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Knowledge absorption and innovation in UK SMEs: A study by economic sector and place

Absorción de conocimientos e innovación en las PYME británicas: Un estudio por sector económico y localización

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Abstract

This study focusses on knowledge absorption in SMEs and their abilities to develop innovations. It does so by examining SMEs in three different economic sectors, namely, manufacturing, high-tech and services. In doing so it provides one of the first comparative studies of SMEs within these different sectors. It also examines variations by place and compares the performance of SMEs across four distinct places within the UK. The research is based around both a quantitative analysis of firm performances followed by a detailed in-depth qualitative study. Our results focussed on the stages of knowledge transfer from acquisition, assimilation, through to the transformation and exploitation of knowledge. The findings draw attention to the significance. of management practices within SMEs and recognised the importance of open innovation. The study indicates that place alone does not play a key role, compared with the industry sector.

Keywords: SMEs; knowledge management; innovation; absorptive capacity; place
JEL Classification: O30; O32; M10

Resumen

El objetivo de este artículo es doble: en primer lugar, identificar los factores internos y externos que afectan a la capacidad de absorción de las PYMEs, con especial énfasis en la localización; en segundo lugar, comprobar si las estrategias empresariales que sustentan la capacidad de absorción varían según la región y el sector. Nuestro análisis empírico se centra en una muestra de PYMEs británicas de los sectores manufacturero, de servicios y de alta tecnología de cuatro áreas. Utilizamos un enfoque de métodos mixtos que examina las cuatro etapas clave de la capacidad de absorción: adquisición, asimilación, transformación y explotación del conocimiento. Los resultados destacan la importancia de las prácticas de gestión para apoyar el desarrollo de la capacidad de absorción de las PYMEs. Además, observamos que las prácticas internas de apoyo a la capacidad de absorción varían según el sector y la región. Estas conclusiones son significativas, pues no sólo mejoran nuestra comprensión de los factores que impulsan la capacidad de absorción, sino que, lo que es más importante, subrayan el papel del entorno en su mantenimiento entre las PYMEs.

Palabras clave: PYMEs; gestión del conocimiento; innovación; capacidad de absorción; ubicación
Clasificación JEL: O30; O32; M10

1. Introduction

Small and medium-sized enterprises (SMEs) play a significant role in the UK economy, as highlighted by both academics and policymakers (Deane, 2016). In 2023, approximately 5.5 million SMEs accounted for 61% of all private sector jobs, providing 16.7 million jobs. Between 2022 and 2023, the total number of businesses increased by 0.8% (FSB, 2023). Further estimates suggest that 75% of all self-employed individuals are business owners (Henley, 2020).

Given the predominance of SMEs in the UK business landscape, economic growth in the UK is closely linked to the performance of this group of firms. International research has consistently emphasised the importance of innovation in driving growth among SMEs. However, one of the key challenges that UK-based SMEs face is the ability to innovate continuously (Forth & Bryson, 2018; Idris et al., 2023). This inherent weakness in UK SMEs has been exacerbated by post-Brexit trade uncertainty, which has further discouraged innovation.

Despite the importance of SMEs in driving growth, little is known about how they absorb new knowledge and, more importantly, what drives their capability to do so. This is particularly significant, as most studies approach absorptive capacity mechanically, without considering whether internal and external factors influence SMEs' ability to absorb new knowledge. Among the external factors considered, we explicitly focus on the role of place and location in shaping absorptive capacity—factors that have often been overlooked. These considerations are especially relevant in the context of post-Brexit policy changes, where the British government has shifted away from local industrial strategies that acknowledged the importance of place in business performance. Understanding whether the local environment affects absorptive capacity may offer policy insights to tackle the slowdown of innovation among SMEs.

The main aim of this paper is to address the gap in the literature. Our two primary objectives are to identify the factors that influence absorptive capacity among SMEs and to determine the extent to which strategies underpinning absorptive capacity differ across economic sectors and regions. More specifically, we explore two research questions:

- RQ1: Are there significant regional differences in the factors driving SMEs' absorptive capacity?
- RQ2: Are there significant sectoral differences in the factors driving SMEs' absorptive capacity?

To answer these research questions, our study employs a mixed-methods approach. We begin with an online survey (see Annex 1) to collect data on how SMEs capture, manage, and utilise external knowledge in their innovation processes. We then apply factor analysis to the survey data, revealing four distinct factors that impact innovation management within SMEs: Decentralised Innovation Management, Employee Engagement, Use of Innovation Knowledge, and Internal Training Procedures. Additionally, we identify regional differences among these factors. Next, we use cluster analysis to segment the SMEs into groups based on similarities in their innovation inputs and outcomes. These clusters demonstrate significant differences in their approaches to decentralised innovation management.

The quantitative analysis is followed by a qualitative analysis, drawing on in-depth interview data. These interviews were structured around the same themes of absorptive capacity but allowed for more open-ended discussions to explore the specific challenges and strategies unique to different types of SMEs (see Annex 2). The analysis suggests that local economic conditions and sector-specific dynamics subtly influence how businesses engage with innovation processes. Moreover, these findings highlight the importance of place in shaping absorptive capacity, as location complements the internal routines and processes that support absorptive capacity among SMEs.

The structure of the paper is as follows: Section 2 summarises the literature on absorptive capacity. The research design and methodology are explained in Section 3, while Sections 4 and 5 present the results. Finally, Section 6 discusses the findings and provides concluding remarks.

2. Literature Review: Innovation and the Role of Knowledge Absorption within SMEs

Given the significant presence of SMEs in the business population, there has been considerable interest in their performance, productivity, and ability to innovate (Casado-Belmonte et al., 2021; Henley, 2020). As a result, researchers have begun to focus on absorptive capacity within SMEs (Forth & Bryson, 2018). Durst and Edvardsson's (2012) literature review highlighted that certain aspects of knowledge absorption among SMEs are relatively well-researched, while others remain somewhat neglected. The well-researched aspects include knowledge implementation, perception, and actual knowledge transfer. In contrast, neglected areas include knowledge identification, retention, and utilisation. More recently, Henley (2020) has also called for 'an integrated approach and a clear understanding of the importance of absorptive capacity' (p. 4) due to its relative neglect.

We define absorptive capacity as the ability of an SME to recognise the value of newly acquired knowledge, as outlined by Lane et al. (2006). The concept of absorptive capacity builds on a range of studies, beginning with the seminal works of Cohen and Levinthal (1990) and Zahra and George (2002). The latter identified four dimensions of absorptive capacity, distinguishing between potential and realised capacity. This builds on Cohen and Levinthal's (1990) earlier definition of absorptive capacity as an organisation's ability to recognise 'the value of external information, assimilate it, and apply it to commercial ends' (p. 128). The operationalisation of the concept involves four dimensions: acquisition, assimilation (or an organisation's potential capacity), transformation, and exploitation (realised absorptive capacity). These dimensions, along with the components applied in our research, are detailed in Table 1.

Table 1. Dimensions of Absorptive Capacity

Dimension	Components Discussed with SMEs
Acquisition	Prior investment scope of search
	Prior knowledge
	Intensity/speed of search
Assimilation	Understanding
	Interpretation
	Comprehension
	Learning
Transformation	Internationalisation
	Conversion
Exploitation	Use
	Core competencies
	Implementation
	Harvesting resources

Source: Modified from Zahra and George (2002)

While there has been an increasing number of empirical studies on absorptive capacity, these have mainly focused on larger organisations or specific sectors, with the software industry being the most commonly studied (Matusik & Heeley, 2005; Noblet et al., 2011). In contrast, Henley (2020) highlights several gaps in the literature on absorptive capacity among SMEs. These gaps include the need for a thorough analysis of the factors that affect the capability to transform knowledge into performance, as well as the use of different perspectives to better understand absorptive capacity.

