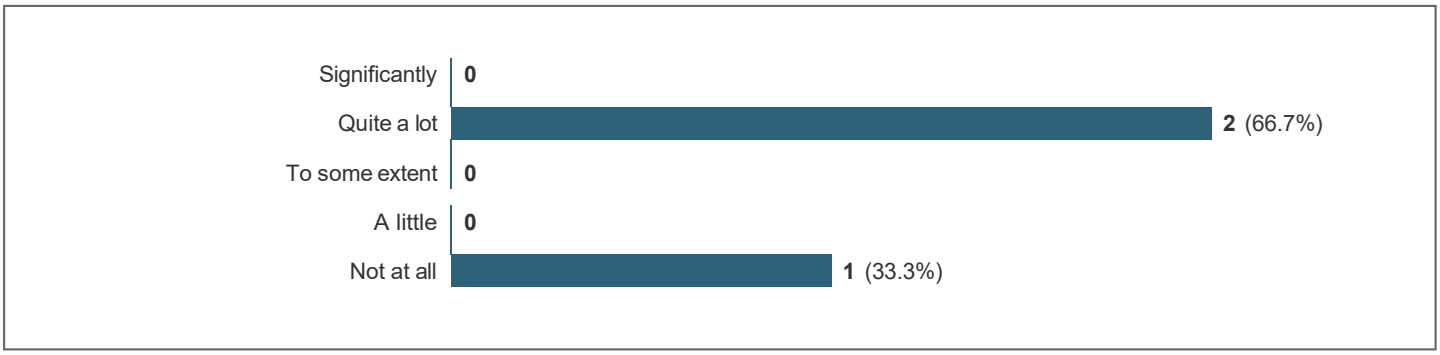


5.2 People

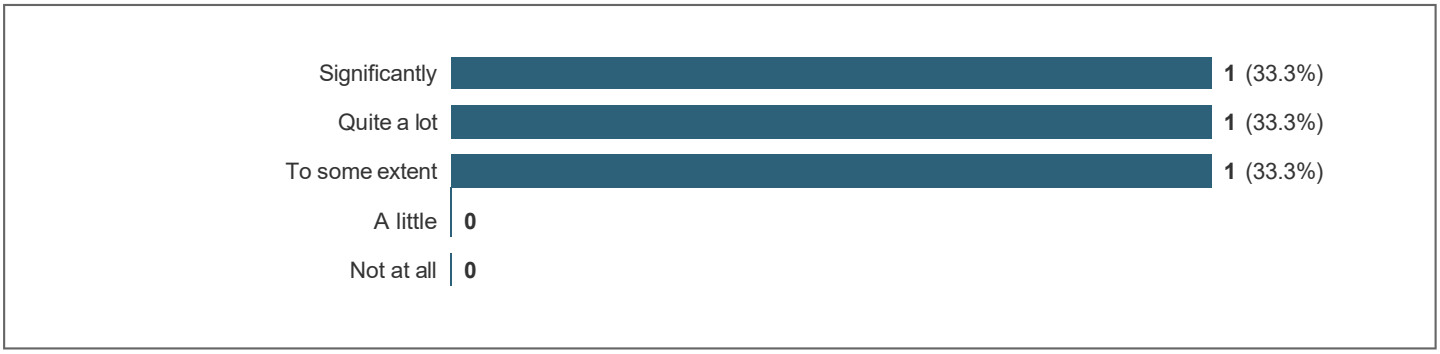


5.3 Processes

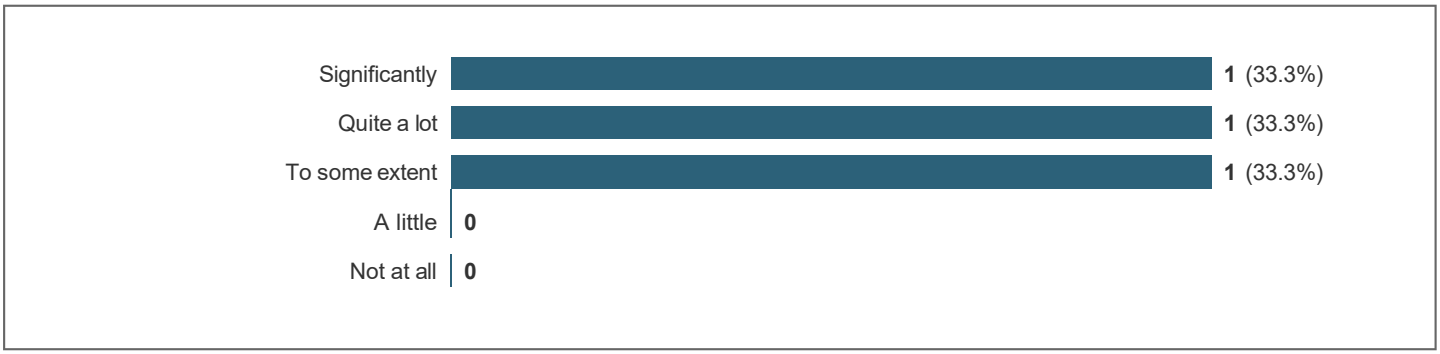
5.4 Marketing



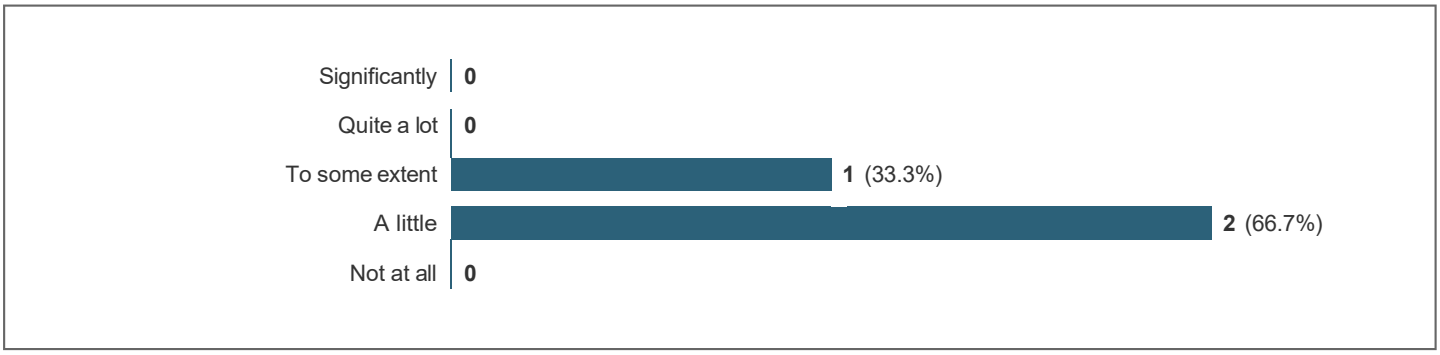
5.5 Information Systems



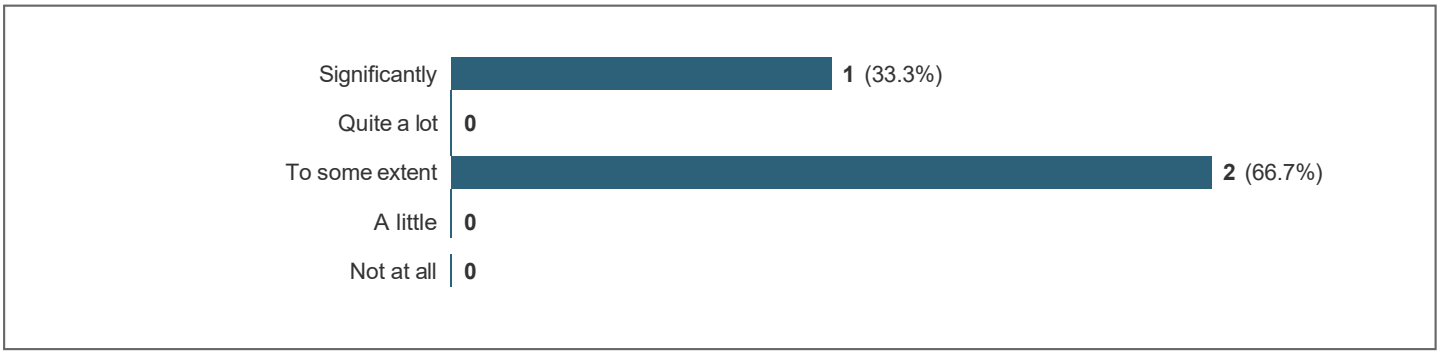
5.6 Knowledge bank



5.7 Leadership and strategy

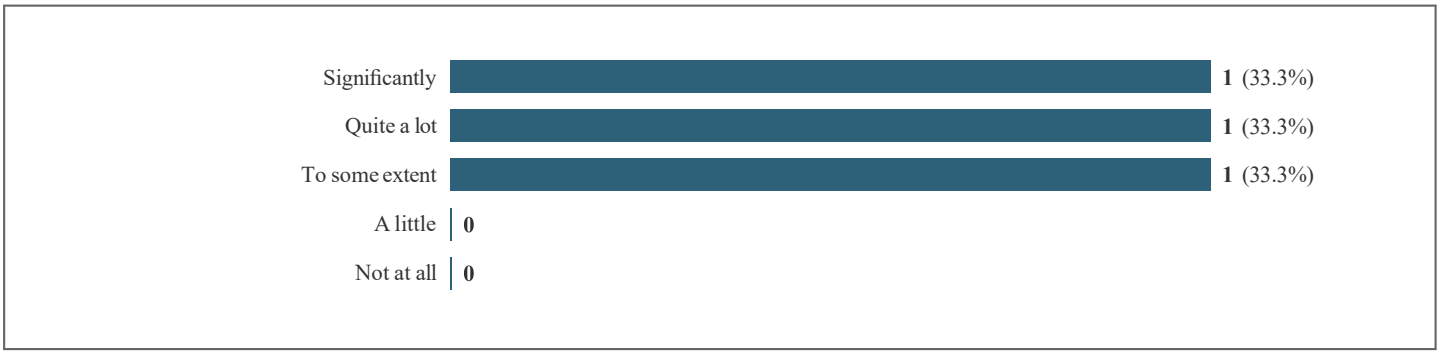


5.8 Communication

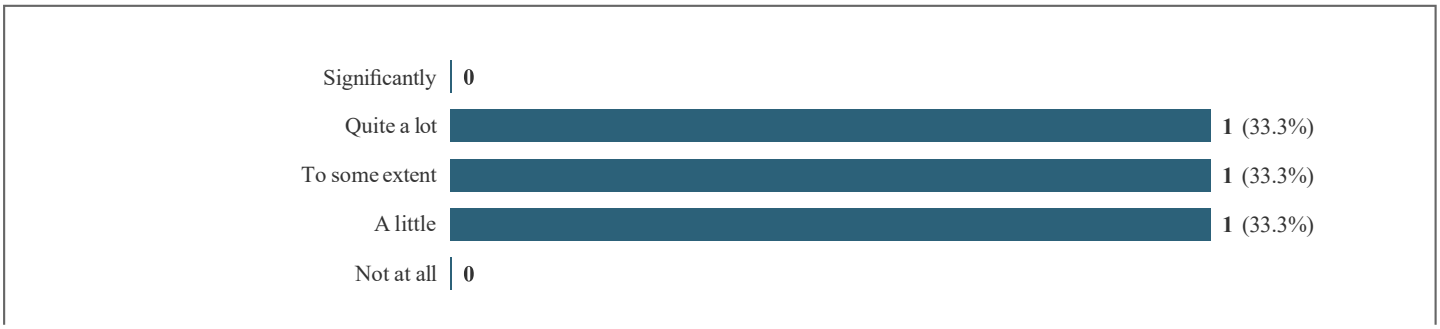


6 Please indicate if there has been innovation in any of the areas listed since the KTP project(s).

