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Investigating Disparities in SMEs Digitalisation

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EXECUTIVE SUMMARY

This research investigates disparities in digitalisation among UK Small and Medium-sized Enterprises (SMEs), with a specific focus on variations by gender, ethnicity, region, and industry. Adopting a mixed-method approach, data was collected from both primary and secondary sources. Primary data was obtained from a panel discussion with academics, SME owners, and industry experts, providing a practical perspective that bridges the gap between theory and practice in digital transformation, particularly in the context of SMEs. Secondary data was sourced from the UK Longitudinal Small Business Survey (LSBS) spanning from 2018 to 2022, which examines digital technology adoption trends across five key digitalisation indicators: Accountancy Software, HR Management Software, Enterprise Resource Planning (ERP) Software, AI/Robotics/Automation, and Virtual Reality/Augmented Reality (VR/AR) technologies.

The findings reveal a high adoption rate for Accountancy software, while AI, Robotics, Automation, and VR/AR technologies have the lowest adoption rates among SMEs. Men-led businesses consistently show higher adoption rates for AI, Robotics, and VR/AR technologies compared to women-led businesses, with both groups increasing their adoption of these technologies in 2022. Non-MEG-led businesses show higher overall adoption rates for digital technologies compared to MEG-led businesses. However, while MEG-led businesses adopt digital technologies proportionately within their group, the total number of MEG-led businesses adopting these technologies is lower due to their smaller overall presence.

Regional disparities are evident, with London and the South East leading in AI, Robotics, and VR/AR adoption, and significant growth observed in London, the West Midlands, and the South East since 2021. Sectoral analysis shows that the Professional/Scientific and Other Service sectors have notable adoption rates for ERP and VR/AR technologies, while the Manufacturing, Information/Communication, and Professional/Scientific sectors lead in AI, Automation, and Robotics adoption within their respective industries. The panel discussion analysis offers deeper insights into the disparities, challenges and effective strategies for the adoption of digitalisation across business demographics. The study highlights the need for targeted strategies to address these disparities and promote more inclusive digitalisation across the UK SME landscape.

KEYWORDS: Digitalisation; SMEs; AI Adoption; Digital Divide; Women-led; Minority-led; UK Longitudinal Small Business Survey

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1. INTRODUCTION

Digitalisation and Artificial Intelligence (AI) technologies are becoming increasingly pervasive, reshaping how businesses operate, transforming business roles, and altering business models. However, not everyone is equally benefiting from digitalisation. Persistent biases and stereotypes in society hinder the opportunities that digitalisation can offer to women and ethnic minorities in business (UNIDO, 2023). Additionally, traditional businesses often show reluctance to change, and a culture of job loss fear further impedes the adoption of digitalisation across various sectors (Radicic and Petković, 2023; Jarvis et al., 2024). It is also observed that the benefits of digitalisation are most significant in innovative regions (Demin et al., 2023). Understanding the disparities in AI and digital technology adoption is essential for developing strategies that promote digital inclusion. This report aims to explore the adoption of digitalisation and AI technologies among UK small businesses, with a focus on variations in leadership by gender, ethnicity as well as geography, and industry sector. Moreover, it investigates the role and impact of peer influence on technology adoption among small businesses within the same industry and UK regions.

This investigation is conducted using data from the UK Longitudinal Small Business Survey (LSBS) and through a panel discussion on the topic. Using data from the LSBS for 2018 to 2022, this study explores the adoption of digitalisation and AI technologies in women-led and ethnic minority-led small businesses, UK regions and sectors. A panel discussion with academics, entrepreneurs, and an industry expert further aids in understanding the reasons behind these disparities. Based on the analysis of data from the LSBS and insights from the panel discussion, recommendations are made to help policymakers address the gaps in the adoption of digitalisation and AI technologies among small businesses. Specifically, the project has the following research objectives:

- To determine the prevalence of digital and AI technology adoption among small businesses in the UK, segmented by the gender and ethnicity of business leaders and across different geographical regions and sectors.
- To investigate the presence and significance of peer effects on small-business technology adoption within the same industry and in the same geographical area.
- To make recommendations to policymakers for addressing the existing gaps related to gender, ethnicity, and sectoral and regional differences in the adoption of digitalisation and AI technologies among small businesses.

Before analysing diversity and inclusion in digital and AI adoption, it is important to differentiate between terms such as digitisation, digitalisation, and digital transformation, which are often used interchangeably but have distinct meanings in a business context. Digitisation refers to the process of converting analogue information (such as physical documents) into a digital format (such as digital files) that can be processed, stored, and transmitted by computers (Verhoef et al., 2021; Loebbecke and Picot, 2015). This process often involves replacing traditional products with digital versions or enhancing existing products with new digital features (Horvath and Szabo, 2019).

However, digitalisation and digital transformation go beyond mere digitisation, involving a deeper transformation of business processes to generate revenue and improve operations (Kraus et al., 2022). Hess et al. (2016) uniquely highlight that digitalisation "calls for new ways of workplace communication and collaboration" and emphasise that digital transformation entails changes in a company's business model. Digital transformation, including AI adoption, involves integrating digital technology into all aspects of an organisation to deliver value to its customers (Kraus et al., 2022). AI, as a subset of digitalisation, attempts to replicate human learning by using data to make decisions akin to human intelligence (Boden, 2018), making it particularly valuable in business decision-making contexts. Understanding these differences is essential for identifying the factors that contribute to the digital divide and for developing strategies to promote digital inclusion across various business contexts.