Table 2. Key Themes and Gaps

Key Themes	Gaps
Absorptive Capacity	More interdisciplinary perspective to SME performance
	Absorptive capacity and the ability of SMEs to translate knowledge into performance
Growth or Productivity	Greater clarity needed in understanding, in the context of SMEs and micro-businesses, the complementarity of growth, employment growth, and productivity
	Evaluation of specific interventions to improve the management of SMEs
Spatial Influences on SME Performance	Need for more work on understanding spillovers
	Scope for research to understand local norms and entrepreneurial culture
	A key question is whether people, place, or a combination of both drives performance.

Source: Modified from Henley (2020)

Several attempts have been made to fill the gaps in the literature on SMEs. Kerste et al. (2002) attempted to map absorptive capacity among SMEs in the Netherlands, but their work was based on just four case studies. More recently, Kmieciak and Michna (2018) studied a relatively large sample of SMEs from Poland, focusing on knowledge management orientation and innovation. However, their sample was drawn from a study conducted between 1989 and 1990, during Poland's transition to a market economy, which limits the generalisability of the results. Overall, studies on SMEs tend to rely on case studies, as demonstrated by Filippini et al. (2012), who emphasised the firm's ability to capture and recognise the significance of external knowledge as a key dynamic capability.

There are additional gaps in the literature on absorptive capacity among SMEs. First, it is reasonable to assume that there are industry-specific variations in how knowledge is absorbed and deployed. SMEs are highly diverse in their management skills and experiences, and these differences can often be attributed to industry practices (Curran & Blackburn, 2001; San-Martín et al., 2020). However, little is known about these industry variations, as empirical studies on absorptive capacity have predominantly focused on manufacturing and high-tech industries, with less attention given to the service sector (with the exception of Thomas & Wood, 2014).

Finally, Henley (2020) highlighted that absorptive capacity may have a regional dimension, suggesting that different regional contexts can influence knowledge and information acquisition. This aspect was also emphasised by Fritsch and Kublina (2018) in their empirical study on Germany. A range of local factors may influence absorptive capacity among SMEs. For instance, regional policy initiatives can enhance SMEs' ability to recognise and utilise valuable knowledge (Knoben et al., 2011). In the past, such initiatives were supported by EU regional policy, particularly in peripheral regions dominated by SMEs (McAdam et al., 2014). One key policy was the Regional Innovation Strategy (2015), discussed by Galbraith et al. (2017) and McAdam et al. (2014). The latter authors also explored the effectiveness of this programme through a study of absorptive capacity among ten SMEs in Northern Ireland. This study was significant, as it provided valuable insights into UK government policy initiatives but again lamented the lack of research on innovation processes among SMEs.

Additionally, strong networks and social ties among local businesses in specific regional economies may enhance knowledge spillovers. Henley (2020) further argues that agglomerations with a high density of SMEs in a particular regional economy can facilitate absorptive capacity. Rocha and Sternberg (2005) made a similar point about German regional clusters, noting their role in knowledge transfer. Fulgence et al. (2023) also argue that cluster environments are strong determinants of innovation and act as mediators in knowledge transfer. Their model underscores the importance of the degree and intensity of SME networks. Similarly, Grandinetti's (2016) review highlights the significance of a firm's relational capabilities, particularly within geographical clusters, in accessing external knowledge sources.

Given the significant gaps in the literature on SMEs and absorptive capacity, our research aims to address these by identifying the internal and external factors that drive absorptive capacity and examining whether it varies by industry and location.

3. Empirical Analysis

3.1 Post-Brexit Economic Policy Context

The UK Government committed to replacing EU Structural funding, as outlined in the newly established UK Shared Prosperity Fund (2016). The goals of improving productivity and developing UK industry were further articulated in the *Building Our Industrial Strategy* green paper (March 2017), which was based on ten pillars underpinning the strategy. Of these, the two most relevant to the research presented here are the development of a more innovative economy and the understanding of variations in innovation activity by economic sector and region (p. 12). These ideas were further expanded upon with the launch of the *Industrial Strategy: Building Britain Fit for the Future* (November 2017), which was strongly endorsed by then Prime Minister Theresa May. This strategy emphasised the need to strengthen the overall business environment and improve productivity, particularly among small and medium-sized enterprises (SMEs) and across different regions.

An additional scheme was developed for SMEs to support smaller firms under the title *Be the Business* (https://www.bethebusiness.com). This initiative grew out of a 2015 government request for top business leaders to review ways to improve productivity. In response, the initiative called for a business-led movement to enhance management skills. It was funded by the government and collaborated with leading UK companies. The idea of improving SME productivity became increasingly important. However, the arrival of the Johnson Government in July 2019 marked a shift away from the UK Industrial Strategy, leading to considerable confusion. A Parliamentary Inquiry was launched in 2020 and reported in 2021, noting that 'the Government's approach to industrial policy shifted rapidly but without establishing a clear direction of travel' (BEISC, 2021). More recently, this was followed by the government's white paper *Levelling Up in the UK* (H.M. Government, 2017), which aims to address regional disparities and inequalities at various levels. However, Shearer (2022) points out that 'several of the areas relevant for levelling up missions – such as business' (p. 4) are not scheduled for review for another 12 months.

3.2 Data Collection

Unlike previous studies on absorptive capacity among SMEs, our research focuses on three main economic sectors: Manufacturing, High-Tech, and Services. The latter is one of the most neglected in comparative studies of SMEs, although there is research focusing on the tourism sector (Thomas & Wood, 2014). These broad sectors were identified using a combination of NACE data and Eurostat definitions, but we did not break down the high-tech sector further[1].

The research encompassed four main regions: Cornwall; Cumbria and North Lancashire; the Edinburgh region; and Essex, Norfolk, and Suffolk. As we will show, these areas have different types of economies. For example, Cornwall and Cumbria had significant numbers of SMEs in the service sector. Data from Essex and Scotland were sourced from Fame, while data from Cornwall and Cumbria were obtained from local databases.

Cornwall (Corn) has a service-based economy, experiencing a long-term decline in primary industries such as mining and fishing. The region is characterised by a small-firm economy, with 90% of businesses employing fewer than ten people and approximately 25,000 employees overall. There is also a growing proportion of high-tech enterprises related to the digital economy and e-health. Productivity is only 74% of the average for England, which may partly be due to the relatively large number of lifestyle entrepreneurs, many of whom are in the tourism sector. Indeed, Cornwall's main economic activity and employer is the tourism sector, which contributes an estimated £1.8 billion per year to the local economy.

For this study, the **Edinburgh region (Edin)** primarily includes the central belt of Scotland, the area with the highest population density, with approximately 3.5 million inhabitants across 10,000 square kilometres. The central belt is one of the UK's highest-performing economic and innovation regions, with Glasgow and Edinburgh ranked 5th and 6th, respectively, in terms of FDI (by value). As of March 2017, an estimated 365,600 private sector enterprises were operating in Scotland. Almost all of these enterprises (98.3%) were small (0 to 49 employees); 3,855 (1.1%) were medium-sized (50 to 249 employees); and 2,365 (0.6%) were large (250 or more employees). SMEs provide approximately 1.2 million jobs. Our survey covered SMEs in the Edinburgh, Glasgow, Livingston, Falkirk, and Penicuik regions.

Essex, Norfolk, and Suffolk (Ess) covers the counties of Essex, Norfolk, and Suffolk. The area's economic structure is dominated by SMEs (fewer than ten employees), mostly operating in the service sector. However, several large companies operate in manufacturing—including pharmaceuticals, telecommunications, and automotive industries—primarily located along the M11 corridor and in South Essex. More recently, several tech businesses have been established in the region, thanks to the presence of large companies such as British Telecom and engineering science parks like Hethel Innovation.

Cumbria and North Lancashire (Cumb) covers the county of Cumbria and the Lancaster-Morecambe Bay area, encompassing diverse sectors. These include the tourism-dominated Lake District, post-industrial West Cumbria (Whitehaven, Workington, and surrounding areas), largely agricultural areas (Eden Valley and rural North Lancashire), and the more mixed urban economies of Carlisle, Barrow, Lancaster, and Morecambe. In West Cumbria, the presence of the Sellafield nuclear processing facility supports a cluster of atomic supply chain SMEs and larger engineering contractors. Based in Barrow, BAE Systems also supports a local supply chain, along with a small number of high-technology SMEs. The mixed urban centres of Carlisle and Lancaster host a range of service SMEs, some with innovative business models.