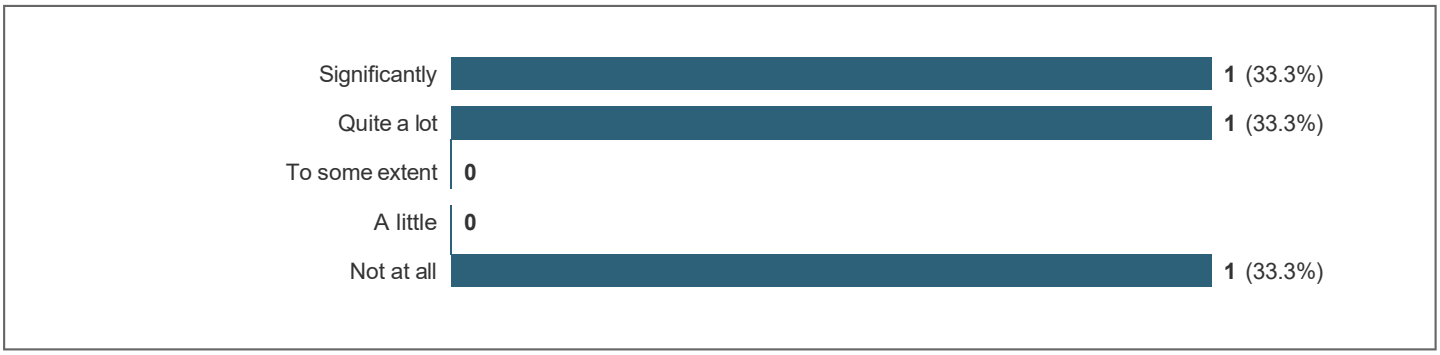
6.1 Products



6.2 People

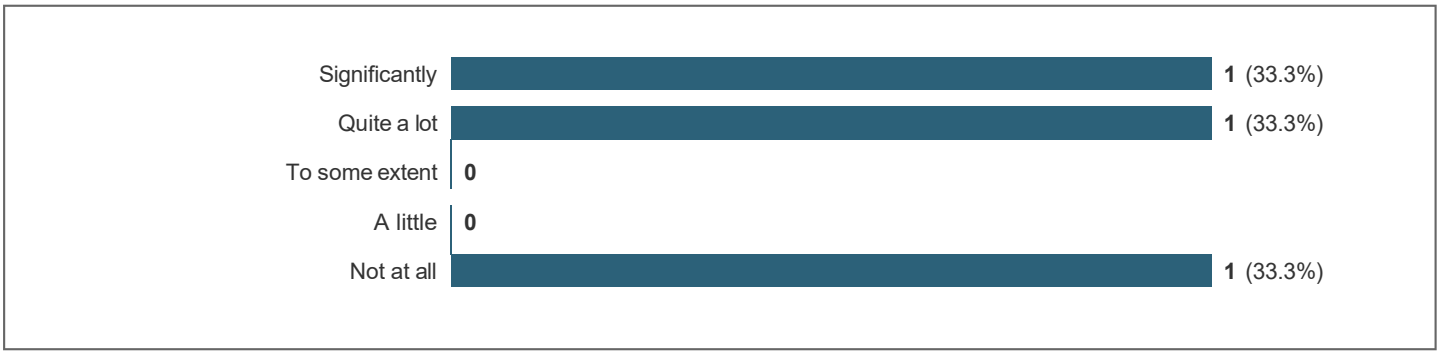


6.3 Processes

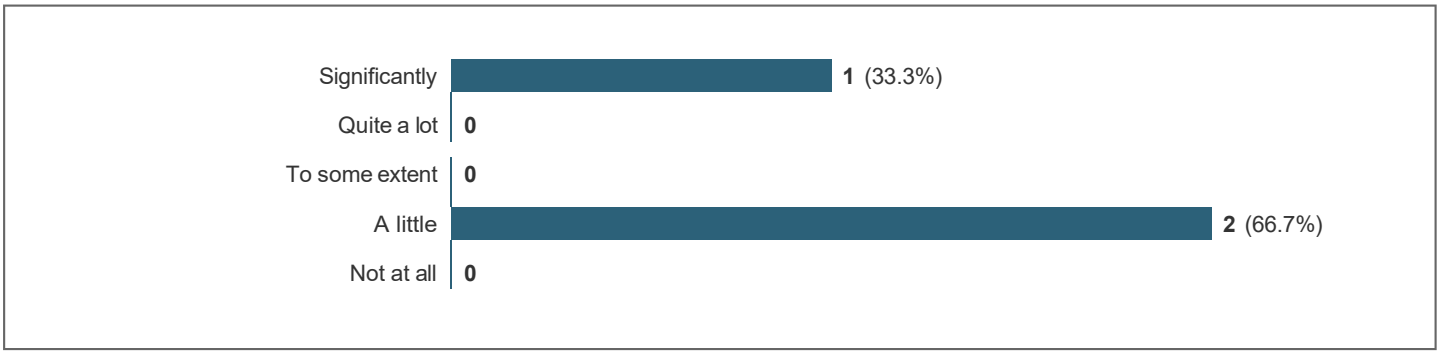


6.4 Marketing

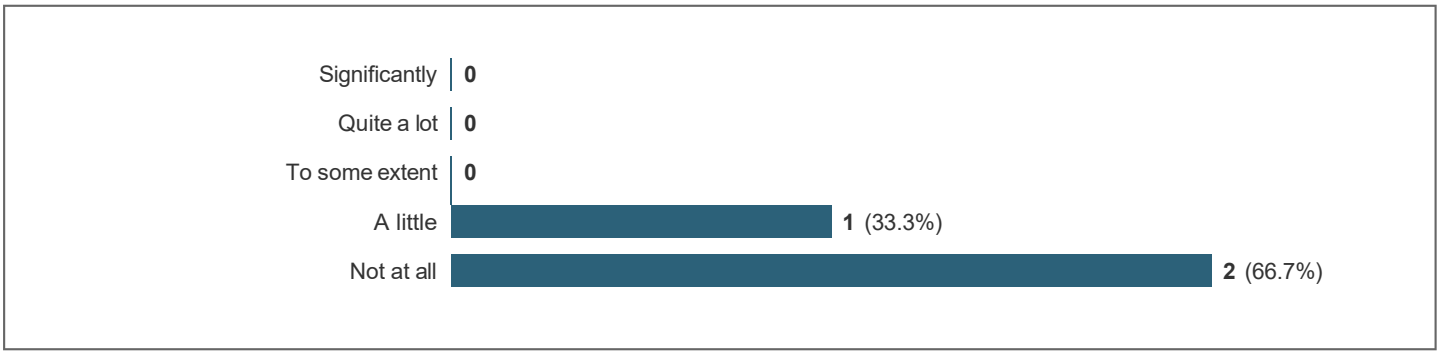
6.5 Information Systems



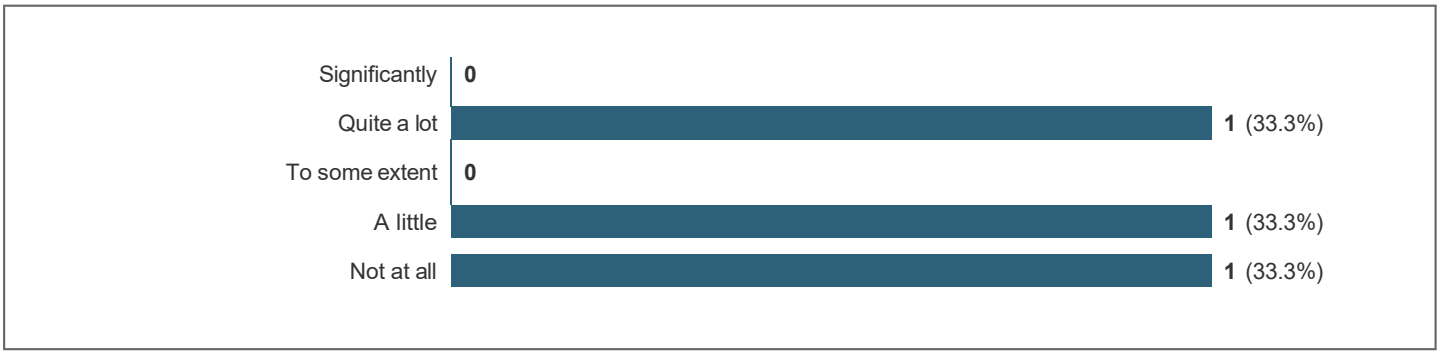
6.6 Knowledge bank



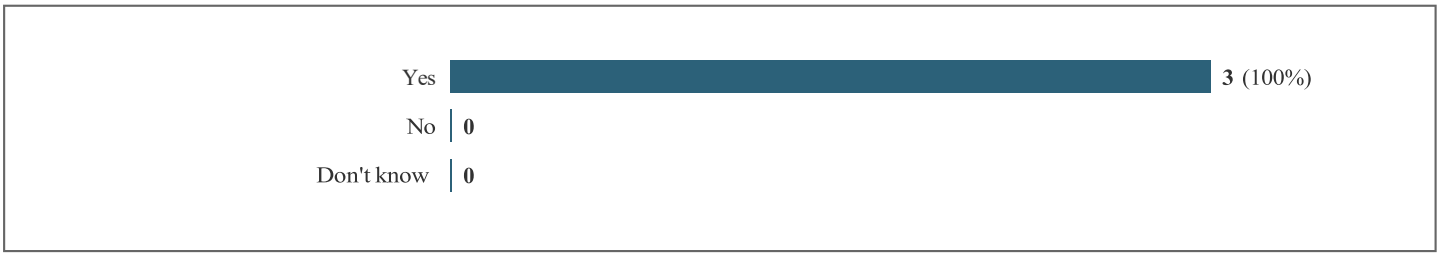
6.7 Leadership and strategy



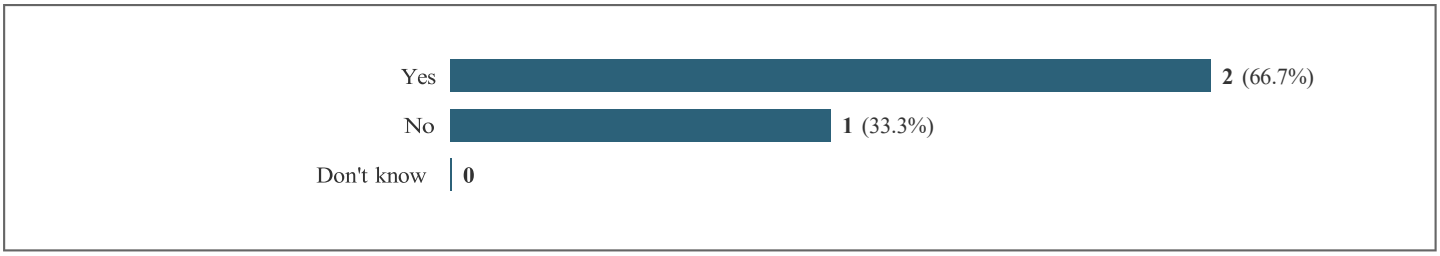
6.8 Communication



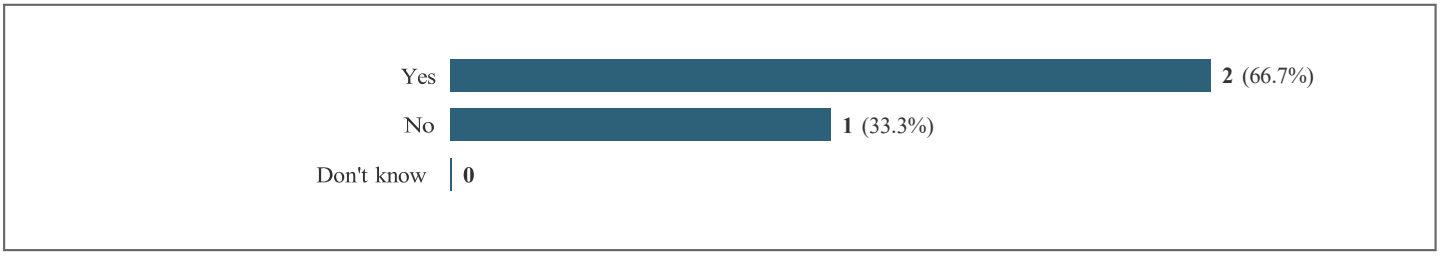
7 Does the company leadership use internal knowledge and skills?