The following second and third sections present the background and literature on digitalisation adoption in SMEs with a specific focus on diversity and inclusion. The fourth section discusses the methodology, and the fifth section presents an analysis, followed by a discussion and policy recommendations and a conclusion.

2. BACKGROUND

Small and Medium-sized Enterprises (SMEs) serve as the backbone of the UK economy by providing 61% of total employment and contributing 99.9% of the private business population (ONS, 2022). In the UK, 5.51 million are small businesses and 36,900 medium-sized businesses with 99.2% and 0.7% respectively of the total business population (ONS, 2023). The digitalisation of SMEs can significantly enhance service quality, increase productivity, improve collaboration, streamline processes, elevate the customer experience, and improve performance (Kádárová et al., 2023). The impact of digitalisation on SMEs can be understood through its potential contribution to the UK economy. Estimates suggest that post-digitalisation, SMEs could contribute £145 billion in annual

economic output, £325 billion in annual revenues, and create 2.7 million jobs (Deamer, 2021). Therefore, understanding and stimulating the enabling factors of digitalisation is an important issue (Del Giudice et al., 2021). Enabling factors can be identified at the governmental, organisational, environmental, and individual levels (Corvello et al., 2023). The latest data on the disparities among SMEs has highlighted the importance of factors such as gender, ethnicity, and geographic location. SMEs are unevenly distributed across the UK, with 87.5% of them located in England, of which more than 34% are situated in London and the southeast of England (ONS, 2023). In the leadership structure of UK SMEs, around 50% of businesses are male-led, 21% are equally led, 13.6% have women in a minority and 17.2% are women-led businesses (Mahmood, et al., 2022). SME ownership does not accurately reflect the population census, as 81.7% of the UK population is classified as white and 18.3% as ethnic minorities, yet 93% of small businesses are owned by white individuals, with only 6.1% owned by other ethnic groups (ONS, 2023). These geographic, gender and ethnic disparities can impact the digitalisation of these businesses.

3. LITERATURE

In the era of the digital revolution, as SMEs face a progressively challenging business environment, digitalisation can be fundamental in driving their sustainable growth and success. (Holl and Rama, 2023; Clemente-Almendros, 2024). As mentioned earlier, digitisation is different from digitalisation, the former involves creating digital artefacts through processes like conversion, representation, and enhancement, whereas the latter refers to transforming the socioeconomic environment by adopting, applying, and utilising these digital artefacts (Gradilas and Thomas, 2023).

Digitalisation empowers modern companies to navigate business complexities and transform their approach to innovation and management within the organisation (Rosyidah et al. 2023) but this journey is not easy for all firms, especially for SMEs. In SMEs, digitalisation entails the enhancement, adaptation, and transformation of business models through the integration of digital technologies (Etienne Fabian et al., 2024). However, most of the SMEs have struggled to keep pace with digital transformation and adoption, largely due to their inherent characteristics (Eller et al., 2020). Moreover, SME managers at times fail to capitalise on various digital technologies due to time constraints, limited resources, or the lack of a clear digital strategy (Mollet and Kaudela-Baum, 2023).

Investigating disparities in the digitalisation of SMEs reveals significant differences influenced by various factors such as digitalisation process, gender, firm size, leadership,

industry sector, geographic location, access to resources and more (Nadeem et al, 2018; Eller et al., 2020; Akpuokwe, et. al., 2024). Literature observed the contribution of various theories for exploring and understanding the dynamic decision-making process behind the adoption of digital technologies like the Theory of Planned Behaviour (TPB), the Technology Acceptance Model, the Resource-Based Theory (RBT) and the Upper Echelon Theory (UET) (Awa et al., 2011). The literature demonstrates a diverse view of digitalisation in SMEs, in which gender, ethnicity, and geography all play important roles in influencing the digital landscape and adoption trends (Owalla et al., 2021). The ongoing discussion in this field reveals the various layers of digital inequalities, arguing for a more inclusive and varied approach to digital transformation strategies in SMEs.

The choice of becoming an entrepreneur is driven by personal and external financial factors of individual and gender studies have reported clear gender gaps in access, use and outcomes of technology and highlighted the potential for transforming women's subjectivity (Oggero et al., 2020; Picatoste et al., 2023). It is argued that the adoption of digitalisation in SMEs is influenced by several internal and external factors of a firm, but the personal characteristics of entrepreneurs like gender, educational background, proactiveness, risk tolerance, and access to technologies are also crucial (Buratti et al., 2017; Orser and Riding, 2018; Eller et al., 2020; Alam et al., 2022; Expósito et al., 2023). It is observed that male entrepreneurs are generally more inclined to adopt technology than their female counterparts and due to high risk tolerance are more interested in taking innovation decisions (MacGregor and Vrazalic, 2008; Guney-Frahm, 2018; Buratti et al., 2017). However, most of the empirical evidence is collected from the traditional industrial, manufacturing, and technological sectors and other female-oriented sectors like education, caring & nursing, creative industries etc., are generally less examined (Pettersson and Lindberg, 2013; Alsos et al., 2016).