3.3 Methodology

This study employs a mixed-methods research design to comprehensively address the research questions regarding the absorptive capacity of UK SMEs. This approach integrates both quantitative and qualitative methods to capture a more in-depth understanding of innovation across different economic sectors and regions.

Integrating data from these two approaches allows for a more comprehensive view of how knowledge management and absorptive capacity influence innovation activities among SMEs. The quantitative data provide a broad overview of patterns and clusters among SMEs, while the qualitative data offer detailed insights into the stages of absorptive capacity—acquisition, assimilation, transformation, and exploitation—as experienced and implemented by SMEs. Together, this mixed-methods approach enables the study to address the research questions effectively, providing robust evidence on the role of absorptive capacity in facilitating innovation across various contexts.

Our study is based on a convenience sample[2] of SMEs selected in equal numbers across three economic sectors. Ten firms from each sector were chosen, totalling at least 30 SMEs per location. The sample was selected to represent at least 20 per cent of the firms' population in each region.

Two surveys were conducted. The first was an online questionnaire that gathered data on how knowledge was used to develop innovations. It also collected demographic information about the respondents, such as age, gender, and educational background, alongside business-specific data such as company size, location, sector, and access to external funding. This was complemented by insights into their experience with innovation capacity, including their innovation processes, inputs, sources of innovation, and staff involvement. Rigorous sample selection criteria were applied to ensure data quality and relevance, screening out incomplete or low-quality responses. By the end of the survey campaign, we received 115 valid responses, each representing a distinct company. These participants held key positions as owners, directors, or managers within their respective businesses. The sample distribution across regions included 30 respondents from Essex, 30 from Cornwall, 25 from Cumbria, and 30 from Edinburgh.

The second data collection phase involved in-depth interviews with businesses selected from the first stage. As far as possible, these interviews were evenly distributed across regions and economic sectors, with a minimum of four interviews conducted in each case study area. The interviews lasted between 30 and 50 minutes, with

an average duration of 40 minutes. They were structured around the four key stages of absorptive capacity and innovation, based on Zahra and George (2002), as shown in Table 1. These dimensions of absorptive capacity were made explicit in the interviews and guided the discussion. The interviews were conducted face-to-face, online, or via telephone, with all data collection taking place during 2018.

4. Innovation Process and Absorptive Capacity: Quantitative Analysis

Our questionnaire (available in Annex 1) is modelled after the UK Innovation Survey (e.g., Robson & Kenchatt, 2010). The survey collected data on the innovation process and the internal practices adopted by respondents to absorb external knowledge, as well as data on business owners and their experiences. These included the number of years spent working in the industry, levels of education, age, gender, and, as a proxy for size, the number of employees (both full- and part-time) in the SME.

Following Robson and Kenchatt (2010), businesses are considered to be innovating if they are engaged in any of the following:

- Introducing new or significantly improved products or processes.
- Investing in internal research and development, training, acquisition of knowledge, or machinery and equipment linked to innovation activities.

Regarding the innovation process, the survey inquired about the proportion of business earnings invested in R&D as a measure of innovation input. In addition, we asked about the number of innovations (as an output) produced in the year preceding the survey. To explore the drivers of innovation, businesses were asked whether they had a dedicated team focused on developing innovations and, more specifically, whether the innovation process was initiated by management and supported by all employees. Finally, we included detailed questions on the actual sources of innovation, such as customers, suppliers, universities, and research institutes.

Our survey also included questions about whether employee participation was actively supported by management and whether employees were encouraged to put forward new ideas. Additionally, we examined staff training, both at the internal firm level and through external courses.

Our analysis of the questionnaire data was structured into two stages to ensure a thorough examination of the underlying patterns and relationships. First, we conducted a descriptive study to provide a clear overview of the SMEs' primary attributes and operational characteristics. Second, we progressed to a more complex multivariate statistical analysis, consisting of Exploratory Factor Analysis, Cluster Analysis, and Analysis of Variance (ANOVA). The Factor Analysis aimed to identify latent variables that critically impact innovation management within SMEs. This method reduces the dimensionality of a large dataset by grouping 47 survey items into coherent factors based on their interrelationships. These items included innovation process management, employee engagement, knowledge codification, and knowledge sources. The Cluster Analysis segmented the SMEs into distinct groups based on similarities in their innovation practices and outcomes. We then used ANOVA to assess differences in innovation practices, examining the factors identified from the Factor Analysis across the four regions to determine regional disparities.

Finally, we compared the clusters of SMEs in terms of their characteristics—such as company size, sector, and geographic region—and the factors derived from the Factor Analysis. This enabled a comprehensive evaluation of how these elements vary across different clusters and contribute to their distinct innovation profiles.

4.1 Descriptive Statistics

Looking at the basic characteristics of our sample firms, approximately 33% of the respondents were directors or managers, while the remainder identified as owners or partners. Around 70% of the respondents were male, with the highest proportion of male respondents in the Edinburgh region (90%), followed by Essex (80%) and Cumbria (68%). Only Cornwall had a relatively equal gender split, with 57% male and 43% female respondents.

Regarding firm size, 58% of our sample had up to nine full-time employees, while only 14% had 10–19 full-time workers. There were interesting variations by region in this variable. For example, 73% of respondents from Cornwall and 70% from Cumbria had up to nine full-time employees, both regions with high proportions of service sector businesses, reflecting the importance of tourism in these areas. Edinburgh followed a different pattern, with 20% of respondents having between 100–149 full-time employees. As for the number of part-time employees, the majority of respondents (83%) had up to nine. Cumbria and Cornwall had particularly large proportions of part-time workers, at 90% and 87%, respectively, compared with 71% in Edinburgh.

The key sections of the questionnaire focused on the managerial processes surrounding innovation in the various enterprises within the sample. This was investigated in three ways. First, questions about direct

management processes were presented through a series of statements, shown in Table 3, using 5-point Likert scale questions. Second, statements regarding internal management processes, particularly employee engagement, were included. Finally, questions addressed sources of knowledge within different sectors, with a special focus on regional variations. Together, these questions were designed to cover key aspects of knowledge transfer and absorption, as discussed in the literature review.

Table 3. Statements Relating to Management Processes Surrounding Innovation in SMEs

	Statement	Mean
A1	The organisation continuously scans the market to identify new trends	4.28
A2	The organisation regularly seeks to introduce new ways and procedures	4.35
A3	A dedicated team of people is employed primarily to conduct R&D	2.97
A4	Management mostly takes a 'wait and see' approach to innovation	2.10
A5	In general, employees in this organisation are not hostile to change	4.19
A6	In the past 12 months, this organisation has not adopted or introduced any new innovations	2.22
A7	Innovation and change are initiated solely at management level	2.69
A8	Innovation and change are implemented at all levels of the organisation	4.08

Of the statements in Table 3, 53% of respondents strongly agreed with the statement, '*The organisation continuously scans the market to identify new trends*' (A1), while 52% strongly agreed with the statement, '*The organisation regularly seeks to introduce new ways and procedures*' (A2). Similarly, 54% agreed with the statements, '*In general, employees in this organisation are not hostile to change*' (A5), and '*Innovation and change are implemented at all levels of the organisation*' (A8) (see Table 3). In contrast, 39% of respondents reported working for an organisation without a dedicated R&D team, which is not surprising given the prevalence of small enterprises in the sample. Moreover, a third of respondents indicated that the innovation management process was seen as proactive and decentralised—meaning control was not solely handled by specific research teams or management. In this context, we use the term '*decentralised management*'.