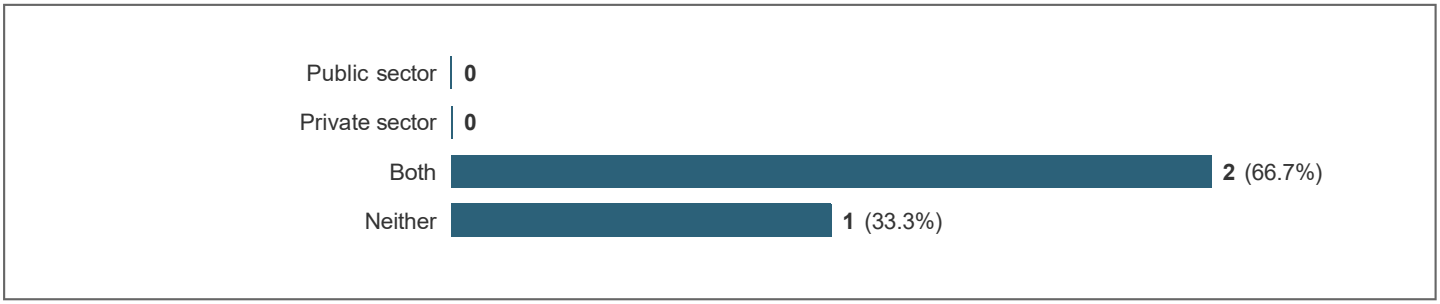
8 Does the company leadership more readily consider a number of external avenues when required to gather knowledge since the end of the KTP project?



9 In the last twelve months, have you sought external advice or information on matters affecting your business?

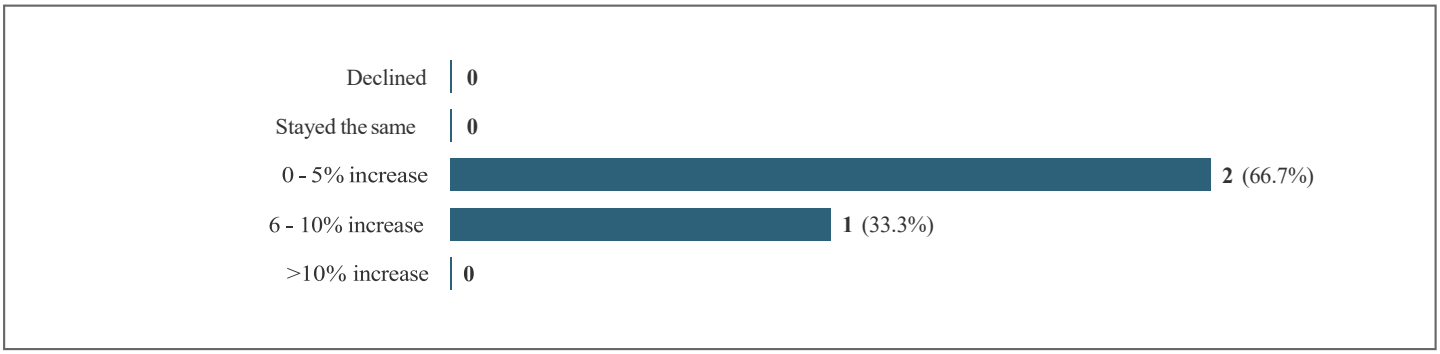


10 Was the information or advice that you sought from the public or private sector, or both?

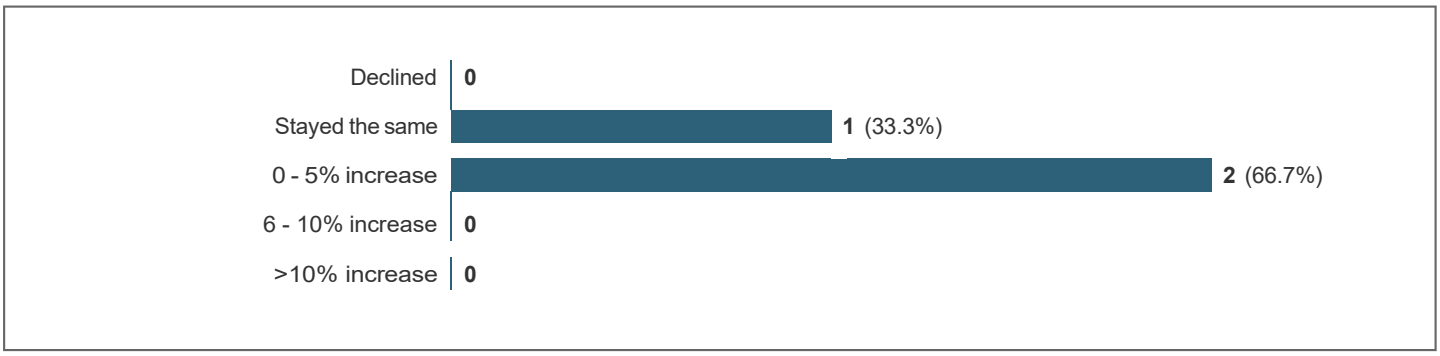


11 Please select on the scale for each of the categories

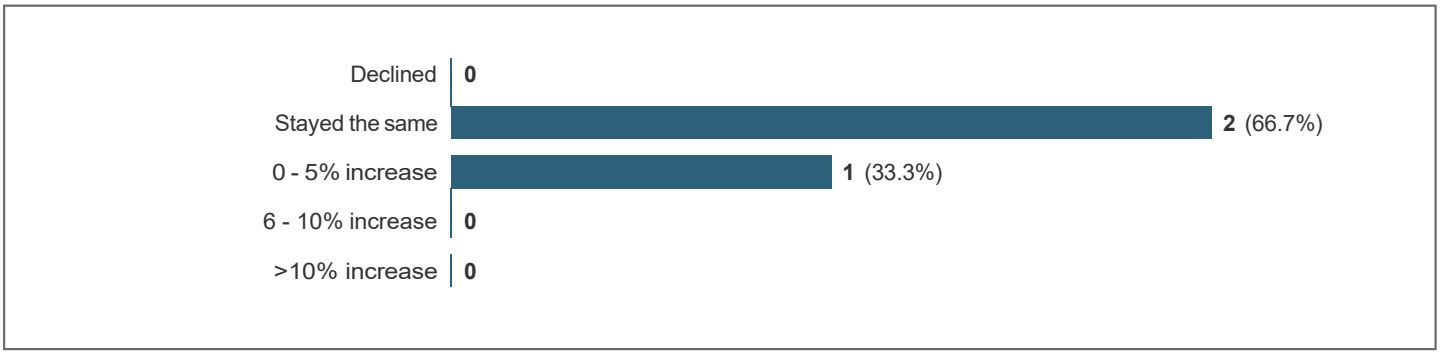
11.1 Sales revenue since completing the KTP



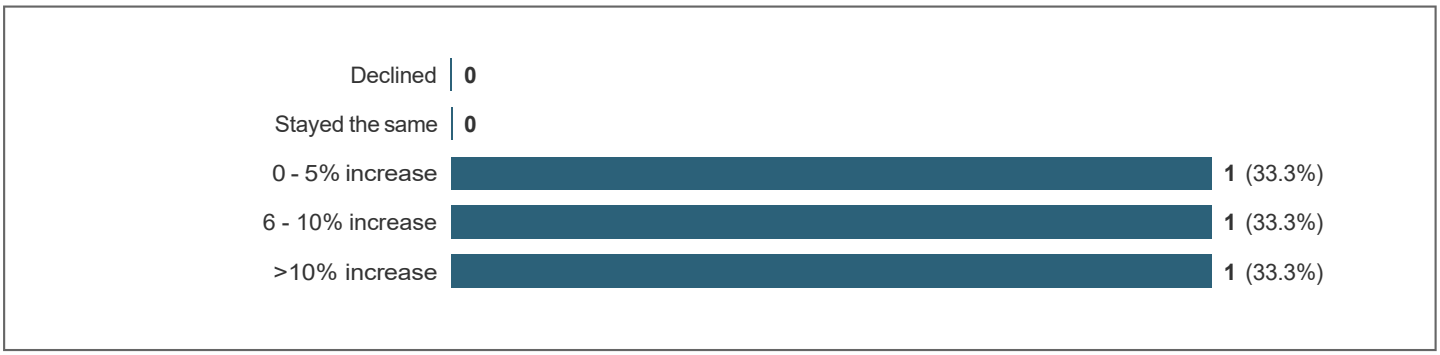
11.2 Market share since completing the KTP



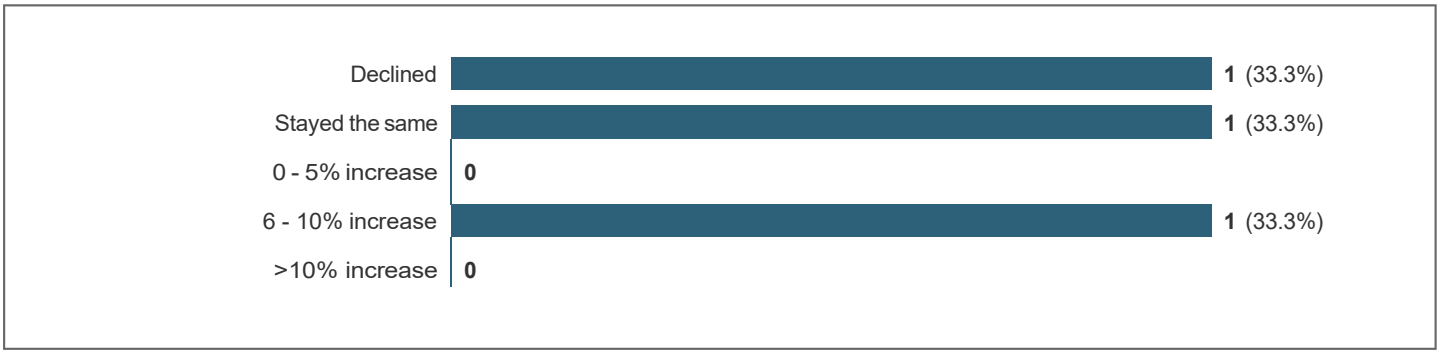
11.3 Efficiency gains since completing the KTP



11.5 Turnover since completing the KTP



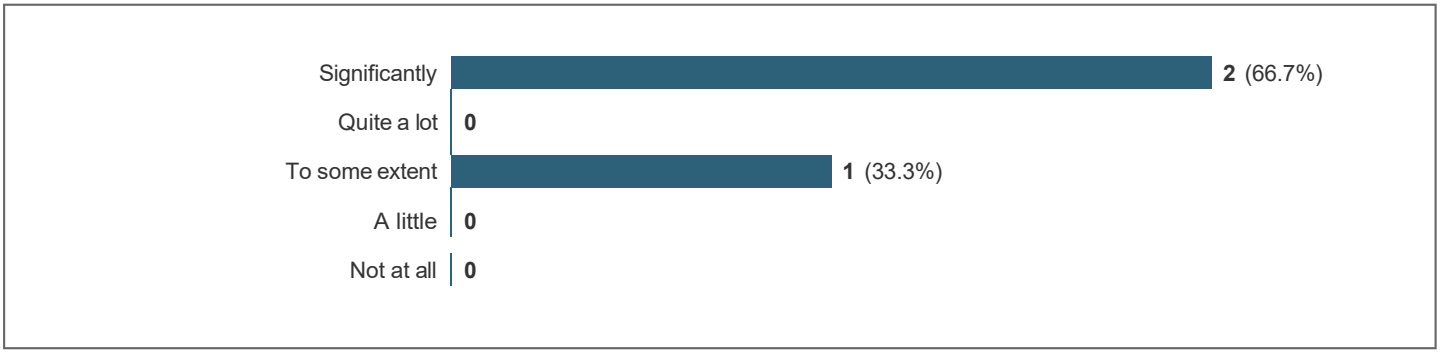
11.4 Cost savings since completing the KTP



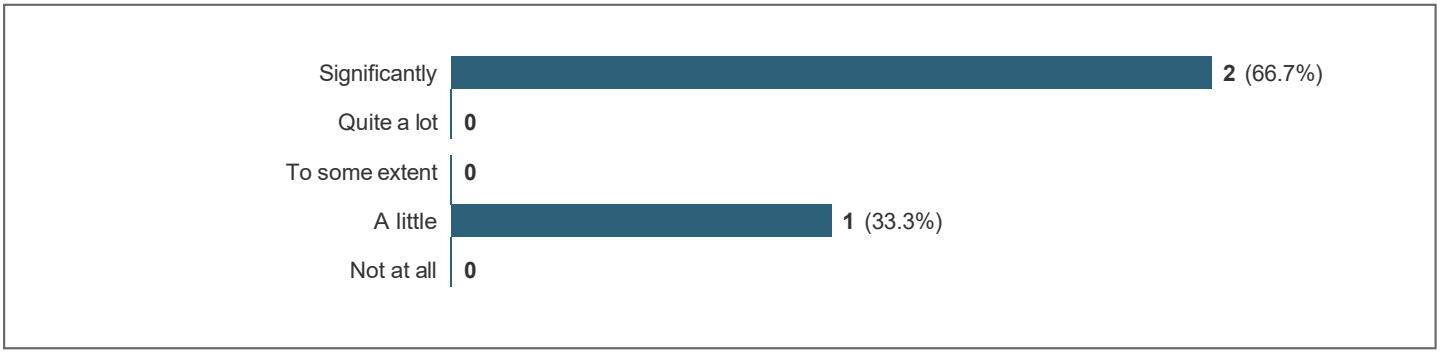
11.6 Margins since completing the KTP

12 Since the KTP project ended has there been a change in the areas below to ensure knowledge gain is part of the strategy?