Literature has suggested many reasons for the digital gender divide like social-cultural norms, educational background, skill, technology literacy, inherent gender bias, knowledge and exposure to IT solutions (Orser and Riding, 2018, Alam, 2022). Many women entrepreneurs have limited financial literacy, which hinders their ability to manage their finances effectively, access financial services, and make informed financial decisions (Expósito et al., 2022). Further, work-life balance is a continuous challenge for female entrepreneurs; therefore, learning and development are usually informal when coupled with resource, time, and role model constraints (Olsson and Bernhard, 2021).

Women entrepreneurs often face significant financial obstacles, including limited access to credit, insufficient collateral, and discriminatory lending practices (Parthiban, et. al., 2022).

These challenges hinder their ability to invest in technology, expand their businesses, and compete effectively in the market (Moeini Gharagozloo, et al., 2024). The literature emphasises the crucial need for diversity and inclusion within SMEs. Woodhams (2009) highlighted the continued issue of digital discrimination, whilst Owalla et al. (2021) emphasised the diversity of women-led SMEs, advocating for a more nuanced understanding of gender in the process of digital transformation. Alam et al. (2022) study also shed light on the different viewpoints held by female entrepreneurs on digital transformation, implying a gendered dimension in digital technology adoption.

Women participation in SMEs is vital for driving innovation, fostering economic development, and promoting gender equality as they contribute a major proportion to the population (Akpuokwe, et. al., 2024). In the UK, 5.6 million businesses are SMEs (ONS, 2023), however, 34% of SMEs are women-led, and 33% of these businesses are sole traders (Owalla et al., 2021). This is not the true reflection of their contribution to the total population, which is 51%, it has grown by 6.7% over one decade (Gov.UK, 2023a). According to the Global Gender Gap Index (GGGI) though overall ranking of the UK has improved from 22nd to 15th, but interestingly it is on 43rd position for Economic participation and opportunity, and 34th in education attainment (World Economic Forum, 2023). This reflects that a lot of work is still required to close the gaps. By addressing gender disparities in access to technology and financial resources, challenging cultural and societal norms, and advocating for policy reforms, stakeholders can create an enabling environment for women's economic empowerment and sustainable development (Akpuokwe, et. al., 2024). Moreover, a policy intervention is necessary to address gender gaps and barriers in the pursuit of equality, diversity, and inclusion.

In a rapidly changing environment, SME entrepreneurs must continuously update and realign their skills and expertise. Adapting to digitalisation demands strong managerial, financial, and technological competencies. However, due to underdeveloped digital platform ecosystems, SME entrepreneurs often get frustrated and demotivated when taking on technology initiatives (Kahle et al., 2020; Chatterjee et al., 2022). There is also a focus on ethnic diversity by highlighting a substantial digital divide and emphasising the ethnic dimensions of digital inequality (Middleton, 2011).

For a better understanding of digital gaps, it is important to analyse the process from the individual perspective of the entrepreneur and understand the impact of ethnicity, region, education, culture, and reach to technology (Prasetyo and Setyadharam, 2022). First-generation migrants are usually compelled to pursue entrepreneurship as a path to economic independence as they are unable to compete for employment opportunities due

to language barriers, cultural differences, discrimination, lack of recognised qualifications and no reach to social networks (Chen, 2024). However, once established, they not only become job creators but also gain significant advantages from the entrepreneurial ecosystem by leveraging community connections, resources, and opportunities in both their host and home countries (Mayuto et al, 2023). The economic contribution of ethnic minority businesses (EMBs) to the UK economy prior to the pandemic is £25 billion and has the potential to grow significantly if these businesses are accurately accounted for and provided with appropriate support (UK Finance, 2022). Due to agility and potential, SMEs can more effectively capitalise on opportunities, resources, market conditions, and networks to implement technology than Multinational Corporation (MNCs) (Mosbah, 2024).

Due to culture and language barriers, immigrants struggle to get jobs and opt entrepreneurial route to support their families. Government assistance can play a crucial role in stabilising the entrepreneurial foundation for immigrants by offering pre-entrepreneurial and professional technical courses, as well as soft resources like networks and knowledge, to help them assess risks, stimulate entrepreneurial thinking, and achieve their goals at each stage (Chen, 2024).

Research shows that both internal and external factors significantly influence SMEs' adoption of AI, either facilitating or hindering the process. Key factors include organisational readiness, management roles, technology strategy, training, macro-environmental influences, and technological infrastructure readiness (Ri and Luong, 2021). Adopting AI presents two major challenges: it is capital-intensive and difficult to integrate. For SMEs, with their limited financial resources compared to larger firms, these challenges can make AI adoption too costly or even impossible (Wei & Pardo, 2022). AI adoption carries ongoing costs for maintenance, updates, and acquiring specialised technical expertise, which can discourage SMEs from investing in digitalisation (OECD, 2023).

According to the Made Smarter Review, faster innovation and adoption of industrial digital technologies could boost UK manufacturing by up to £455 billion over the next decade, increase annual sector growth by 1.5-3%, create 175,000 jobs, and reduce CO2 emissions by 4.5% (DBEIS, 2017). However, SMEs have been slow to adopt digital solutions within their organisations, with cost being recognised as one of the primary barriers to adoption (McFarlane et al., 2020).

Digitalisation in the manufacturing sector is crucial in the UK it is commonly referred to as the "Future of Manufacturing" in the UK, " and "Industry 4.0” in the EU (Yin et al., 2018). In the UK, the manufacturing sector employ 53% of the workforce and contributes 45% of the economic output. SMEs in this sector are facing two challenges in digitalisation, high

installation cost and complexity of digital solutions (Horvath and Szabo, 2019). The government can support SMEs in addressing these challenges.