The second part of the survey focused on the role of employees in the innovation process, with 72% of respondents agreeing that employees were encouraged to share their ideas for improving products or processes. The final part of the survey examined the sources of knowledge, with 85–95% of respondents emphasising the importance of customer knowledge, as well as knowledge gained from suppliers or competitors. These factors were consistently important across all four case study regions.

4.2 Multivariate Analysis

4.2.1 Exploratory Factor Analysis

Following the descriptive analysis, we applied multivariate statistical tests to explore variations in how SMEs manage innovations and knowledge. These included Exploratory Factor Analysis (EFA) using Varimax rotation to maximise the explanatory power of the indicators (Hair et al., 2013). The factor analysis was conducted using 47 items measuring key aspects of the questionnaire data: the management of the innovation process (Table 3), employee engagement, knowledge codification, and sources of knowledge. The Kaiser-Meyer-Olkin measure of sampling adequacy was above the commonly recommended value of 0.6 (Kaiser, 1970). Bartlett's test of sphericity was significant, and Cronbach's alpha exceeded 0.6, indicating an acceptable level of internal consistency. After a careful review of the context of knowledge absorption, nine items with low factor loadings were removed (Child, 2006).

The EFA revealed four factors related to absorptive capacity: (1) 'Decentralised Innovation Management,' (2) 'Employee Engagement,' (3) 'Use of Innovation Knowledge,' and (4) 'Internal Training Procedures.' Factor 1 refers to whether the workforce is actively involved in innovation management, while Factor 2 relates to employee engagement. Factor 3 concerns the use of innovation knowledge, as detailed in Table 4, and Factor 4 measures internal training procedures. Employee engagement was the most prevalent factor ($\bar{x} = 4.08$), while the least prevalent was the use of knowledge ($\bar{x} = 2.63$). Sources of innovation primarily came from stakeholders such as customers, suppliers, and competitors. Notably, in this sample of SMEs, more formal sources, such as government organisations, played a minor role ($\bar{x} = 1.89$).

Table 4. Results of Exploratory Factor Analysis

Factors	% Variance	Cronbach's α	Mean	Factor Loading	Item Description
Decentralised Innovation Management Mean = 3.99	16.8	0.69	4.28	0.46	The organisation continuously scans the environment to monitor new market trends
			4.35	0.64	The organisation regularly seeks to introduce new ways and procedures for doing business
			3.9	0.65	Management mostly takes a 'wait and see' approach in the context of new trends and methods
			4.19	0.61	In general, employees in this organisation are not hostile to change and innovation
			3.78	0.24	In the past 12 months, this organisation did not adopt or introduce any new or innovative ways of doing business
			3.31	0.23	Innovation and change are initiated solely at management level
			4.08	0.39	Innovation and change are implemented at all levels of the organisation
Employee Engagement Mean = 4.08	13.48	0.76	4.3	0.69	Employees are required to participate in meetings on a regular basis.
			4.57	0.61	During meetings, all participants are encouraged to put forward new ideas for discussion and development
			3.97	0.54	New employees are trained in the organisation's processes and practices before commencing work
			3.44	0.62	Employees are required to attend in-house training courses on a regular basis
			4.43	0.34	The organisation encourages employees to share new market, technical, or other knowledge with their colleagues
			4.28	0.69	The organisation has rules and places to record its procedures
			4.03	0.65	The record/manual of organisation practices and process is updated regularly
			3.63	0.72	The organisation's policies for idea generation and knowledge sharing are clear to all employees
Use of Innovation Knowledge Mean = 2.63	9.04	0.85	3.35	0.34	Suppliers of equipment, raw materials, components, or software
			3.31	0.51	Competitors
			3.91	0.43	Customers or clients
			2.34	0.54	Commercial laboratories/R&D enterprises
			2.68	0.6	Consulting firms or external skilled personnel
			2.35	0.63	Joint venture partners
			2.85	0.39	Universities or other higher education institutes
			1.89	0.38	Government research organisations
			1.78	0.44	National or public testing institutes
			1.63	0.49	Private research institutes
			2.16	0.7	Other public sector organisations (e.g. government offices)
			2.44	0.38	Trade associations or cooperatives
			3.27	0.61	Professional conferences or meetings
			2.73	0.76	Technical/ trade press, computer databases
			2.9	0.72	Fairs, exhibitions
			2.25	0.64	Technical standards
			2.32	0.5	Health and safety regulations
			2.58	0.64	Environmental standards and regulations
Internal Training Procedure Mean = 3.76	6.13	0.65	4.19	0.5	Employees are encouraged to undertake training to broaden their knowledge of the industry
			3.91	0.23	The internal processes necessary to obtain authorisation for employee training are known by workers
			3.02	0.3	The organisation has policies requiring employees to document newly acquired knowledge from training
			4.37	0.31	Organisational policies do not allow employees to undertake training during normal working hours
			3.34	0.58	Many employees are not aware of the organisation's policies which require them to document the knowledge acquired from training

4.2.2 Analysis of Variance (ANOVA)

While the results shown in Table 4 point to the importance of certain variables for the SMEs in the study, they do not highlight variations by place or economic sector. Given the sample sizes in each region, we first conducted ANOVA tests to compare SMEs across different locations. This was based on the four main factors identified in the EFA. Table 5 indicates a significant difference in the decentralisation of innovation management between Cornwall and Essex, while other pairs did not differ significantly, as verified through post hoc testing using the Tukey method. Employee engagement with the innovation process also showed a

significant difference ($p = 0.016$) across the four locations, with a medium effect size (0.088) (J. Cohen, 2013). Regarding sources of innovation knowledge, all four regions reported low agreement with the items provided, and there were no statistically significant differences between the regions. As the EFA suggests, the SMEs' knowledge sources primarily came from market relationships, a finding consistent across all locations.

Table 5. Results on Innovation Absorption – Factors by Region

	Location	Mean	Std. Deviation	F value	p value
Decentralised Innovation Management	Essex	3.73	0.613	2.592	0.056
	Cornwall	4.19	0.662		
	Cumbria	3.99	0.731		
	Edinburgh	4.05	0.612		
Employee Engagement	Essex	4.4	0.503	3.571	0.016
	Cornwall	4	0.673		
	Cumbria	3.89	0.714		
	Edinburgh	4	0.686		
Use of Innovation Knowledge	Essex	2.64	0.66	0.448	0.719
	Cornwall	2.51	0.685		
	Cumbria	2.63	0.818		
	Edinburgh	2.74	0.89		
Internal Training Procedures	Essex	3.41	0.35	4.348	0.006
	Cornwall	3.93	0.735		
	Cumbria	3.77	0.771		
	Edinburgh	3.94	0.698		

The analysis revealed a significant difference between the four regions in relation to internal training processes (Factor 4), with a relatively high effect size of 0.107. The differences were particularly notable between Cornwall and Essex, and between Edinburgh and Essex.

RQ1 aimed to determine whether there are significant regional differences in innovation absorption factors among SMEs. The ANOVA results present a mixed picture across the factors, highlighting the importance of considering regional contexts when addressing innovation management within SMEs.

The analysis of variations across the three economic sectors—manufacturing, high-tech, and services—was conducted to test for any differences related to knowledge and innovation factors. The ANOVA test revealed small differences between the sectors, but these were not statistically significant at the 0.05 level, suggesting a negative answer to RQ2. This implies a possible convergence in innovation management practices across these sectors, potentially due to the similar challenges and opportunities SMEs face.

4.2.3 Cluster Analysis

Another key component of our analysis involved conducting a cluster analysis. We used two variables for the analysis: the monetary input for innovation, measured by the percentage of revenues allocated to fund innovations, and the innovation outputs produced over the previous 12 months. The results identified three distinct clusters based on the levels of inputs and outputs, the degree of decentralised innovation management, employee engagement, use of innovation knowledge, and company size in terms of employees. The classification was supported by an average Silhouette Coefficient of 0.6 (Rousseeuw, 1987), indicating an appropriate fit. The analysis revealed no statistically significant differences based on location, size, or sector (see Table 6).