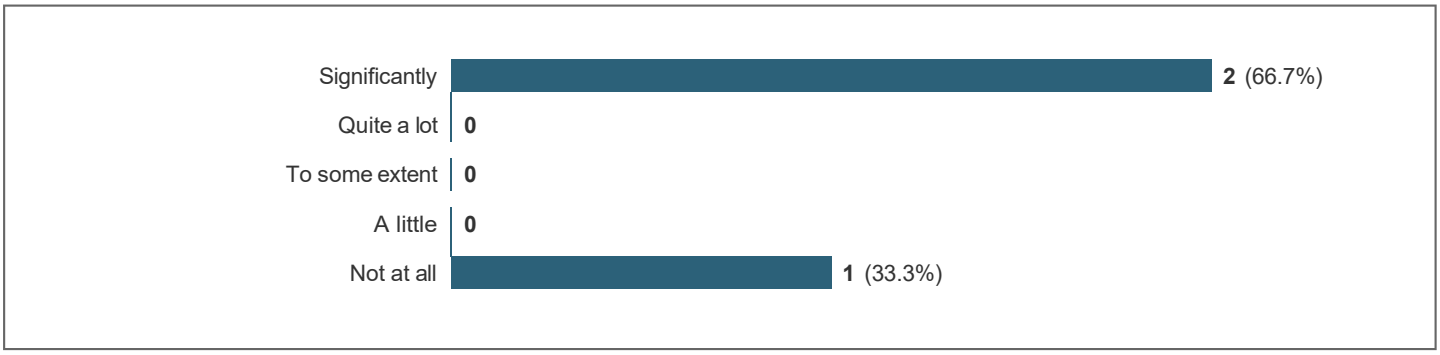
12.1 Skills Training



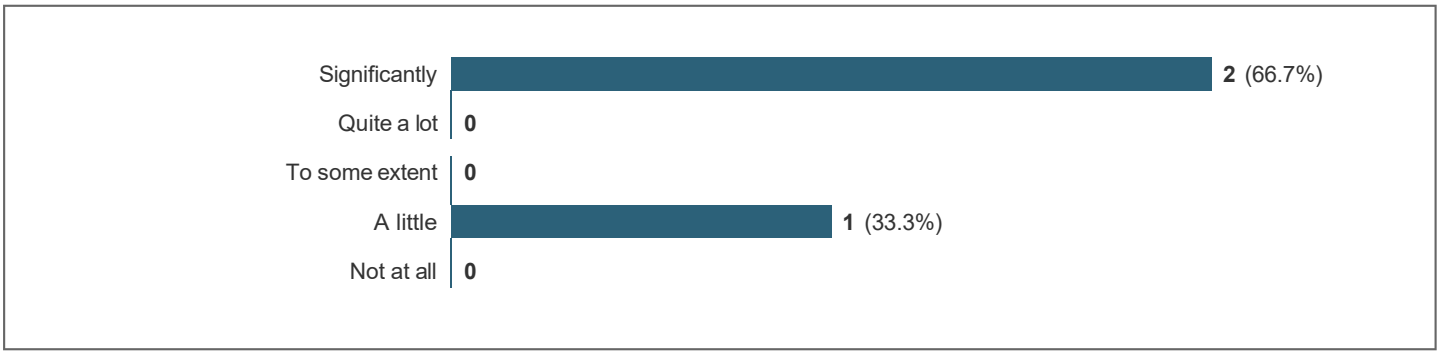
12.2 Research and Development



12.3 Collaboration with external sources

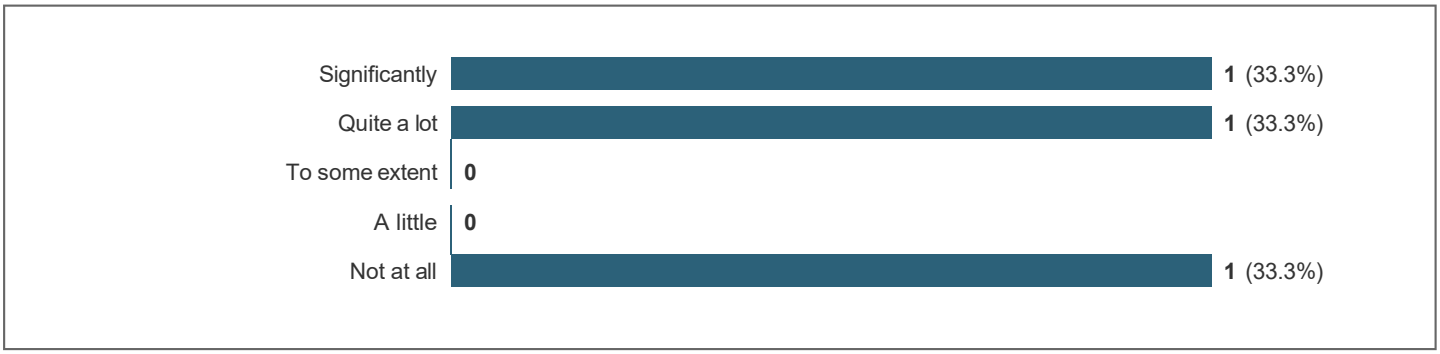


12.4 Market research

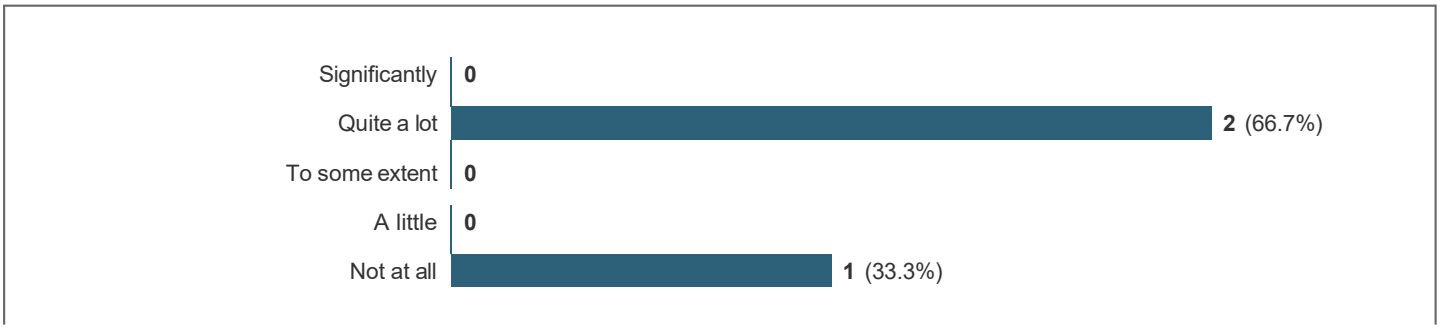


13 Since the KTP project ended have the successful practices of embedding knowledge become part of the business?

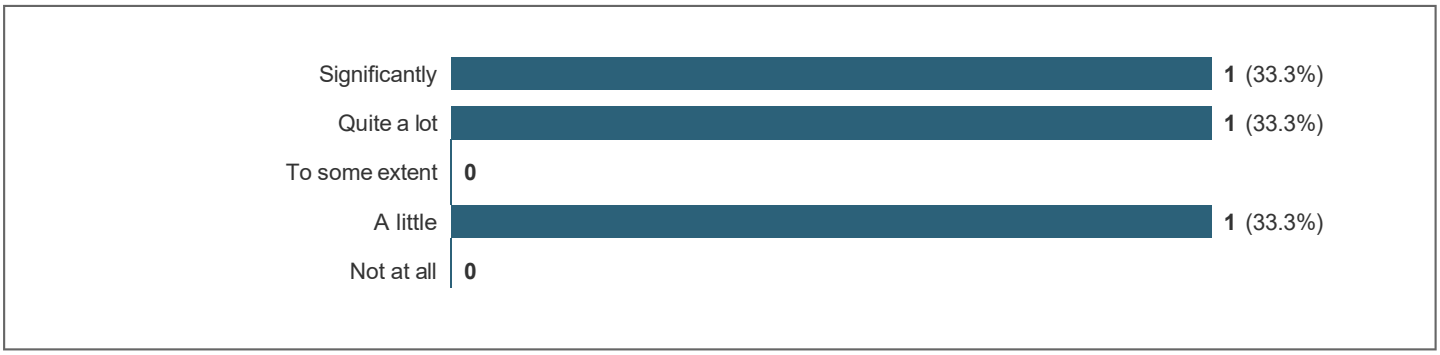
13.1 Project planning and review



13.2 Project Champions appointed

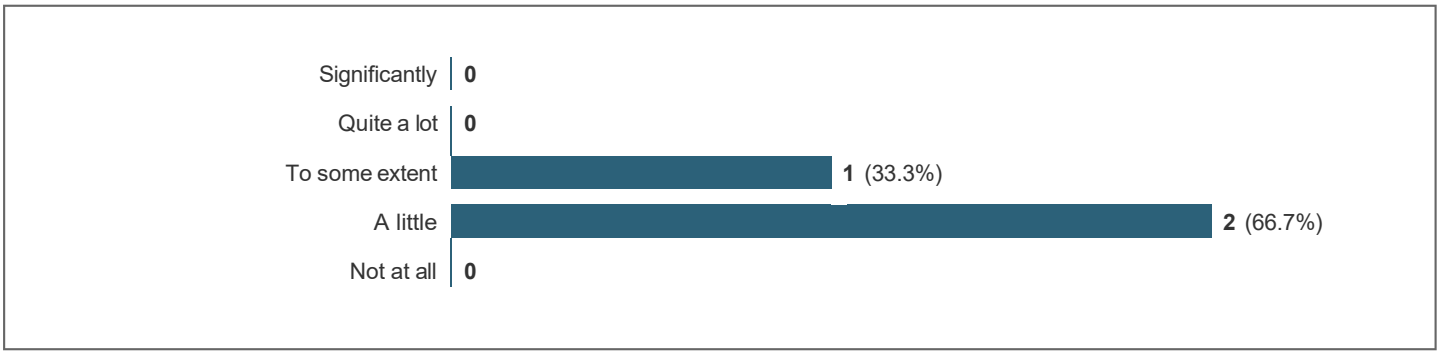


13.3 Measurement or Key Performance Indicator (KPI) reporting



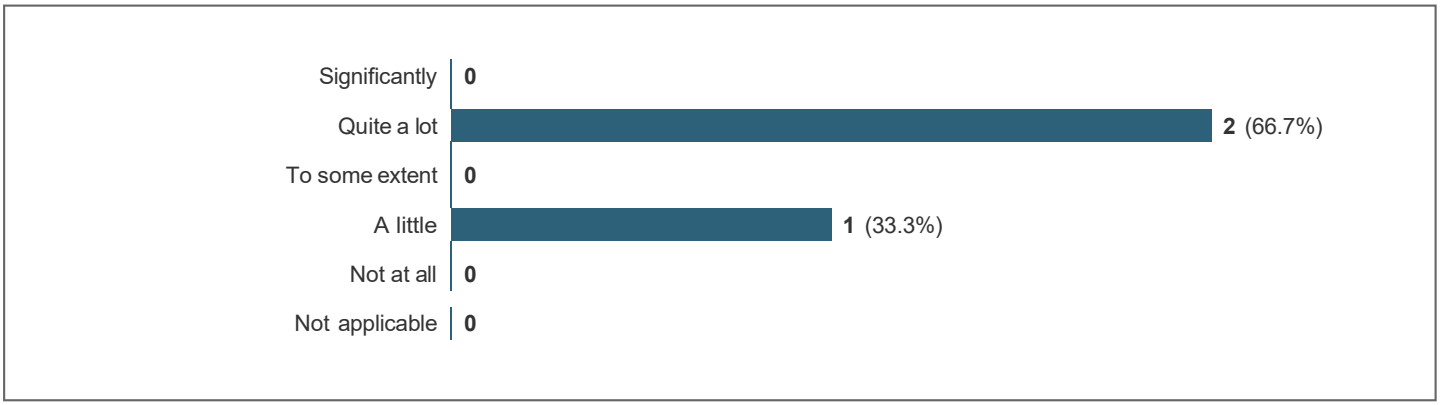
13.4 Communication notices or boards

13.5 Company results and actions communicated to all



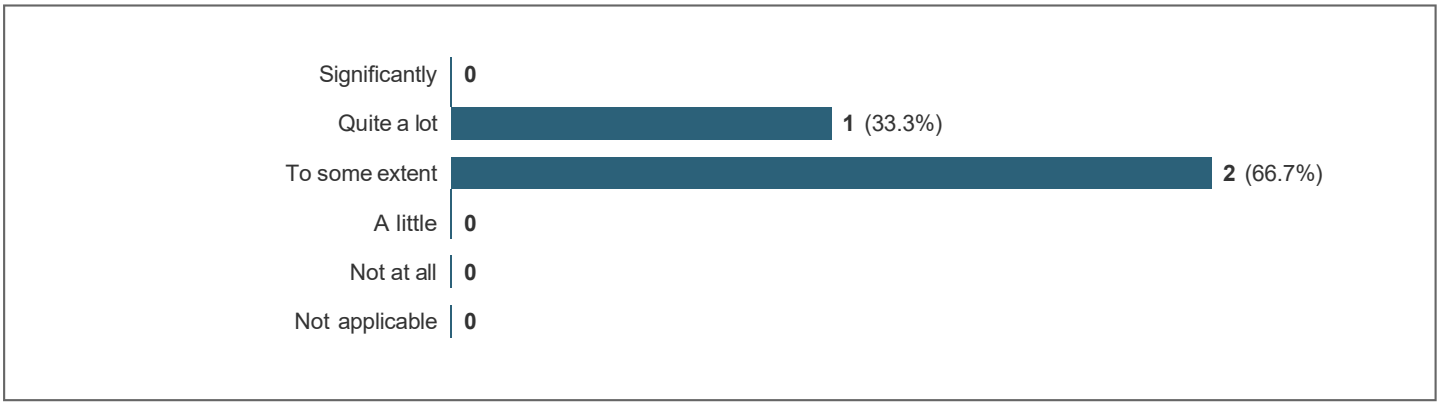
14 Has the company increased in competitive position in relation to its competitors since the KTP project ended?

14.1 Increased product types

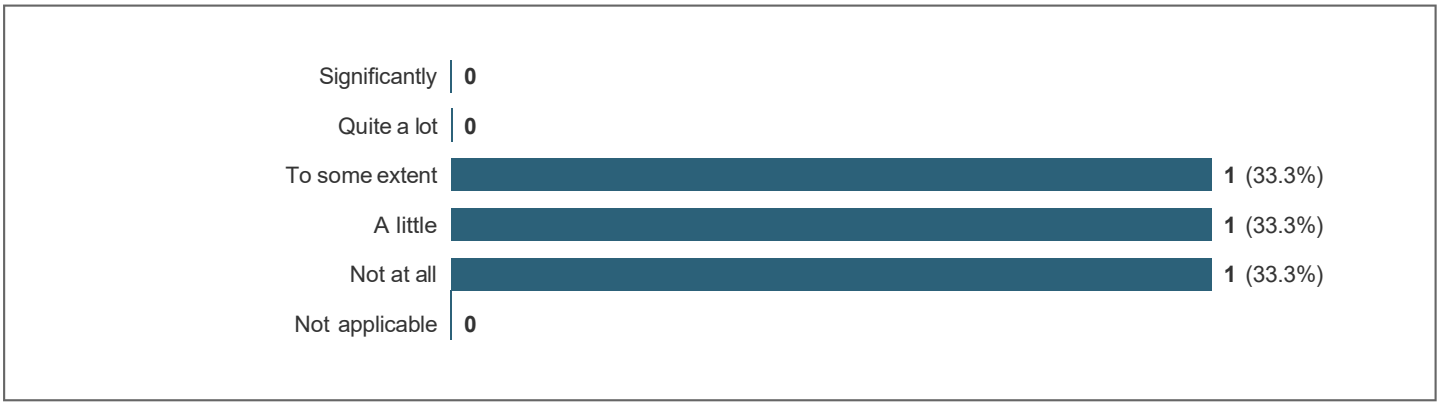


14.2 Increased customers

14.3 Increased sales



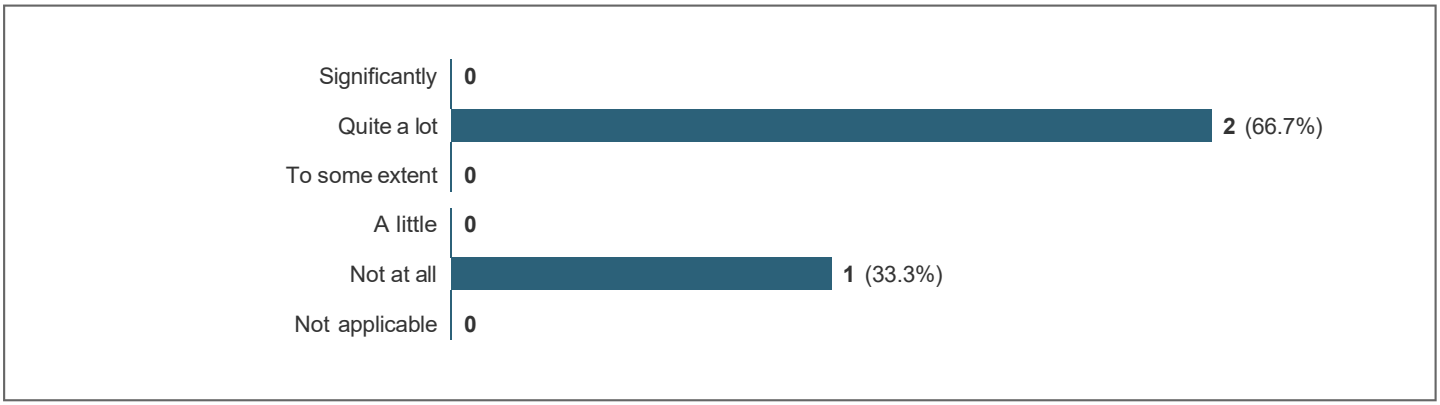
14.4 Increased speed of new products to market



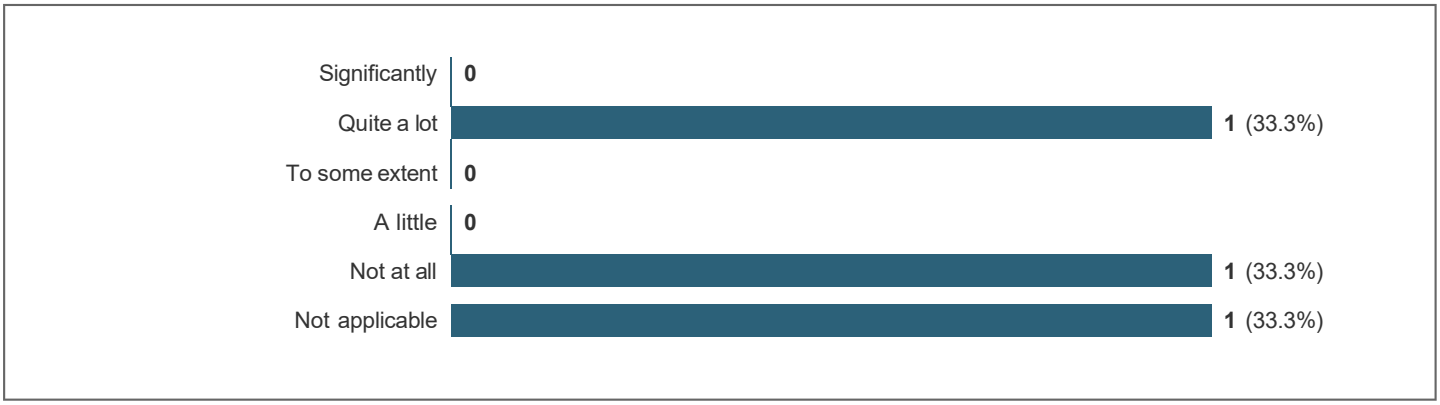
14.5 Product specification improvements

14.6 Improved or added to customer service provision

14.7 Improved process efficiency



14.8 Reduced selling costs



15 Enter here any further comments that will assist this study to identify changes made to the business model as a result of the KTP project. This may be related to products, processes, machinery & equipment, people, procedures or the strategy.

Showing all 3 responses	
Nothing to add	166201-166195-13408136
Identified that people with knowledge need to be taken into the business. Capability gap is decreasing as the time increases with no new intake. R&D would develop faster than it is with recruiting experience and knowledge. R&D projects are increasing but it is slow from identification to testing and implementation. Marketing Team set up since KTP from zero to having this facility. Owner/manager issues identified as resistant to change and risk avoidance. The practices supported are risk averse and determined by fear of failure.	166201-166195-15534559
Changes to culture were real and lasting Continuous Improvement is part of the culture Diversification was made possible Consolidation Real Change typified by: Consortium membership leading to a very large collaboration project. More partnership opportunities being explored externally Impact may be waning and there has been no new knowledge recruited into the business in the period since the Associate left although he did stay on after the KTP project.	166201-166195-15534816

Knowledge Transfer and the Business Model Impact (copy)

Page 1: Welcome