Rural business often faces challenges of high operational costs, recruitment of skilled staff, and access to required infrastructure for smooth broadband services (Malecki, 2003; UK Parliament, 2019). The literature on the digital rural-urban divide highlights that this disparity affects both the social and business life of entrepreneurs (Freeman and Park, 2015; Roberts et al., 2017). Rural and small-town areas are less likely to adopt digital technology, even when accounted for country, sector, and firm-specific factors (Holl and Rama, 2023). Moreover, when inadequate infrastructure is combined with insufficient political support for technology adoption, social and geographical exclusion is further intensified (Roberts et al., 2017).

Under the regional innovation system (RIS) firms are often required to upgrade or modify assets at the firm level along with other major changes, being an expensive process, this could be mainly achieved with external support (Trippl et al., 2020). Therefore, the regional innovation system (RIS) approach emphasises that firms gain resources, information, expertise, and knowledge from various external sources, supported by an institutional infrastructure (Asheim et al. 2019). A robust regional development strategy is essential for fostering the growth of innovative companies. These companies, in turn, play a crucial role in developing digital skills within the region. In other words, without a comprehensive regional strategy, it would be challenging to create the environment needed for both innovation and the advancement of digital skills (Demin et al., 2023).

According to the European Commission's pan-European survey (2020), the AI adoption rate for the UK is 34%, and 20% of UK firms are planning to incorporate AI into their business. However, a big proportion (i.e., 46%) is not using AI and has no plan to use it in the near future. This survey also identified that cost, difficult operational processes, lack of skilled staff, insufficient IT infrastructure and complexity of algorithms are the main internal barriers to the adoption of AI in the UK. Whereas, lack of public funding, absence of strict laws and regulations on reputational risk, and liability of damage are the main external factors hindering the adoption of AI in the UK.

In 2022, the DCMS commissioned EY to analyse evidence and conduct market research on data foundations and AI adoption. The EY survey revealed that AI adoption rates are higher in younger companies (41%) compared to older firms (33%), aligning with literature that suggests firm age influences AI adoption. Additionally, AI adoption varies across sectors, with the highest rates in finance and technology (52%), followed by media and telecom (38%). The survey also indicates that 90% of large firms in the UK private sector

have either adopted or plan to adopt AI, whereas the adoption rate among SMEs stands at 48%. This finding supports existing literature that highlights the impact of firm size on AI adoption decisions.

According to the DCMS (2021), the sectors in the UK projected to see the most significant increase in AI adoption by 2040 are IT and Telecommunications (29%), followed by Media, Marketing, and Sales (24%). Small businesses in the UK are adopting digital technology at a record pace. According to the Federation of Small Business FSB (2023), 87% of small businesses now have a website and 70% use online marketing. The UK government initiative “Help to Grow: Digital scheme” supported small businesses in taking digital initiatives (TaxAgility, 2023). The UK government has created a ten-year plan to establish Britain as a global AI superpower by 2030. It is essential to address rapid changes and challenges while promoting inclusive and equitable growth across business sectors, minority groups, and regions.

4. METHODOLOGY

For this report study, we have used a mixed-method approach and data is collected from primary and secondary data sources. The primary data is collected from a panel discussion with academics, SME owners, and industry experts. The secondary data is collected from the Longitudinal Small Business Survey (LSBS), provided by the UK Department for Business and Trade (DBT) (BEIS, 2024).

The panel discussion aims to bridge the gap between theory and practice in digital transformation, particularly in the context of SMEs. It seeks to highlight inclusivity issues in SME digitalisation and serves as a platform for gathering firsthand insights from both experts and practitioners. The discussion also addresses the challenges and concerns surrounding digital transformation, particularly considering the increasing significance of AI and data analytics. The goal is to propose policies that promote inclusivity within the digital ecosystem, ensuring that all stakeholders are effectively supported. Ethical approval is requested from the Faculty of Arts Business and Social Science (FABSS) Research Ethics Committee, University of Wolverhampton. The ethics committee reviewed the study and approved the ethics application to collect and use the data from panel discussions for research purposes and research paper development. The consent form is completed by the panellist and the participants. The data is only used if they have signed the consent form.

The LSBS is a comprehensive, large-scale telephone survey of UK small business owners and managers. It has been commissioned by the Department for Business, Innovation and

Skills (BIS) and is the latest in a series of Small Business Surveys. LSBS started in 2015 and 2022 is the 8th Wave that covers a broad range of topics, providing insights into SME performance and the factors influencing it. The following sections provide details on the LSBS dataset utilised in the study.

4.1 Longitudinal Small Business Survey Dataset

For this study, we selected five key digitalisation indicators below from the LSBS data, focusing on the years 2018 to 2022. These indicators were chosen because they had consistent data available over this period and were considered essential for analysing recent trends in digital technology adoption among UK small businesses. The selected indicators are:

- Accountancy Software
- HR Management Software
- Enterprise Resource Planning (ERP) Software
- AI, Robotics, and Automation
- Virtual Reality (VR) and Augmented Reality (AR) Technologies

The selection of these specific indicators was driven by the need to include both foundational digital business management tools and cutting-edge digitalisation technologies. Accountancy Software, HR Management Software, and ERP systems are essential for efficient business management, enabling businesses to handle financial operations, human resources, and overall enterprise planning effectively. On the other hand, AI, Robotics, and Automation, as well as VR and AR, represent the forefront of digital transformation, offering advanced capabilities that can revolutionise business processes and create new opportunities for growth and innovation.