Cluster 1 represents SMEs with minimal involvement in innovation, having between one and two innovations over 12 months and spending an average of just 8.24% of income on research. Compared with Clusters 2 and 3, this cluster reported lower levels of innovation management and employee engagement but slightly higher use of innovation knowledge. The cluster largely consisted of small companies, with 74.07% having fewer than ten full-time employees and 96% having up to nine part-time workers.

In contrast, nearly 54% of respondents in Cluster 2 reported having access to substantial external funding compared to the other clusters. Cluster 2 appears to be the most innovative group, with nearly 84% developing more than six innovations over 12 months. Companies in this group invested an average of over 20% of their annual income in product or service development. This cluster also exhibited higher levels of decentralised management and employee engagement. Interestingly, their use of innovation knowledge was relatively low compared to Clusters 1 and 3. Over 65% of the companies had fewer than 20 full-time employees, but this cluster also included more than 24% of businesses with over 100 full-time employees.

Cluster 3 represented 45% of respondents. SMEs in this group reported introducing three to five innovations over 12 months, spending an average of just over 10% of their annual income on innovation. A larger proportion of companies in this cluster, nearly 69%, operated in the service sector. However, this variable was not statistically significant.

Table 6. Characteristics of Clusters

	Cluster 1	Cluster 2	Cluster 3	For X^2 value	p value
Size	26.60%	28.40%	45.00%		
Number of Innovations in 12 months	1-2	6-8	3-5	201.772	0
Percentage of Income Spent on Research	8.24%	20.13%	10.10%	4.731	0.011
Decentralised Innovation Management	3.61	4.19	4.05	7.078	0.001
Employee Engagement	3.85	4.16	4.16	2.384	0.097
Use of Innovation Knowledge	2.77	2.35	2.62	2.527	0.085
Internal Training Procedures	3.77	3.71	3.77	0.091	0.913
Full-Time Employees				31.101	0.054
1-9	74.07%	51.72%	53.19%		
10-19	0.00%	13.79%	21.28%		
20-29	11.11%	3.45%	4.26%		
30-39	0.00%	0.00%	2.13%		
40-49	0.00%	0.00%	4.26%		
50-59	7.41%	0.00%	2.13%		
60-79	0.00%	6.90%	2.13%		
80-99	7.41%	0.00%	0.00%		
100-149	0.00%	13.79%	4.26%		
150-199	0.00%	6.90%	4.26%		
200-249	0.00%	3.45%	2.13%		
Part-Time Employees				8.671	0.371
1-9	96.00%	86.21%	77.78%		
10-19	0.00%	13.79%	11.11%		
20-29	0.00%	0.00%	4.44%		
30-39	0.00%	0.00%	2.22%		
80-99	4.00%	0.00%	4.44%		
Percentage of Employees Who Are Part of the Owner's Family	13.79%	32.26%	26.53%	2.889	0.236
Distribution of Sector				3.539	0.472
Manufacturing	35.71%	34.48%	27.66%		
Services	53.57%	48.28%	65.96%		
High Tech	10.71%	17.24%	6.38%		
Distribution of Region				6.67	0.352
Cumbria	20.69%	19.35%	20.41%		
EA	20.69%	16.13%	38.78%		
Edinburgh	31.03%	32.26%	22.45%		
Exeter	27.59%	32.26%	18.37%		
Number of Innovations in 12 months				201.772	0
None	0.00%	6.45%	0.00%		
1-2	100.00%	0.00%	0.00%		
3-5	0.00%	9.68%	100.00%		
6-8	0.00%	35.48%	0.00%		
9-10	0.00%	16.13%	0.00%		
10+	0.00%	32.26%	0.00%		
Access to External Funding				2.289	0.318
No	46.15%	48.00%	63.16%		
Yes	53.85%	52.00%	36.84%		

5. Interview Results

We conducted 20 in-depth interviews across the four regions and three industries (see Table 7). Businesses were selected from the original sample based on their availability to participate following the administration of the survey. Each interview lasted approximately 40 minutes on average. The interviews covered various stages of knowledge absorption, including networks and relationships, facilitation and business support, the importance of place, lifestyle entrepreneurs, and innovation funding. The interview questions are listed in Annex 2.

Our starting point was the conceptualisation of innovation within the context of each business. Between 60–90% of the respondents identified their businesses as innovative. For many respondents, innovation was equated with incremental changes, although differences were observed between service sector firms and

those in high-tech and manufacturing. Despite these variations, respondents shared a relatively consistent framing of innovation, which included the following perspectives:

- *'Doing things better, commitment to quality, looking for new technologies that will bring solutions that may be different to anything we've used before, combining two approaches: blue-sky thinking while responding to specific customer needs/problems'* (Cumb.1).
- *'Developing new technology to stay ahead of competitors. Our competition is always moving, so really the imperative in any business is a commercial imperative'* (Edin.2).
- *'Innovation is central to the whole business. We innovate continuously and have a view focused on the development of new products. This includes new products, new services for customers, and new processes in the company. We must innovate to grow the business and stay competitive'* (Ess.5).
- *'Innovation is a big word, and sometimes people think it must be something grand, but it can be those small things too that make a difference, and for me, that is innovation.'* (Corn.5)

Table 7. The Characteristics of the Firms Interviewed

	Code	Place	Company Size (No. of Employees)	Sector
Cumb.1	1R-HT	R	160	High-Tech
Cumb.2	2U-S	U	1	Service
Cumb.3	3U-S	U	2	Service
Cumb.4	4U-M	U	1	Manufacturing
Edin.1	5U-M	U	100-149	Manufacturing
Edin.2	6U-HT	U	50-59	High-Tech
Edin.3	7U-HT	U	1-9	High-Tech
Edin.4	8U-HT	U	60-79	High-Tech
Edin.5	9-S	U	100-149	Service
Corn.1	10R-HT	R	1-9	High-Tech
Corn.2	11-HT	R	1-9	High-Tech
Corn.3	12-M	U/R	1-9	Manufacturing
Corn.4	13R-S	R	10-19	Service
Corn.5	14U-S	U	1-9	Service
Ess.1	14R-HT	R	1-9	High-Tech
Ess.2	15U-HT	U	1-9	High-Tech
Ess.3	16U-S	U	1-9	Service
Ess.4	17R-S	R	1-9	Service
Ess.5	18R-M	R	10-19	Manufacturing
Ess.6	19U-HT	U	1-9	High-Tech

Code: U = Urban, R = Rural, HT = High Technology, M = Manufacturing, S = Service

In general, most of our sample discussed innovation in terms of product design and delivery. Small businesses often referred to innovation as something intrinsic to their entire business model or as something they aspire to. For example, one smaller business in Cornwall (Corn.1) viewed innovation as 'a warning to change things'. In other words, for them, it is more of a reactive process. An interesting result was that all the firms in the survey were willing to discuss innovation as a general concept; however, when asked about specific innovations, many respondents referred back to their broader comments on what innovation meant to them. Some did provide specific examples; for instance, one respondent stated, *'I would say it's our business plan itself that is already an innovation because just by the fact that we are reducing our costs'* (Corn.1).

The main focus of the interview process was researching the four stages of absorptive capacity, as outlined by Zahra and George (2002). Our results are presented according to these different stages. The analysis began by examining how individual respondents conceptualise innovation within the context of their business and, by extension, their respective sector.

A relatively large proportion of interviews came from the high-tech sector. Among respondents in this sector, there was a consistent framing of innovation, which included the following features:

- *'Doing things better, commitment to quality, looking for solutions to specific problems. Looking for new technologies that will bring solutions that might be left field compared to anything we've used before'* (Cumb.1), combining two approaches: blue-sky thinking while responding to specific customer needs/problems.
- *'Developing new technology to stay ahead of competitors. Our competition is always moving, so really the imperative in any business is a commercial imperative'* (Edin.2).