This survey aims to gather responses about the longer-term effects of a Knowledge Transfer Partnership (KTP) project for SMEs. The focus is on Design and Manufacturing companies. You have been asked to participate as you have been a previous KTP Company partner with a University Knowledge Base under the funding programme from the Technology Strategy Board now Innovate UK.

An individual **KTP Impact Report** can be compiled and sent after completion of the survey **see Question 10**. You will also receive a copy of the analysis and results from this KTP Impact Survey. If you wish to agree to an interview, please contact me on this email s.murray@herts.ac.uk

The research is an opportunity to establish if the model of knowledge transfer through university – industry collaboration using the Knowledge Transfer Partnership project has developed the knowledge capital that can be accessed internally and externally and impacted the competitive advantage for the business. This will be explored to establish the translation into the individual business models and the businesses strategic development.

University ethics committee have approved this study Protocol number: TBA. The survey is

completed anonymously and can be saved part way through.

Note that once you have clicked on the CONTINUE button at the bottom of each page you cannot return to review or amend that page.

Page 2: Data Protection statement

All data collected in this survey will be held anonymously and securely. No personal data is asked for or retained.

Cookies, personal data stored by your Web browser, **are not used in this survey**.

Page 3: Industry Sector

1. Please select an appropriate Industry sector from the list *Required*

1.a. If you selected Other, please specify:

2. Please select the number of employees currently for your business *Required*

3. Which year did your last KTP project finish? *Required*

- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
- Earlier than 2004

Page 4: Business Model Impact

4. What level of growth for your business, if any, has there been since the KTP project?
Required

- Decline
- Same 0
- - 5%
- 6 - 10%
- >10%

5. Has the company increased in Competitive Position in relation to its competitors since the KTP project ended? *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 5 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Increased product types					
Increased customers					
Increased sales					
Increased speed of new products to market					
Product specification improvements					
Improved or added to customer service provision					

Improved process efficiency	☐	☐	☐	☐	☐
Reduced selling costs	☐	☐	☐	☐	☐

6. Please select on the scale for each of the categories for the Business Model Impact
☐ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 4 answer(s).