For analysis of these digital technologies, we have used these key variables: Gender - Women-led and Men-led businesses; Ethnicity- Minority Ethnic Group (MEG)-led and non-MEG-led businesses, Region – UK regions and Sectors - Sector (SIC 2007 1 digit) from LSBS 2018-2022.

The following table shows the descriptive statistics of the variables used in this study:

Table 1: Descriptive Statistics

	Average 2018-2022 Total *(%)*		Average 2018-2022 Total *(%)*
Gender		**Sectors**	
Women-Led Business	1,801 *(18%)*	Primary	408 *(4%)*
Men -led Business	**8,214 *(82%)***	Manufacturing	1,015 *(10%)*
		Construction	995 *(9%)*
Ethnicity		**Wholesale/Retail**	**1,680 *(16%)***
MEG-Led_Businesses	525 *(5%)*	Transport/Storage	383 *(4%)*
Non-MEG-Led_Businesses	**9351 *(95%)***	Accommodation/Food	876 *(8%)*
		Information/Communication	587 *(6%)*
Regions		Financial/Real Estate	465 *(4%)*
East Midlands	739 *(7%)*	**Professional/Scientific**	**1,515 *(14%)***
East of England	1,075 *(10%)*	Administrative/Support	836 *(8%)*
London	**1,139 *(11%)***	Education	277 *(3%)*
North East	270 *(3%)*	Health/Social Work	731 *(7%)*
North West	852 *(8%)*	Arts/Entertainment	307 *(3%)*
South East	**1,641 *(16%)***	Other service	425 *(4%)*
South West	**1,208 *(11%)***		
West Midlands	873 *(8%)*	**Digitalisation & AI technology usage**[1]	
Yorkshire & the Humber	732 *(7%)*	**Accountancy software**	**1,725 *(86%)***
Scotland	917 *(9%)*	HR_Management_Software	413 *(23%)*
Wales	521 *(5%)*	ERP_Software	182 *(10%)*
Northern Ireland	576 *(6%)*	AI_Robotics_Automation	256 *(6%)*
		VR_AR	102 *(3%)*

4.2 Longitudinal Small Business Survey Analysis

In our analysis, we examined the adoption of these digitalisation factors across several key dimensions:

- **Gender**: We analysed the data to compare digital technology adoption between Women-led and Men-led businesses, aiming to identify any disparities and trends over time. Prior literature indicates that women entrepreneurs face barriers, such as gender biases ingrained in financial systems, training programmes, and policy-

[1] Note: A significant amount of data is missing for these variables.

making processes, which create subtle but significant obstacles (Poggesi et al., 2016). Additionally, to remain competitive, women entrepreneurs often need to continually acquire new digital skills to harness digital opportunities and keep up with the pace of digitalisation in their businesses (Olsson and Bernhard, 2021). These challenges suggest that there may be significant differences in digital adoption rates between women-led and men-led businesses.

- **Ethnicity**: We explored the differences in technology adoption between Minority Ethnic Group (MEG)-led and non-MEG-led businesses. Prior research indicates that ethnic minority entrepreneurs often have a limited ability to compete with other businesses (Razzak et al., 2023), largely because they are prevalent in sectors with lower economic returns (Jones and Ram, 2012), operate in disadvantaged areas, and primarily serve their own ethnic markets (Carter et al., 2015). These factors can negatively impact the capacity of ethnic minority-run businesses to adopt digital technologies. Therefore, this analysis helps to uncover whether ethnic background influences the likelihood of adopting certain digital technologies.

- **Regional differences**: We assessed how digitalisation adoption varies across different UK regions (e.g., e.g., London, South East, West Midlands, Wales, Northern Ireland). In the context of the UK's digital ecosystem, there are significant disparities in how the digital economy[2] contributes to the prosperity of different nations and regions. These differences in economic growth rates can impact the adoption of digital and AI technologies by SMEs. While digital activities are present across all regions, London and the South East are particularly noted as tech hotspots (Steer Economic Development, 2021). Therefore, it is essential to investigate digital adoption rates by SMEs across UK regions. By understanding regional disparities, we can identify areas that may require targeted interventions to bridge the digital divide.

- **Sector-specific analysis**: We analysed 14 sectors to determine which industries are leading in the adoption of digital technologies and which are lagging behind such as Manufacturing, Construction, Transport/Storage, Information/Communication, or Professional/Scientific. The rate of digital adoption varies significantly across sectors in the UK. AI adoption is highest in knowledge-

[2] 'digital economy' is defined as businesses and organisations producing products and services in digital sectors, plus those job roles in sectors not classified as digital but which require digital skills and activity (such as a software developer working for, for example, a logistics company) (Steer Economic Development, 2021).

based sectors such as IT and telecommunications (29.5%) and legal services (29.2%), whereas it is much lower in traditional sectors like hospitality (11.9%), healthcare (11.5%), and retail (11.5%) (DCMS, 2022). Furthermore, within all UK businesses, only 8% of medium-sized firms (approximately 1,500 companies) and 3% of small firms (around 49,300 companies) are currently utilising four or five AI technologies in their business operations (DCMS, 2022). The analysis of these disparities in adoption rates across different sectors allows us to understand the unique challenges and opportunities of using digitalisation in different sectors.