- *'Innovation is central to the whole business. We innovate continuously and have a vision that focuses on the development of new products. It's new products, new services for customers, and new processes within the company. We need to innovate to grow the business and stay competitive'* (Ess.5).
- *'It's also a warning to change things. If we are dissatisfied with a process or a method, we will change it'* (Corn.1).

In general, most respondents discussed innovation in terms of product design and delivery. The smaller businesses in our sample often referred to innovation as a feature they see as intrinsic to their entire business model or as something they aspire to. Our findings suggest that most businesses view innovation as being driven by several key factors: a commitment to doing things better and maintaining quality, solving specific problems, seeking out new technologies through blue-sky thinking, and ensuring long-term sustainability. Within the sample, only two businesses, Cumb.2 and Cumb.3, held views that differed from those discussed above.

5.1 Acquisition of Knowledge

Our respondents identified several sources of knowledge, including networks and customers. As one respondent explained, *'I think here in Cornwall we have a good network of innovating groups of people in different kinds of businesses, and this is a good way of getting started'* (Corn.1). This emphasises the importance of local networks as sources of knowledge. Consistent with the questionnaire survey results, a key source of information was customers. Typical of the interview comments was this perspective from a business in Essex (Ess.1): *'We get a lot of information from our customers, mainly about the problems they encounter, which allows us to write a spec of what the product needs to do to overcome these issues'*. This contrasts with a more formal approach highlighted by a service sector business in Cornwall, which stated, *'We pay to be part of an innovative group, and we use an advisor as a sounding board'* (Corn.2).

Of all the respondents listed in Table 7, all but three mentioned a range of external knowledge sources. Those in the high-tech sector mentioned engagements with industry groups, forums, and collaborations with technical partners, such as larger organisations. Several businesses in the service sector explained that they drew on previous experiences, while others mentioned regional organisations and networks (e.g., the Institute of Directors). A few smaller businesses were more proactive in horizon scanning using social media, with respondents from the more rural areas of Cornwall, Cumbria, and Essex noting that social media was an increasing source of knowledge.

5.2 Assimilation Processes

Most respondents indicated that the early stages of assimilation were primarily focused on evaluating any new knowledge. This evaluation process involved aligning the new knowledge with the firm's overarching business strategy. The interviews highlighted differences based on the size of the business. However, several respondents emphasised that the evaluation and decision-making process was inclusive. In this context, the size of the company influenced the scale and, to some extent, the formality of the knowledge evaluation process, as illustrated in Table 8. These differences in formality were also, to some degree, reflected in the variations between manufacturing and the service sector, though this was not as clearly defined in the interviews as expected.

The differences between formal and informal processes based on firm size are not surprising, but our results show that assimilation is a significant component regardless of firm size or sector. Moreover, in many cases, it appears to have been an inclusive process involving the workforce.

Table 8. Types of Evaluation in SMEs Relating to Knowledge Assimilation

Size	Sector	Evaluation
Medium	High-Tech	'Formal processes stage and gate process' – look at the fit between project and product portfolio (Cumb.1)
Medium	Manufacturing	'Inclusive process, main decision' (Edin.1)
Small	High-Tech	'We are a small entrepreneurial organisation. We have created a team of individuals with strong entrepreneurial spirit – they learn all the time' (Edin.3)
Small	Service	'Partners divide what makes sense to invest in. However, employees may be involved in an informal way' (Ess.4)
Micro	Service	'We talked it through with people we trust'. This was a micro business that relied on outside help (Cumb.3)
Micro	Service	'Informal discussion of new ideas with either existing or prospective customers' (Ess.4)

5.3 Knowledge Transformation

This stage of knowledge absorption revealed the greatest variety in how respondents understood the process. Some businesses, particularly those in the high-tech sector, described a formal, evidence-based approach through experimentation. As one medium-sized business in Cumbria explained, *'It moves straight to a formal*

design trial-and-error process, for example, to find out about a new material with a different application' (Cumb.1). Others emphasised a more scientific approach, with one respondent stating, '*We create hypotheses about what the market wants. Being experimental, knowledge is dynamic, not static, and needs updating when new evidence comes in'* (Ess.2).

In contrast, in two cases, businesses carried out the knowledge transformation process without significant modification. In response to the question, '*Was there anything that had to be done to the new knowledge?'*, a medium-sized manufacturing company in Edinburgh indicated, '*No, you think just from people. When you get everybody's buy-in, and everybody agrees, that's a good idea. You get on it to a new product'* (Edin.1). Another respondent to the same question stated, '*No, not really, we both understood how to create a product out of our ideas'* (Ess.4).

Two other businesses described the involvement of universities in the knowledge transformation stage. A medium-sized high-tech firm in Edinburgh stated, '*A lot of knowledge would come in from the university that would be very academic in its nature. You would have to adapt it to make it more commercial and deal with real-world scenarios'* (Edin.2). In another case, a small service firm in Essex stated, '*We had to consult an external company and a university to be able to set up the database system'* (Ess.3).

5.4 Knowledge Exploitation

Respondents were asked about the outcomes of the knowledge absorption process in terms of outputs. Three main types of responses were identified. First, regarding the knowledge process and its aims, one respondent from a small high-tech business stated, '*Very successful. Profits and stable growth are the targets'* (Ess.2). A small manufacturing company in Cornwall was also positive, indicating, '*Yes, I think so. Often, we get offshoots of things that you are not expecting. Learning through mistakes or areas, just by chance'* (Corn.3). Another respondent offered a more optimistic view, saying, '*The system [referring to the innovation process] is in use. We see some benefits, but we are now planning to enhance it with AI'* (Ess.6).

A second set of views saw the innovation process as ongoing and self-reinforcing. One respondent from a medium-sized company in Edinburgh (Edin.2) indicated, '*We sold to new clients around the world and brought in money. We can use that to do new things. So, it's a constant sort of flywheel. You innovate, you sell, get some money, and use that for further innovation'*.

A third perspective viewed the outcomes of innovation as creating new opportunities. For example, a medium-sized high-tech firm in Cumbria mentioned new possibilities: '*Sometimes we'll develop an innovation and realise it could be used in a completely different way in a different industry'*.

Beyond the four main stages of the knowledge absorption process, we also examined during the interview phase what SMEs perceived as the aids and barriers to obtaining new knowledge internally (see Table 9). Most responses identified the factors that support the absorption of new knowledge. Several firms referred to what they called a 'management culture', which centred around dialogue and effective communication. Interestingly, some small companies viewed themselves as more fluid and responsive to change compared to larger corporate cultures. This was noted by respondents from Ess.2, Ess.4, and Corn.1.

In contrast, a few respondents highlighted what they saw as significant barriers to knowledge absorption. Two companies pointed to the challenge of reacting to customer requirements rather than following their planned innovation road map. They emphasised the lack of time to '*get products out of the door over new product development'* (Cumb.1 and Edin.4).

5.5 Place

We also investigated the importance of place in the qualitative survey. The significance of location has been highlighted in the literature, as it can influence levels of entrepreneurial activity, local labour availability, and access to capital (Fritsch & Storey, 2017; Henley, 2020). In our interviews, we found differences across economic sectors in how SMEs perceived the importance of place. The development of small service sector businesses was closely linked to their location and related communities, as seen in Cornwall and Cumbria. In contrast, place was either neutral or viewed negatively in the context of high-tech businesses. For example, one company in Cumbria stated, '*A complete hindrance for us, we can't get skills – it presents a massive difficulty in terms of skills shortages'* (Cumb.1). Similarly, a high-tech business in Edinburgh noted, '*Our engineers come from all over Europe, and it is difficult to find engineers with similar capabilities in the UK at the moment'* (Edin.3).

Some respondents highlighted labour mobility and access to talent as significant issues. For example, two of the high-tech companies in Edinburgh approached knowledge acquisition by recruiting staff internationally, bringing in a high level of technical expertise. As one respondent explained, '*Knowledge is coming from the employees we hire, and that is the technique we have used on a number of occasions, bringing in someone*

who had a particular knowledge' (Edin.2). Several small businesses in the rural areas of Cornwall and Cumbria also relied on social media to help develop new ideas or as a source of information when other options were not available.