	Declined	Stayed the same	0 - 5% increase	6 - 10% increase	>10% increase
Sales revenue since completing the KTP	☐	☐	☐	☐	☐
Market share since completing the KTP	☐	☐	☐	☐	☐
Efficiency gains since completing the KTP	☐	☐	☐	☐	☐
Turnover since completing the KTP	☐	☐	☐	☐	☐
Cost savings since completing the KTP	☐	☐	☐	☐	☐
Margins since completing the KTP	☐	☐	☐	☐	☐

7. Since the KTP project ended has there been a change in the areas below to ensure knowledge gain is part of the strategy? ☐ *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 4 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Skills Training	☐	☐	☐	☐	☐
Research and Development	☐	☐	☐	☐	☐
Collaboration with external sources	☐	☐	☐	☐	☐
Market research	☐	☐	☐	☐	☐

Page 5: Operational Impact

8. Please indicate the level of impact on each of the listed areas affected since the KTP project(s). *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 8 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Products	☐	☐	☐	☐	☐
People	☐	☐	☐	☐	☐
Processes	☐	☐	☐	☐	☐
Marketing	☐	☐	☐	☐	☐
Information Systems	☐	☐	☐	☐	☐
Knowledge bank	☐	☐	☐	☐	☐
Leadership and strategy	☐	☐	☐	☐	☐
Communication	☐	☐	☐	☐	☐

9. Since the KTP project ended have the successful practices of embedding knowledge become part of the business? *Required*

Please don't select more than 1 answer(s) per row.

Please select at least 5 answer(s).

	Significantly	Quite a lot	To some extent	A little	Not at all
Project planning and review	☐	☐	☐	☐	☐
Project Champions appointed	☐	☐	☐	☐	☐

Measurement or Key Performance Indicator (KPI) reporting	☐	☐	☐	☐	☐
Communication notices or boards	☐	☐	☐	☐	☐
Company results and actions communicated to all	☐	☐	☐	☐	☐

Page 6: KTP Impact Report

10. I would like to receive an Individual KTP Impact Report *Required*

More info

10.a. If YES then Enter a contact for a direct email.

10.b. Enter here any further comments that will assist this study to identify changes made to the business model as a result of the KTP project. This may be related to products, processes, machinery & equipment, people, procedures or the strategy. *Required*

10.c. I would like to assist in this research and agree to further contact to arrange an Online or Telephone meeting. The interview questions will be sent prior to the meeting *Required*

Page 7: Final Page

The FINAL page

Thank you for your contribution by completing this survey.

All information gained in this survey will be stored securely and anonymity be protected. If you have any

questions, please do not hesitate to contact the author Susan
Murray s.murray@herts.ac.uk.

Respondents can now leave the survey Please

follow this link to return to the: Bristol Online

Surveys Homepage

Appendix 7 KTP Project Impact Report

Double click on text below to view full file.

KTP IMPACT REPORT

Company V

Abstract

Supported by the School of Engineering and Technology, University of Hertfordshire the aim of this research is to explore the impact of Knowledge Transfer Partnership (KTP) projects on the business model for small to medium enterprises.

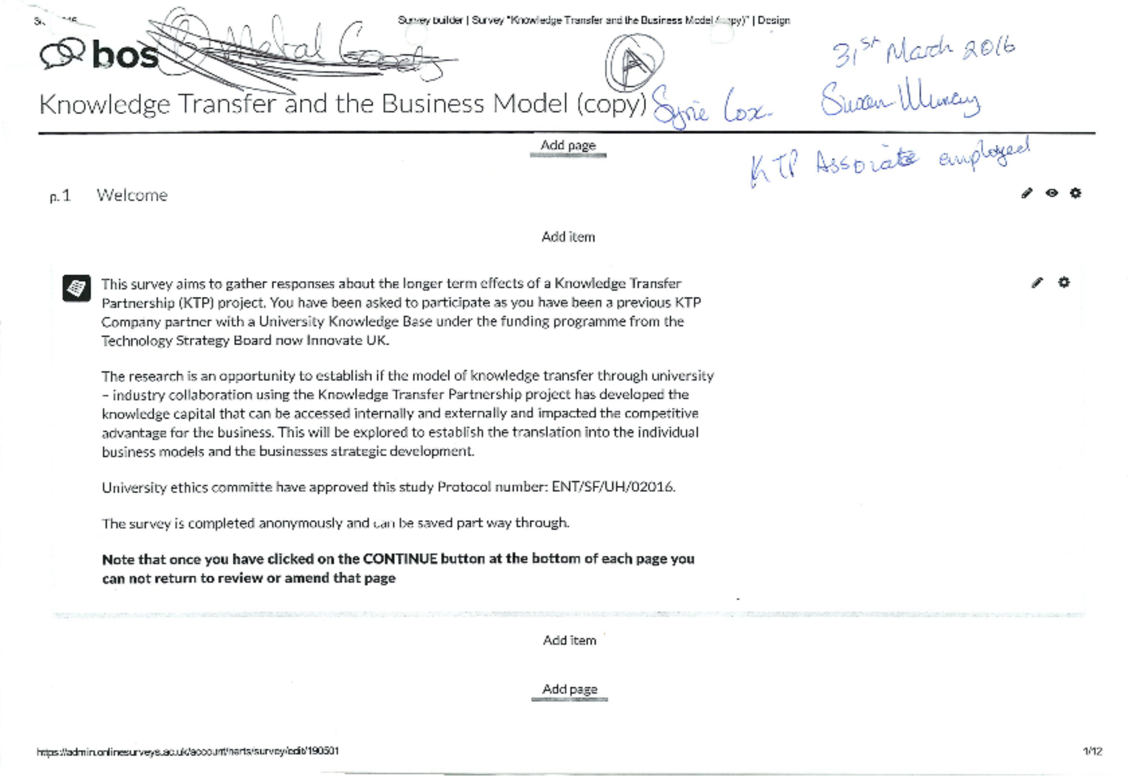
Susan Murray

s.murray@herts.ac.uk

University of Hertfordshire UH

Appendix 8 Interview data

Double click on text below to view full file.



Survey builder | Survey "Knowledge Transfer and the Business Model (copy)" | Design

bos

Knowledge Transfer and the Business Model (copy)

31st March 2016

KTP Associate employed

Add page

p.1 Welcome

Add item

This survey aims to gather responses about the longer term effects of a Knowledge Transfer Partnership (KTP) project. You have been asked to participate as you have been a previous KTP Company partner with a University Knowledge Base under the funding programme from the Technology Strategy Board now Innovate UK.

The research is an opportunity to establish if the model of knowledge transfer through university – industry collaboration using the Knowledge Transfer Partnership project has developed the knowledge capital that can be accessed internally and externally and impacted the competitive advantage for the business. This will be explored to establish the translation into the individual business models and the businesses strategic development.

University ethics committe have approved this study Protocol number: ENT/SF/UH/02016.

The survey is completed anonymously and can be saved part way through.

Note that once you have clicked on the CONTINUE button at the bottom of each page you can not return to review or amend that page

Add item

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https://admin.onlinesurveys.ac.uk/account/herts/survey/edit/190501 1/12

Appendix 9 Survey letter for mail merge

Double click on text below to view full file.

KTP Impact Survey July 2018

My name is Susan Murray and I am currently undertaking PhD research within the School of Engineering and Technology, University of Hertfordshire. The aim of this research is to ascertain the impact of Knowledge Transfer Partnership (KTP) projects on the company business model with focus on SMEs. This survey is only applicable for former KTP Company Partners through Innovate UK and completing this survey you can indicate if you would like to receive an individual Knowledge Transfer Partnership (KTP) Impact report based on your response.

The link for completing the brief survey is shown below.

Knowledge Transfer Projects and Business Impact survey

All data will be treated in accordance with the Ethical Policies and Procedures here at the University of Hertfordshire and this survey has approval under Protocol number: **aENT/PGR/UH/02016(4).**

Thank you for your help and support and I anticipate the findings will allow development of practices for future KTP projects and some further focus and guidance for you on the areas to create value and capturing that value to gain competitive advantage.

Thank you for your help and support

Susan Murray CEng MIET PGCE MA FHEA
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T: 01707 284270

Appendix 10 Case Study A, B, C, D and E

Case Study A (CSA)

Introduction

An interview with Company A was conducted on 31st March 2016 as part of a pilot study. Company A, a medium-sized charitable organisation, collaborated with the University of Hertfordshire on a Knowledge Transfer Partnership (KTP) project that ran from late 2009 to 2012. The primary objective of the KTP was to enhance the organisation's ICT capacity and capabilities, thereby enabling it to better support its mission of assisting vulnerable young people.

The KTP initiative significantly contributed to the organisation's operational efficiency and strategic focus. While maintaining consistent staffing levels, the organisation prioritised income generation and asset acquisition within a challenging public sector environment. The KTP facilitated the transition to e-marketing and the adoption of social media applications, while integrating knowledge from the fields of software development and psychology.

KTP objectives and outcomes

A key outcome of the KTP was the reduction of administrative burdens on staff, allowing them to allocate more time to value-adding activities. Centralized and remote access to information enabled faster reporting, such as the preparation of annual reports required by funding bodies. The institution's achievements during the KTP were recognized in 2013 with the Queen's Award for Enterprise. This accomplishment, combined with the attainment of the matrix quality standard for information and guidance, underscored the KTP's success.

The enhanced focus on marketing led to the recruitment of a Marketing Officer, Graphics Designer, and Video Producer. Although the organisation incurs minimal selling costs due to its charitable nature, it is proactively developing new offerings to remain relevant in the public sector marketplace.

At the time of the KTP, the project's strategic relevance was heightened by increasing competition in the sector, necessitating agility in responding to emerging opportunities and evolving requirements. The acquisition and divestment of initiatives such as shops, cafés, and educational facilities underscored the necessity for a scalable and adaptable IT infrastructure. The KTP

Associate was retained as a Business and Technology Developer to sustain these advancements.

Organisational Growth and Strategic Outcomes

The KTP catalysed significant growth and structural transformation within the organisation. Participation in large collaborative projects expanded the charity's services to a broader demographic. Consortium membership facilitated further partnerships and collaborative opportunities. As part of its strategic evolution, the charity transitioned to Academy Trust and Free School status, now offering Key Stage 4 education (ages 14–16) with a curriculum that includes five GCSEs. The enhanced website played a pivotal role in increasing funding, user engagement, and organisational reach.

From a financial perspective, the organisation experienced substantial growth. Fixed assets and financial accounts grew from £1.8 million in 2012 to £2.236 million in 2015, surpassing the predicted growth target of £2.1 million. This represents a growth rate exceeding 10%, a significant impact attributed to the KTP's contributions.

The interview recorded high levels of operational impact across multiple dimensions, including knowledge management, information systems, communication, product development, staff skills, and marketing. However, leadership and strategy saw limited impact. The competitive nature of the sector for funding was identified as a key challenge to innovation.

Knowledge Transfer and Capability Development

The KTP profoundly enhanced internal knowledge and skills, with sustained impact observed four years after the project's conclusion. Applications for funding have become more effective, and staff management practices have improved. Initiatives such as the McKinsey Online Capacity Assessment Tool, staff forums, and enhanced training programs have fostered a flat hierarchy and a culture of creativity.

The organisation has also sought external expertise to supplement internal knowledge, engaging HR consultants, health and safety specialists, legal advisors, and external mentors. These collaborations have yielded measurable

improvements in the quality of information and advice provided to young beneficiaries. A recent example includes an external monitoring and evaluation project initiated within the last 12 months.

Conclusion

The KTP's impact on the organisation's business model is evident in increased grant-based income and operational efficiencies. While market share remains unchanged, the cultural shift toward continuous improvement and diversification has been profound. The importation of external knowledge and skills has been instrumental in driving these transformations, which would not have occurred otherwise.