To assess the adoption rates of these digitalisation factors, LSBS data were extracted from SPSS and analysed. We cleaned the data and analysed it by calculating the percentages[3] and technology adoption rates[4]. To visually present the differences and trends, we utilised percentage adoption rates within graphs, which enabled a proportional comparison of the use of digitalisation technologies across different variables.

5. ANALYSIS AND RESULTS FROM LSBS

5.1 Trends in digitalisation adoption among all UK Businesses (2018-2022)

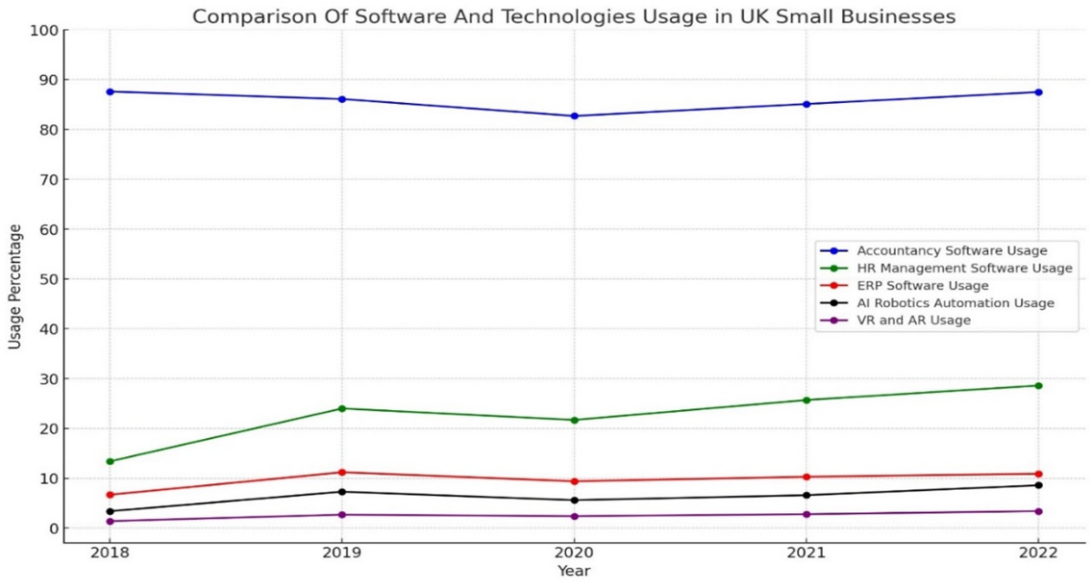
Five digitalisation indicators were chosen from the Longitudinal Small Business Survey (LSBS) due to the availability of their data for at least five years between 2018 and 2022. The results show that from 2018 to 2022, there are notable trends and differences in the adoption of various technologies among UK small businesses (Fig 1). **Accountancy Software** remains the most widely used, consistently above 80%, indicating its critical role in business operations. **HR Management Software** has seen a significant increase from 13.4% to 28.6%, highlighting its growing importance. **Enterprise Resource Planning (ERP) Software** usage has gradually risen from 6.7% to 10.9%, showing a steady but slower adoption rate. **AI, Robotics, and Automation** usage has also increased from 3.4% to 8.6%, reflecting an emerging interest in this area, although this pattern might change significantly in the coming years due to the rapid advancement of AI. In contrast, **Virtual Reality (VR) and Augmented Reality (AR)** technologies have the lowest adoption rates but have shown a gradual increase from 1.4% to 3.4%, indicating a slow but steady uptake in the small business sector. These findings suggest varying degrees of technology integration in UK businesses over the years. The slow adoption of certain technologies like

[3] For instance-women-led businesses using AI_Robotics_Automation/Total- led businesses using AI_Robotics_Automation

[4] For instance - Number of businesses adopted AI_Robotics_Automation in a certain sector /Total Number of businesses in the same sector

AI, robotics, automation, VR, and AR by UK small businesses can be attributed to their high costs, complexity, and the need for specialised knowledge and infrastructure, which can be challenging for smaller enterprises. Moreover, uncertainty around the return on investment and the evolving nature of these technologies can make businesses cautious about committing resources. In contrast, accountancy software seems to be more practical and essential for many SMEs, leading to its higher use.

Figure 1: Comparison of software and technologies usage in UK Small Businesses (2018-2022)



5.2 Digitalisation adoption and gender disparities in UK Businesses

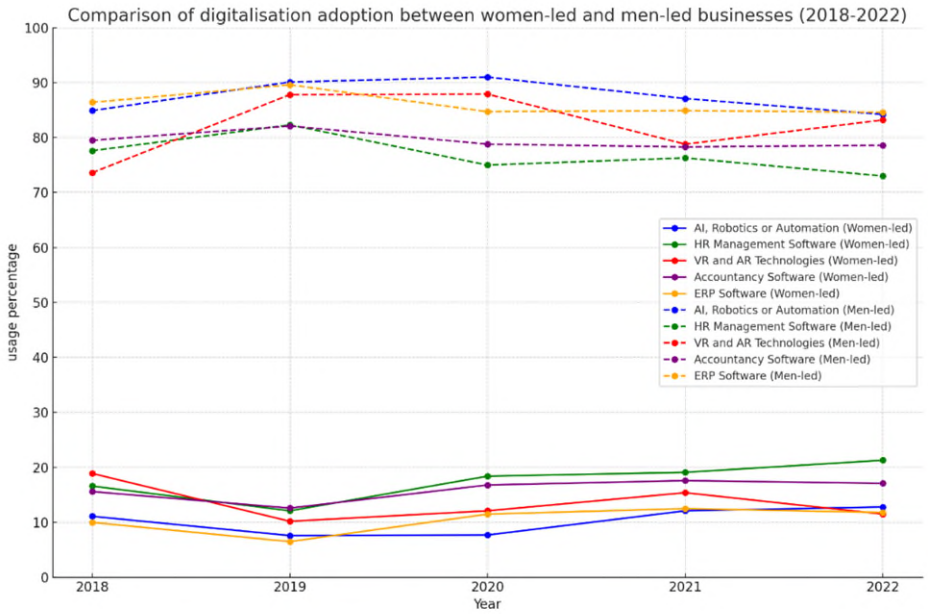
5.2.1 Digital technology adoption trends between Women-led and Men-led businesses