Finally, we asked the business owners whether they had received any support or funding to aid their innovation process in the recent past. The responses varied, with 50% of respondents reporting that they had received assistance or funding. Some businesses, however, encountered obstacles in accessing funding (see Table 9). In these cases, respondents requested further support, as the Innovate UK process appeared somewhat opaque to some business owners. In contrast, there were numerous examples of SMEs benefiting from Innovate UK grants and other funding sources, as also shown in Table 9.

Table 9. Problems and Positive Views on Funding Opportunities

Business	Size	Issues
Cumb.1	Medium	'The difficulty in funding comes from the structure of funding. Innovate UK tends to be structured in terms of its call. You have to have your team ready to respond.'
Cumb.3	Small	'I've looked at Innovate UK, and if I could figure out a way of accessing money… I would like to do that. If there was someone that could help, it would be useful.'
Edin.2	Medium	'We have received government money and relatively small amounts in the past. I honestly don't think it was that effective for a company like us. It seemed to be geared to universities rather than businesses.'
Cumb.2	Small	'I did manage to get £10k from a local uni for a project helping community organisations using digital tech. The value was to explore feasibility of a tracking app.'
Corn.1	Small	'We have received support from: Unlocking Potential, Oxford Innovation, Growth Hub, FTI, and Outset Cornwall. I didn't know anything about business when I first started. Without this support, I would not have got this far, to be honest.'
Ess.3	Small	'Some Innovate UK funding has helped us to work with the university.'
Edin.3	Small	'We won three grants from Innovate UK, so we built an ecosystem with small companies, larger companies, and universities from all over the UK.'

6. Discussion and Conclusions

6.1 Theoretical Contribution

The main goal of our study was to identify the factors that drive absorptive capacity among SMEs while testing whether there are significant regional and industry differences in the levels of absorptive capacity among SMEs. One of the key contributions of our study is its focus on the four dimensions of absorptive capacity, as identified by Zahra and George (2002), as well as on the role of place in shaping SME absorptive capacity. However, unlike other studies, we have attempted to measure firm responses across each dimension. Our quantitative analysis highlights that, on average, there are differences—although not uniform across all factors—among the SMEs in our sample across four key factors: Decentralised Innovation Management, Employee Engagement, Use of Innovation Knowledge, and Internal Training Procedures.

We also tested whether these differences could be attributed to industry practices. An important element of our study was the comparison of SMEs across three economic sectors (Manufacturing, High-Tech, and Services), which differs from many other studies. Our findings suggest that sectoral differences do not significantly impact absorptive capacity. For instance, cluster analysis indicates that the most successful cluster, which engaged with decentralised management, comprised SMEs from all three sectors. This result supports existing literature emphasising the importance of governance in innovation—found by Noblet et al. (2011), along with Kodama (2005) and Du (2021)—as well as the role of human capital, as noted by Jones-Evans et al. (2016). Indeed, Iammarino et al. (2012) argue that this link with employees is complementary to the innovation process.

Our qualitative analysis has yielded interesting findings for each component of absorptive capacity. For instance, all SMEs have established routines to assimilate and exploit the external knowledge they acquire. Typically, the acquisition process involves diverse forms of collaboration with external parties, including customers, suppliers, universities, and indigenous capabilities (Marshall & Murphy, 2020; Martínez-Alonso et al., 2024). Knowledge is assimilated through an inclusive process, where both management and employees evaluate and make decisions.

Knowledge appears to be transformed in various ways, either through trial and error and experimentation or, for some SMEs, by adopting what they considered a more scientific approach. In other firms, knowledge transformation seems to have been carried out unknowingly as part of routine developments. Finally, once absorbed, knowledge exploitation becomes a relatively straightforward process.

Altogether, these findings suggest that internal processes facilitating the use of external knowledge for innovation, while varying across firms, are not industry-specific but rather specific to the SMEs and the opportunities they encounter as a group. One objection could be that SMEs are a heterogeneous group, and

therefore, we might expect to find more differences in their practices around absorptive capacity compared to other types of firms. Our cluster analysis tested this argument, specifically examining whether SMEs differ by location, size, or sector within each cluster. The study suggests there are no such differences. However, the ANOVA indicates significant regional differences among certain factors. Although the differences vary across regions, this key finding confirms the importance of considering the regional context when focusing on absorptive capacity.

While we do not explore which place-specific factors impact absorptive capacity, our study confirms the importance of clients, suppliers, similar organisations, and universities at certain phases of the innovation process. In locations where these actors are absent, or where links to other actors are underdeveloped, the absorptive capacity of SMEs may be limited. Close connections with the market via clients are well documented in the literature through various studies (Iammarino et al., 2012; Madriz et al., 2018; Tether, 2002). Additionally, a wealth of literature on local innovation systems shows how the local environment can influence knowledge flows and usage. Research by Jones-Evans et al. (2016) constructed an innovation network index that highlighted regional variations using ONS data. As Kitson (2019) argues, '*local innovation systems will vary and will reflect different structures and trajectories of development*' (p. 293).

6.2 Managerial Implications

This paper contributes to managerial practice by demonstrating that the key to successful innovations lies in using new knowledge through open management processes that draw on employees' contributions. In our analysis, this was termed decentralised management, highlighting the importance of management skills across all types of SMEs. The UK's *Be the Business* initiative recognised this, aiming to promote best management practices. Increased management expertise within SMEs, alongside a degree of trust within the business, is highlighted by Cavusgil et al. (2003). Kodama (2005) also emphasises the critical role leaders play within the company, which, in our case, refers to the manager or owner of the SME (Noblet et al., 2011). Additionally, the workforce played an active role in the knowledge absorption process.

The qualitative analysis revealed a clear recognition among SMEs that local environments can constrain growth and potential innovation. One example of this variation from our research came from a high-tech company in Cumbria, which acknowledged that their location was a disadvantage. To compensate, they operated a global collaboration model. This type of flexibility may mitigate some of the constraints associated with place (Du, 2021; Troilo et al., 2017). Another mechanism to compensate for a weak regional environment is the increased use of social media platforms as sources of knowledge. Some businesses in our sample, particularly those in the rural areas of Cornwall and Cumbria, emphasised the importance of social media as a knowledge source. This trend is widely recognised in studies that identify social media as an important driver of innovation within SMEs, especially in the service sector (Papa et al., 2018).

6.3 Limitations and Future Research Avenues

One of the limitations of this empirical paper is its focus on four regions, which do not represent the whole of the UK. It is possible that similar analyses in different UK regions, particularly the devolved nations, could produce results that differ in specific details. Additionally, we want to highlight that this study can be easily extended to other countries and regions, potentially opening new research avenues by exploring other aspects of the innovation process that are typically not covered by traditional innovation surveys.

6.4 Conclusions

Our research has provided a detailed perspective on the role absorptive capacity plays within a range of SMEs. In addition, we identified the ways in which SMEs obtain external knowledge. By using a range of methodologies, we were able to explore how SMEs perceive the external knowledge environment. Successful SME innovations often hinge on managers or owners who foster a participatory environment and decentralised management structures. This empowers employees to actively engage in the absorption of new knowledge, driving innovation forward.

Our analysis also revealed that strategies underpinning absorptive capacity vary across economic sectors and regions, which was the main aim of the paper. This finding is significant, as it underscores the need for policymakers to work at the intersection of regional policies and industrial strategies to improve the performance of SMEs across the UK.

Acknowledgements

Annexes

Annex 1. Original Online Survey

		Original Online Survey					

Dear Business Owner/Respondent

I would greatly appreciate your help in completing the attached survey. The questionnaire is part of a study being conducted, which aims to understand how businesses gain and use knowledge on innovations in products and services. The information you provide will be confidential and neither yourself nor your business will be identified. All data will be anonymised and will not be given to any third party or used for commercial means. The survey is being undertaken in four different regions of the UK and is funded by Innovate UK.