Case Study B (CSB)

Introduction

An interview with Company B was conducted on 4th April 2016 as part of the pilot study. Company B, a microenterprise, undertook a short Knowledge Transfer Partnership (KTP) with the University of Hertfordshire from 2009 to 2010. The company specializes in manufacturing and supplying equipment for commercial heating systems and refrigeration plants, including pressurization units used with commercial boilers, as well as ancillary products such as header arrangements for boiler connections, heat exchangers, and ball valves.

Company B identified a market demand for a device to manage domestic hot water and heating functions in individual dwellings connected to District Heating or Group Heating schemes, particularly in apartment blocks. This device would also provide metering for energy usage in each unit. However, the company lacked the in-house technical expertise, as well as product development, testing, and design capabilities, to bring such a product to market. The interdisciplinary nature of the required expertise made it unsuitable for outsourcing to a consultancy. Embedding this knowledge within the organisation was deemed essential to enable future product innovation.

KTP objectives and outcomes

At the conclusion of the KTP project in 2010, Company B employed 1 to 9 staff members. Since then, the company has experienced significant growth, with a

30–40% increase in sales revenue. A primary area of impact was the investment in software and staff, including the employment of the KTP Associate, to facilitate Computer-Aided Design (CAD) for individual projects. This investment has had a substantial effect on the company's product portfolio and a moderate impact on its knowledge base.

Despite these advancements, the interview revealed limited impact in other domains, such as people, processes, marketing, leadership and strategy, and communications. The KTP represented the sole instance of product innovation for the company, with no subsequent product developments reported. However, the company has engaged students through industrial placements, some of whom, including the KTP Associate, have transitioned into employment, contributing to a high impact on the organisational knowledge base. Beyond these hires, the company has experienced minimal staff turnover.

Knowledge Acquisition and Organisational Growth

Company B has increasingly relied on external sources for knowledge acquisition, particularly from the private sector, within the 12 months preceding the 2016 interview. Turnover rose from £632,000 in 2010 to £855,000 in 2015, representing a 33% increase. Sales revenue growth of 30–40% was achieved over six years. Notably, the company had forecasted a turnover of £700,000 for 2011, indicating that actual performance exceeded initial projections.

Investment in research and development has been limited, with a stronger emphasis on design innovation and speed rather than traditional research activities. This focus has yielded a high impact in terms of product development, although there has been minimal impact on other areas related to knowledge and innovation.

Knowledge Transfer and Capability Development

The company has assigned a Project Champion to oversee projects, which has had a moderate impact on project outcomes. However, other measures, including key performance indicators (KPIs) and internal communications, have seen little effect due to the company's small size. Communication is managed through regular meetings held every two to three months and an annual review.

The industry sector in which Company B operates is characterized by slow innovation cycles. This is reflected in the company's stable market share, with

consistent sales of 900 to 1,000 units annually for the past eight years (as of the 2016 interview). Unlike competitors who sell directly to end-users, Company B sells its products through third-party distributors. While this approach impacts profit margins, it minimizes costs associated with sales and commercial staffing.

Conclusion

The KTP project resulted in several key benefits for Company B, including growth in human resources, enhanced competitiveness through improved design IT capabilities, and sustained improvements in product development over the past four years. However, the company acknowledges the need for more rapid innovation to remain competitive in the market. The knowledge embedded through the KTP has positioned the company for continued development, albeit within the constraints of its current operational and market environment.

Introduction

Company C was interviewed on 3rd February 2016 as part of the pilot study. A medium-sized enterprise, the company undertook a second Knowledge Transfer Partnership (KTP) with the University of Hertfordshire between 2009 and 2011. This decision followed an earlier unsuccessful KTP project, which failed several years prior. Despite prior setbacks, the company qualified for KTP funding and decided to revisit the initiative to address its strategic needs.

At the time of the KTP application, the company had undergone a significant restructuring process, including changes in senior management. These changes highlighted the need for further improvements, particularly in increasing sales potential within the UK and expanding export markets. Additionally, the company had recently invested in a large-scale NVQ Level 2, and 3 training programmes aimed at upskilling its operations staff, an investment that required optimization through the adoption of modern manufacturing processes.

KTP objectives and outcomes

The primary objective of the KTP was to facilitate the profitable growth of the company by fostering employee creativity across all business processes. This initiative aimed to achieve the corporate goal of generating a return on capital employed (ROCE) exceeding 25%. While the Managing Director championed the project, there was initial scepticism among senior management regarding its feasibility.

The challenges facing the business at the outset of the KTP included:

- A lack of embedded knowledge in critical areas of the business.
- Insufficient technical and operational depth to meet requirements.
- Limited expertise in key domains such as quality control and financial management.

These gaps constrained the company's ability to exercise effective control over operations and maintain high skill levels. In particular, the research and development (R&D) activities required advanced expertise in material behaviour, such as Finite Element Analysis (FEA), which was absent within the organisation. Despite these constraints, significant potential was identified within factory operations. However, political resistance within the senior team initially hindered efforts to secure broader support for these initiatives. The KTP project introduced structured project management methodologies, which facilitated new product development in collaboration with customer partners. This success demonstrated

the value of systematic project management and reinforced its adoption across the organisation.

Knowledge Acquisition and Organisational Growth

Before the KTP, research and development had not been prioritized, with the company primarily focusing on stabilizing existing processes and validating applicable standards. The introduction of Statistical Process Control (SPC) enhanced process reliability, while the KTP project promoted innovation by emphasizing the importance of R&D. Despite these advances, the organisational culture remained risk-averse, with senior leadership often reluctant to assume ownership or champion new initiatives.

By 2016, newly appointed senior managers were actively supporting and promoting projects, marking a shift from the hierarchical leadership style previously adopted by the owner/manager. External collaborations facilitated through the KTP pathway also became a notable strength, with the company engaging in additional KTP projects, retaining KTP Associates, and leveraging external expertise for projects that were previously managed in-house. Greater involvement of customers in new product innovation further exemplified the success of these collaborative efforts.

Knowledge Transfer and Capability Development

The operational impact of the KTP was particularly pronounced in areas such as the internal knowledge base, information systems, and marketing, with moderate impact observed in product development, process improvements, and communication. The knowledge base was strengthened through the employment of apprentices and external partnerships, which brought specialized expertise into the business.

Quality standards improved significantly, with the achievement of AS9000 (Aerospace Standard) and ISO14001 (Environmental Standard) certifications. These enhancements expanded the company’s potential customer base. Specific quality control projects, such as the prevention of foreign object inclusion in production, were successfully completed, with suppliers contributing to these improvements.

From a commercial perspective, the company maintained stable profit margins between 2011 and 2015, despite challenging market conditions, including

fluctuations in the Euro, the financial crisis, and volatility in oil and gas prices. Turnover in 2015 was reported at £14 million, exceeding the KTP project's 2011 recorded turnover of £11.565 million and surpassing the projected increase of £550,000 by 2014.

Long-Term Impact and Strategic Development

Post-KTP, the company reported significant advancements in skills training, R&D, and collaboration with external stakeholders. These improvements had a lasting impact on the organisation's knowledge base. Measures such as the appointment of project champions, the implementation of project planning and review processes, and the establishment of Key Performance Indicators (KPIs) have been embedded into the company's operations. Regular updates to communication boards have also contributed to improved internal processes.

The R&D function has expanded, with projects now increasing in scope and opportunities being identified through enhanced market research efforts. A Market Research Team, previously non-existent, was established, comprising three members. Major customers gained through these initiatives include BAE Aerospace and Jaguar Land Rover. Collaboration has also been extended to government resources, trade missions, and industry-university partnerships, such as a 3D printing project.

The company's competitive position has been strengthened, with enhancements in product diversity, process efficiency, and reduced selling costs. A strategic focus on adding secondary operations to increase product value has also been developed. While some improvements identified during the KTP project have faced delays in implementation, they remain part of the company's long-term plans.

Conclusion

The KTP project significantly contributed to Company C's growth and development, addressing critical gaps in knowledge and operational capability. While challenges related to leadership and cultural resistance persist, the organisation has demonstrated its capacity for innovation and collaboration. The continued prioritization of R&D, alongside improvements in market research and external partnerships, positions the company to maintain its competitive advantage and achieve sustained growth.

Case Study D (CSD)

Introduction

Company D was interviewed on 23rd August 2018 as part of this study. Initially established as a micro-enterprise in 2004, the company grew progressively to a small enterprise and subsequently to a medium-sized SME, supported by a series of funded projects, including Knowledge Transfer Partnerships (KTPs), from 2012 onwards. Notably, these KTPs were conducted in collaboration with institutions other than the University of Hertfordshire.

Founded by two medical doctors, the company was driven by a desire to address the misuse of disinfectants and cleaning products in healthcare settings. The founders developed what they considered to be safer, more effective, and superior disinfectant products. By 2012, the company employed 15–20 staff, a figure that grew to 150 by 2018, illustrating substantial organisational expansion over this period.

KTP objectives and outcomes

The company's KTP activities began with a project (2012–2014) focused on enhancing existing products and establishing in-house research and development (R&D) facilities. This was followed by a second KTP (2015–2016) aimed at developing new products, incorporating emerging technologies, and identifying new market opportunities. A subsequent KTP (2016–2019) concentrated on marketing the newly developed products, particularly demonstrating their effectiveness against virucidal and tuberculocidal pathogens.

During 2016–2017, the company conducted a feasibility study exploring methods of application, including pumps and biofilms, as well as the potential use of the products at catheter and small surgical sites. A fourth KTP (2019–2022) expanded on antimicrobial surface technologies to reduce microbial infections in patients. Concurrently, the company pursued a Collaborative R&D project to explore antimicrobial customization for cancer delivery systems and short-lived antiseptic agents.

The KTP initiatives enabled the company to expand its technical capabilities and broaden its scope of operations. The organisation demonstrated strong support for the KTP model, leveraging it to embed knowledge transfer across all areas of the business. This led to widespread integration of knowledge exchange processes into the company's systems and practices.

A comprehensive portfolio review resulted in the identification of two premier product ranges with unique selling propositions (USPs) that became the company's flagship offerings. Employees benefitted from enhanced training programs, while KTP Associates contributed through PhD research, publications, and subsequent employment within the company. Four additional KTP projects were successfully secured, as detailed in Innovate UK (2022) and Appendix 11.

These subsequent KTPs facilitated the development of new products, the enhancement of existing offerings, and the identification of market gaps. Knowledge transfer partnerships involved external expertise, including contributions from NHS nurses and clinical biologists, which enriched the company's infection control practices. As a result, organisational structures such as a New Product Development Team and a Clinical Team were established.

Knowledge Transfer and Capability Development

The knowledge transfer processes initiated during the KTPs continued to influence the company's skills training and R&D activities. Collaborative research extended to other UK higher education institutions with further R&D trials. In 2018, the company pursued international collaboration through a visit overseas to discuss infection control and microbiology, which further informed product development.

Key actions and outcomes included:

- Expansion of product ranges through successive KTPs.
- Comprehensive education and training for employees and management.
- Integration of R&D activities in-house by 2018, after evaluating external facilities such as university laboratories.

The company maintained a strategic focus on external collaborations, planning further partnerships to complement its in-house R&D capabilities.

Long-Term Impact and Strategic Development

The KTP projects facilitated significant structural and process enhancements:

- In 2012, communication was straightforward due to the small size of the team.
- By 2018, a dedicated New Product Development Department and Project Management Team had been established.
- Key performance indicators (KPIs) and a Quality Management System (QMS) had been in place since 2012, driving operational efficiency.

The company's evolution included transitioning from supplying standard disinfectant wipes to offering specialized patient wipes, equipment services, and disease containment solutions. Clinical evidence demonstrating product efficacy was increasingly applied in real-life scenarios, although more robust studies were identified as necessary to strengthen the company's USPs.

By 2018, the company had established an international sales presence across 40 countries, with plans to grow its customer base further by 2021. New markets included non-acute sectors such as dental, optical, and veterinary practices. Organisational growth necessitated structural changes, with the introduction of new business functions to support the increased workforce. Collaborative office designs, such as open-plan layouts, facilitated communication and idea sharing.

The company's value capture strategies included:

- Expansion into global markets, including the establishment of a new office in Australia.
- Offering niche, high-performance products, such as efficient disinfectant wipes.
- Continuing publications to demonstrate product efficacy and regulatory compliance.