The analysis of digitalisation adoption from 2018 to 2022 shows distinct trends between women-led and men-led businesses across various technologies. The analysis of digitalisation adoption from 2018 to 2022, based on businesses that declared having used these technologies in the survey, reveals significant disparities between women-led and men-led businesses across several digitalisation sectors. In **AI, Robotics, or Automation**, women-led businesses reported a much lower adoption rate (10%) compared to men-led businesses (87%). Similarly, in **HR Management Software**, the adoption rate for women-led businesses stood at 17%, markedly below the approximately 77% for men-led businesses. This pattern persists across other sectors like **VR and AR Technologies**, **Accountancy Software**, and **ERP Software** (**Figure 2**). These findings underscore the need for targeted policy interventions to bridge the digital divide and ensure equitable

access to technology, enhancing competitiveness and innovation within women-led businesses.

However, from 2018 to 2022, women-led businesses have shown a gradual increase in adopting digital technologies, particularly in **HR Management Software**, reflecting a positive trend towards greater digital integration, but still lagging far behind men-led businesses.

Figure 2: Gender disparities in digital technology adoption (2018-2022)



5.2.2 Digital technology adoption among Women-led and Men-led businesses

To get a better understanding of digitisation adoption by women and men-led businesses, we adjusted adoption rates based on the total number of women-led or men-led businesses, meaning the interpretation must consider that the adoption rates are relative to the group sizes. The following graphs demonstrate a proportional increase in the adoption of digital technologies among both women-led and men-led SMEs. As the data is adjusted to group sizes, the percentages might be influenced by a small number of businesses within a smaller group (women-led SMEs). In a smaller group, even a modest increase in the number of adopters can result in a significant percentage increase.

AI/Robotics/Automation: From 2018 to 2020, the adoption rate for AI/Robotics/Automation in women-led SMEs remains relatively low and stable, at 0.5%. There is a sharp increase starting in 2021, with the rate reaching around 6.0% by 2022. Similarly, the adoption rate for men-led SMEs stays relatively low and stable from 2018 to 2020, with minor fluctuations (Fig 3). A significant increase is also observed starting in 2021, with the rate peaking at 9.4% by 2022.

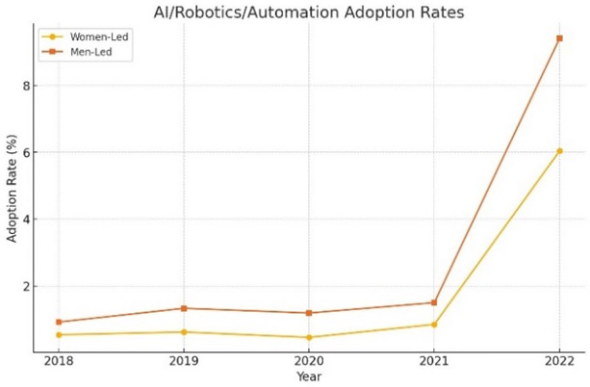


Figure 3: AI/Robotics/Automation adoption rates in women-led and men-led businesses from 2018 to 2022

The increase in adoption rates for both women-led and men-led businesses after 2020 indicates a growing trend in embracing AI/Robotics/Automation technologies. This could be due to the increased availability of these technologies, a response to competitive pressures, or a shift in strategic focus towards digitalisation.

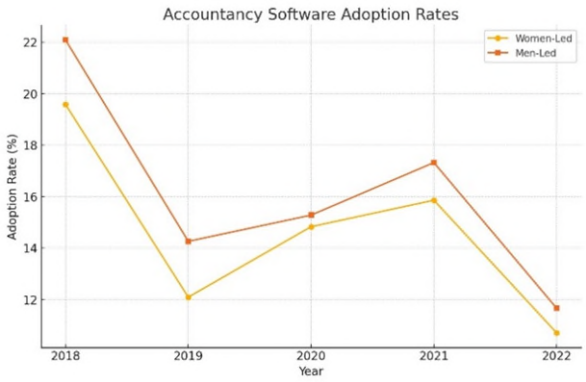


Figure 4: Accountancy Software adoption rates in women-led and men-led businesses from 2018 to 2022

Accountancy Software: Despite the high overall accountancy software usage, the women-led and men-led SMEs show a declining trend in the usage of accountancy software in their groups (Fig 4). For women-led SMEs group, usage dropped from 19.6% in 2018 to 10.7% in 2022. After 2019, the adoption rate shows a slight increase in 2021 before declining again in 2022. Even though the adoption rate for women-led SMEs declined to around 11% in 2022, this means 11% of all women-led businesses are using accountancy software relative to their total number.