We realise that you are extremely busy, and we have designed the survey to be completed within about 15 minutes.

The questionnaire is divided into six main sections. Thank you for your help.

Part 1	This section is about you and your business.						
	1.	What is your gender?					
	2.	What is your age?					
		<20;20-24;25-29;30-34;35-39;40-44;45-49;50-54;55-61;>61					
	3.	Which of these qualifications do you have?					
		Non-Degree or equivalent level (O Level/CSE/GCSEs/A Level/ Higher School Certificate/Advanced Diploma or similar level), Foundation Diploma *Vocational (NVQ Level, Apprenticeship, BTEC, etc.)* *Bachelor's degree (e.g., BA, BSc, etc.)* *Master's degree (e.g., MA, MSc, MRes, MPhil, etc.)* *Doctorate or equivalent Level (e.g., PhD, DPhil, etc.)* *Other, please specify* *No formal qualifications*					
	4.	For how many years have you worked in this industry, to date?					
		<1;1-3;4-6;7-9;10-12;13-15;16-18;19-21;22-24;25+					
	5.	For how many years have you worked for this organisation?					
		<1;1-3;4-6;7-9;10-12;13-15;16-18;19-21;22-24;25+					
	6.	What is your current position within the organisation?					
		Owner ;Director/Manager ;Partner;Other, please specify					
	7.	How many years of experience do you have in your current role?					
		<1;1-3;4-6;7-9;10-12;13-15;16-18;19-21;22-24;25+					
	8.	How many full or part time people does your organisation employ?					
		1-9;10-19;20-29;30-39;40-49;50-59;60-79;80-99;100-149;150-199;200-249;250+					
Part 2	**Innovation and your organisation**						
	12.	How far do you agree with each of the following statements?	1	2	3	4	5
		The organisation continuously scans the environment to monitor new market trends					
		The organisation regularly seeks to introduce new ways and procedures for doing business					
		A dedicated team of people is employed primarily to conduct research and develop new business ideas					
		Management mostly takes a 'wait and see' approach in the context of new trends and methods					
		In general, employees in this organisation are not hostile to change and innovation					
		In the past 12 months, this organisation did not adopt/introduce any new or innovative way of doing business					
		Innovation and change are initiated solely at management level					
		Innovation and change are implemented at all levels of the organisation					
		1-Strongly disagree; 2-Somewhat disagree; 3-Neither agree nor disagree; 4-Somewhat agree; 5-Strongly agree					
	13.	Thinking about the organisation over the past 12 months, how many innovations (new products, processes, procedures etc.) can you recall having been introduced?					
		None;1-2;3-5;6-8;8-10;10+					
Part 3	**Your organisation's practices with respect to change and innovation**						
	14.	How far do you agree with each of the following statements?	1	2	3	4	5
		Employees' participation in meetings is required on a regular basis					
		During meetings, all participants are encouraged to put forward new ideas for discussion and development					
		New employees are trained in the organisation's processes and practices before commencing work					
		Employees are required to attend in-house training courses on a regular basis					
		Employees are required to attend external organised training courses on a regular basis					
		The organisation encourages employees to share new market, technical or other knowledge with their colleagues					
		The organisation has rules and places where to record its procedures					
		The record/manual of organisation practices and process is updated regularly					
		Organisation's policies, for idea generation and knowledge sharing, are clear to all employees					
		Employees' ideas are never taken on board and developed into new/better business, process or products					
		1-Strongly disagree; 2-Somewhat disagree; 3-Neither agree nor disagree; 4-Somewhat agree; 5-Strongly agree					
Part 4	**Openness & interaction of your organisation with external sources**						
	15.	In the last two years, indicate the extent to which each of the following external sources of ideas, information and knowledge was useful for innovation activities by your organisation? How useful was each source?	1	2	3	4	5
		Suppliers of equipment, raw- materials, components or software					
		Competitors					
		Customers or clients					
		Commercial or clients					
		Commercial Laboratories/R&D enterprises					
		Consulting firms or external skilled personnel					

Annex 1. Original Online Survey

		Original Online Survey					
		Joint venture partners					
		Universities or other higher education institutes					
		Government research organisations					
		National or public testing institutes					
		Private research institutes					
		Other public sector organisations e.g. government offices					
		Trade associations or cooperatives					
		Professional conferences, or meetings					
		Technical/ trade press, computer databases					
		Fairs, exhibitions					
		Technical standards					
		Health and safety regulations					
		Environmental standards and regulations					
		1-Not useful at all; 2-Somewhat useful; 3-Moderately useful; 4-Quite useful; 5-Extremely useful					
Part 5	**Role of learning within your organisation.**						
	16.	How much do you agree with the following statements? *Optional*	1	2	3	4	5
		Employees are encouraged to undertake training so as to broaden their knowledge of the industry					
		The internal processes necessary to obtain authorisation for employee training are known by workers					
		The organisation has policies which require employees to document new acquired knowledge from training					
		Organisation's policies do not allow employees to undertake training during normal working hours					
		Many employees are not aware of the organisation policies which require them to document the knowledge acquired from training					
		Most employees carefully document newly acquired knowledge					
		Employees have a clear understanding of who is responsible for the storage and sharing of information within the organisation					
		The organisation uses employees' knowledge and skills effectively					
		Employees are kept informed of important developments within the organisation					
		The organisation encourages informal conversations amongst employees to share information and knowledge					
		Interdepartmental meetings are organised regularly to discuss developments					
		1-Strongly disagree; 2-Somewhat disagree; 3-Neither agree nor disagree; 4-Somewhat agree; 5-Strongly agree					
Part 6	**Other questions**						
	17.	Can you please identify the sector in which your organisation works?					
		Manufacturing;Services;High Tech					
	18.	Please provide the name of your organisation:					
	19.	Organisation post code:					
	20.	Organisation website:					
	21.	Is there anything else you would like to add? We would welcome any comments you may have about your experiences of work, especially those relating to innovation, openness, how learning is used, and knowledge exploited in your organisation.					

Annex 2. Qualitative Interview Questions

Interview script/questions
Preamble Thanks for agreeing to participate in this research project, which we're carrying out in partnership with three other universities across the country. We're looking at how organisations innovate, and how they obtain or source new knowledge, which is at the heart of innovation, how it is embedded, and how it's used to make a difference or to drive change. Can you start by telling me about the role and importance of innovation in your organisation? What does innovation mean in [organisation]? What would you say are the key drivers for innovation in your organisation? *(e.g., grant funding, need to grow the business, maintain competitiveness, lost a key supplier, change in regulatory/policy, other horizon scanning)*
The next few questions are aimed at understanding, in detail, a practical example of how innovation works in your organisation. Can you think of an example of a recent innovation within your organisation? What makes it innovative?
Acquisition Thinking about the first stage of innovation – acquiring new knowledge. Can you tell me where the new knowledge came from?
Assimilation This is about working out how it's [the new knowledge is] relevant to the organisation, making sense of it, and understanding the value to the organisation. How did this happen, and who's involved? Can you tell me what you think helps or hinders the communication of new information and ideas in your business?
Transformation This is about adapting and applying the new knowledge to your organisation and context, it's a design stage of innovation. Was there anything that had to be done to this new knowledge to make it useful for your organisation?
Exploitation What were the outcomes, what were the benefits? How successful has it been, and what have been the results? Has it led to any unforeseen or unintended outcomes?
Can you comment on any help (or hindrance) you encountered from external organisations, partners, networks
Have you received any support or funding for innovation in the past? If yes, how effective has it been, and why?
Is there anything else that I haven't asked about that you thought we'd be talking about today, or anything else that you'd like to share?

Footnotes

[1] The high-tech industry is a specific aggregation of manufacturing industries according to the level of their technological intensity (R&D expenditure/value added), using the Statistical Classification of Economic Activities in the European Community (NACE Rev.2) at the two- or three-digit level

[2] A convenience sample is a non-probabilistic sample consisting of units that are included because they are easily accessible to the researcher

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