Conclusion

The KTP model provided a robust framework for Company D's growth and innovation. The company's strategic integration of R&D, supported by strong leadership and collaboration, positioned it for sustained success. While further improvements, such as robust clinical studies, are required to solidify its USPs, the company has established itself as a leader in infection control, with a competitive product portfolio and an expanding global presence.

Case Study E (CSE)

Introduction

Company E participated in an interview on 17th January 2022. This interview was formally sanctioned to provide insights into the company's development trajectory. Initially a micro-enterprise, Company E experienced growth into a small and subsequently a medium-sized enterprise, supported by a series of funded projects, including Knowledge Transfer Partnerships (KTPs) initiated in 2011 in collaboration with the University of Hertfordshire.

KTP objectives and outcomes

Company E's engagement in KTP activities began with the 2011–2014 partnership, focusing on new product development. At that stage, the company was already supplying several globally recognized brands.

Building on the KTP's success, the company undertook a funded feasibility study during 2013–2014 under the Collaborative R&D funding stream. This study aimed to refine the unique processes and facilitate further product development. From 2014 to 2015, additional Collaborative R&D funding enabled the company to evaluate its business model, emphasizing sustainability. Between 2018 and 2020, further research expanded knowledge of alternative materials, while a study conducted in 2020–2021 focused on advancements in processing technology and the development of higher-performance materials.

These efforts encompassed product design innovations, process enhancements, and technology assessments to ensure scalability for full-scale production. A subsequent KTP (2020–2023) concentrated on product development as well as addressing critical issues such as cost reduction and supply chain stability.

Additionally, Collaborative R&D funding for 2021–2023 supported automation in manufacturing processes, targeted powder compositions for specific applications, and design improvements to enhance heat dissipation and product performance (Innovate UK, 2022).

Knowledge Acquisition and Organisational Growth

Internally, employees demonstrated pride in their work and generated numerous ideas for improvements, though these lacked initial discipline. Exposure to academic rigor through the KTPs addressed this issue, instilling structure and discipline in innovation processes.

In 2017, the company established in-house R&D facilities, contributing to reductions in production costs and an expansion of its global commercial supply. Gross profits increased significantly, rising from £6.7 million in 2013 to £15 million by 2021.

Improved Processes and Outcomes

The KTP initiatives introduced disciplined innovation practices, enhancing project planning and management. Tools such as Gantt charts were adopted, which improved organisational efficiency and facilitated successful project execution.

A key benefit of participating in KTPs and Collaborative R&D projects was the robust verification of new products prior to their market launch. Access to high-quality academic resources significantly improved decision-making regarding which innovations to pursue. This collaboration elevated internal knowledge and skills, enabling the development of new ideas with a rigorous, evidence-based approach.

Post-KTP Developments and Legacy

The advancements initiated during the KTPs continued to yield benefits even after the projects concluded. High-value analytical equipment was integrated into manufacturing processes, enhancing quality control. Supply chain management improved through the implementation of stricter controls and higher material specifications.

The KTP Associate, who made substantial contributions to the project, was offered a permanent position within the company. However, the Associate opted to join a global organisation, reflecting the employability and professional development achieved through participation in the KTP.

Conclusion

The Knowledge Transfer Partnerships and Collaborative R&D projects were instrumental in driving Company E’s growth and innovation. These initiatives introduced academic rigor, improved internal processes, and facilitated technological advancements, ultimately positioning the company as a leader in its field.

Appendix 11 Case Study D & E funding table

Double click on text below to view full file.

Appendix 8 Case Study D & E fund tables

Case Study D record of funded projects (Innovate_UK, 2022)

Project Title	Innovate UK Product Type	Participant Name	CRN	Project Start Date	Project End Date
Encapsulated antimicrobial precursors for non-antibiotic treatment of MDRO in poultry.	Collaborative R&D	Company AA	05316871	01/02/2019	31/08/2022
Cardiff University and GAMA Healthcare	Knowledge Transfer Partnership	Company AA	05316871	01/02/2019	28/02/2022
Investigation of efflux pump biocide and antibacterial resistance mitigation in organisms within biofilms	Feasibility Studies	Company AA	05316871	01/04/2016	31/03/2017
Cardiff University and GAMA Healthcare Limited	Knowledge Transfer Partnership	Company AA	05316871	01/04/2016	31/03/2019
Cardiff University and GAMA Healthcare Limited	Knowledge Transfer Partnership	Company AA	05316871	01/05/2015	31/10/2016
Cardiff University And GAMA Healthcare Limited	Knowledge Transfer Partnership	Company AA	5316871	01/06/2012	30/06/2014

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Appendix 12 Main survey responses

Double click on text below to view full file.

Appendix 11 Main Survey and responses.zip

Appendix 13 KTP Impact Pilot survey results

Double click on text below to view full file.

Knowledge Transfer and the Business Model

Showing 3 of 3 responses
Showing all responses
Hiding question 15
Response rate: 6%

1 Please select an appropriate Industry sector from the list

Please select an appropriate Industry sector from the list	Sales revenue since completing the KTP					No answer	Totals
	Declined	Stayed the same	0 - 5% increase	6 - 10% increase	>10% increase		
Aerospace	0	0	0	0	0	0	0
Agriculture, forestry, fishery	0	0	0	0	0	0	0
Bricks, cement, glass manufacturing	0	0	0	0	0	0	0
Chemical manufacturing	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0
Education, administration	0	0	0	0	0	0	0
Energy, water	0	0	0	0	0	0	0
Finance	0	0	0	0	0	0	0
Food, drink, tobacco	0	0	0	0	0	0	0
Footwear, textile manufacturing	0	0	0	0	0	0	0
Furniture, games, jewellery	0	0	0	0	0	0	0
Instrument, electrical manufacturing	0	0	0	0	0	0	0
IT, multimedia	0	0	0	0	0	0	0
Medical (inc medical device manufacturing)	0	0	0	0	0	0	0
Membership professional orgs	0	0	0	0	0	0	0
Metal goods (inc vehicle manufacturing)	0	0	0	0	0	0	0
Metal manufacturing	0	0	0	1	0	0	1

1 / 25

Appendix 14 Pilot Study key file raw results

Double click on text below to view full file.

URN		Unique Response Number
Q1		Please select an appropriate Industry sector from the list
	1	Aerospace
	2	Agriculture, forestry, fishery
	3	Bricks, cement, glass manufacturing
	4	Chemical manufacturing
	5	Construction
	6	Education, administration
	7	Energy, water
	8	Finance
	9	Food, drink, tobacco
	10	Footwear, textile manufacturing
	11	Furniture, games, jewellery
	12	Instrument, electrical manufacturing
	13	IT, multimedia
	14	Medical (inc medical device manufacturing)
	15	Membership professional orgs
	16	Metal goods (inc vehicle manufacturing)
	17	Metal manufacturing
	18	Plastics, paper, printing industries
	19	Publishing, media, sport
	20	R&D
	21	Service industry (inc distribution)
	22	Sustainability
	23	Transport
	24	Wood
	25	Other
	26	Other
Q1_a		If you selected Other, please specify:
Q2		Please select the number of employees currently for your business
	1	1 to 9 employees (Micro)
	2	10 to 49 employees (Small)
	3	50 to 249 employees (Medium)
	4	>249 employees (Large)
	5	>250 employees
Q3		Which year did your last KTP project finish?
	1	2004
	2	2005
	3	2006
	4	2007
	5	2008
	6	2009
	7	2010
	8	2011
	9	2012
	10	2013
	11	2014
	12	2015

Appendix 15 Main Survey Free text entries summary

Double click on text below to view full file.

Appendix 11 Free text entries from SME survey

A	Changes to culture were real and lasting Continuous Improvement is part of the culture. Diversification was made possible Consolidation Real Change typified by: Consortium membership leading to a very large collaboration project. More partnership opportunities being explored externally. Impact may be waning and there has been no new knowledge recruited into the business in the period since the Associate left although he did stay on after the KTP project.
B	Nothing to add
C	Identified that people with knowledge need to be taken into the business. Capability gap is decreasing as the time increases with no new intake. R&D would develop faster than it is with recruiting experience and knowledge. R&D projects are increasing but it is slow from identification to testing and implementation. Marketing Team set up since KTP from zero to having this facility. Owner/manager issues identified as resistant to change and risk avoidance. The practices supported are risk averse and determined by fear of failure.
D	
E	The 2008 / 2009 recession had a huge impact on us. Otherwise, I think the improvements would have been better.
F	As an explanation of the reduction in turnover/demand steel prices have halved in the last 5 years with severe consequences.
G	We have extended the consulting element of our business which now includes air quality modelling as well as dust modelling and has brought in new, higher value clients.
H	The KTP project only contributed marginally to our company growth and ability to deliver new products to market
I	Unfortunately, I think that this survey has a fundamental flaw. Our company has indeed experienced huge growth since the KTP(s) ended, but that growth is in no way related to the KTP. We have used 3 KTP's since 2007 and none of them have had any real impact on the business. My view is that this is primarily due to the boundary between academia and industry (particularly in the engineering sector). The associates which we've had (including a PhD) just don't have the necessary experience and skillset to contribute. I'm happy to discuss this further if required. Dr David Thewsey
J	The KTP project was a major success. It produced a significant change in the culture of the company that enabled big growth to take place.
K	No entry
L	No entry
M	No entry
N	Following transfer of our knowledge to the post graduate and manager, both left the project without carrying out the expected development. WE therefore abandoned the project.
O	No entry
P	No entry
Q	NO entry
R	The project was a complete waste of time, I had my KTP with Westminster University who were only interested in the money, they gave me a Chinese person who could not speak or write in English they falsified the reports and I stopped the project half way through to save government money
S	None of the changes I have indicated were as a result of the KTP project. They are as a result of the growth of the company and other factors. I would say that the KTP project was a failure overall and gained us very little. This was due to our inability to monitor progress properly and due to the individual concerned whose motivation was self-interest.
T	No entry
U	The individuals and collaborative organisations are what makes the impact, thus choosing the RIGHT ones is critical. We chose the right KTP candidate, the right academic supervisor, but totally the wrong collaborative institute (Anglia Ruskin University). Certainly it was the case with

Appendix 16 Example KTP Impact Report – Company AA

Double click on text below to view full file.

KTP IMPACT REPORT

Company AA

Supported by the School of Engineering and Technology, University of Hertfordshire the aim of this research is to explore the impact of Knowledge Transfer Partnership (KTP) projects on the business model for small to medium enterprises.

Susan Murray
s.murray@herts.ac.uk
University of Hertfordshire UH

Appendix 17 UH Initial and Final KTP Reports

Double click on text below to view full file.

Knowledge
Transfer
Partnerships

Grant Application and Proposal Form

Single Associate Project Part A

Grant Application and Proposal Form
Single Associate Project Part A (Version 3.4 – April 2008)

Once completed, all Sections of this form except Section 1 will be treated as Commercial in Confidence.

Knowledge
Transfer
Partnerships

Partners Final Report Form

SUMMARY OF KNOWLEDGE TRANSFER PARTNERSHIP

Partnership: KTP007392

KNOWLEDGE BASE PARTNER

Institution name: **University of Hertfordshire**
Department: Business School

Lead academic

Name: Dr Jyoti Choudrie
Address 1: DeHavilland Campus
Address 2:
Address 3:
Town: Hatfield
Postcode: AL10 9AB
Telephone: 01707 281271

Other academics

1

Title: Ms
Name: Angela Bond

COMPANY PARTNER

Company name: **Southend-on-Sea YMCA**
Parent group name: N/A
Company contact: Mr John Levy
Address 1: 85 Ambleside Drive
Address 2:
Address 3:
Town: Southend-on-Sea
Postcode: SS1 2FY
Telephone: 01702 301320
Company size (or Group if applicable): S

ASSOCIATE(S)

Associate 1: Mr Shaun Biggs

All information provided through this form will be treated in confidence.

IF NECESSARY CONFIDENTIAL REPORTS ON BEHALF OF INDIVIDUAL PARTIES MAY BE SUBMITTED SEPARATELY.

The completed form must be received within one month of the end of the Knowledge Transfer Partnership.

Appendix 18 KTP Impact Report indicators analysis (not utilised)

Double click on image below to view full file.

Appendix%2018%20KTP%20mpact%20R