Similarly, men-led SMEs saw a decrease from 22% to 11.7% over the same period. Similar to the trend observed for women-led SMEs, there is a slight increase in 2021, followed by a decline in 2022. The graph shows similar trends for both women-led and men-led businesses, with both groups experiencing a peak in adoption rates around 2018, followed by a decline, a slight recovery in 2021, and another drop in 2022.

HR Management Software: Both women-led and men-led businesses exhibit similar trends in HR management software adoption, with a noticeable convergence in adoption rates between 2020 and 2021. Both groups experienced significant growth in adoption during this period, followed by a decline in 2022 (Fig 5). In 2022, the adoption rate in Women-led businesses dropped to 4.4%. Similarly, the adoption rate in Men-led businesses declined sharply to 3.5%.

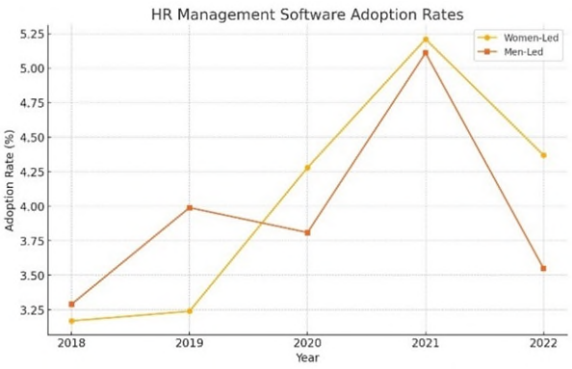


Figure 5: HR Management software adoption rates in women-led and men-led businesses from 2018 to 2022

A similar peak in 2021 for both groups suggests a broad trend of increased HR software adoption during this period, potentially due to external factors such as the Covid-19 pandemic, which may have driven the need for more robust HR management tools to handle remote work and other challenges. The decline in 2022 may indicate either a reduction in the perceived need for HR management software as businesses stabilise post-pandemic or could reflect financial constraints

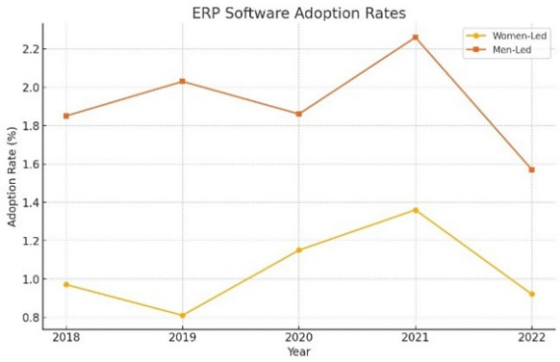


Figure 6: ERP software adoption rates in women-led and men-led businesses from 2018 to 2022

ERP Software: The adoption rate for ERP software among women-led businesses starts at less than 1% in 2018 and declines slightly in 2019. It then gradually increases in 2021, before dropping sharply in 2022.

The adoption rate for men-led businesses begins at about 1.8% in 2018, increases slightly to around 2% in 2019, and remains relatively stable through 2020. It peaks in 2021, followed by a significant decline in 2022 (Fig 6). The graph demonstrates that both women-led and men-led businesses experienced fluctuations in ERP software adoption rates from 2018 to 2022. While both groups showed increased adoption from 2019 to 2021, the subsequent decline in 2022 was more pronounced in women-led businesses.

VR/AR Technologies: In VR/AR technologies, men-led businesses increased their adoption from 0.33% in 2018 to 3.65% in 2022. Women-led businesses lagged, reaching 2.13% in 2022 (Fig 7). Both women-led and men-led SMEs started with low adoption rates for VR/AR technologies in 2018, with minimal change up to 2021. The adoption rates for both groups increased sharply between 2021 and 2022, with men-led SMEs showing a more substantial increase. This could be due to advancements in these technologies, making them more accessible and useful for SMEs, or external factors such as the COVID-19 pandemic, which accelerated the need for innovative digital solutions, particularly for remote work, training, and customer engagement.

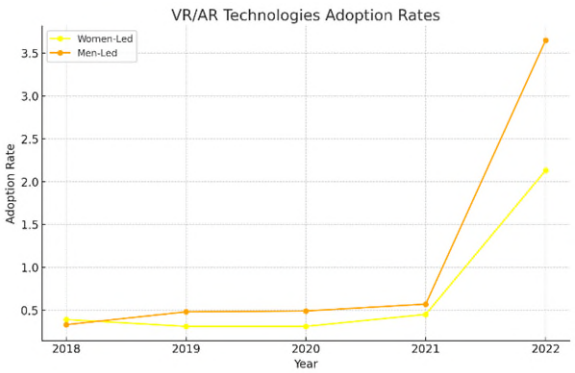


Figure 7: VR/AR technologies adoption rates in women-led and men-led businesses from 2018 to 2022

Efforts should prioritise women-led businesses to access and adopt advanced technologies, such as AI/Robotics and VR/AR. Providing targeted financial support, specialised training, and mentorship programmes could help close the digitalisation gap and foster a more inclusive technological environment. This focus is particularly important given the rapid advancements in AI and large language models (LLMs) like ChatGPT, which have the potential to significantly enhance various aspects of UK businesses (see also Townsend, 2023; Rajaram and Tinguely, 2024).

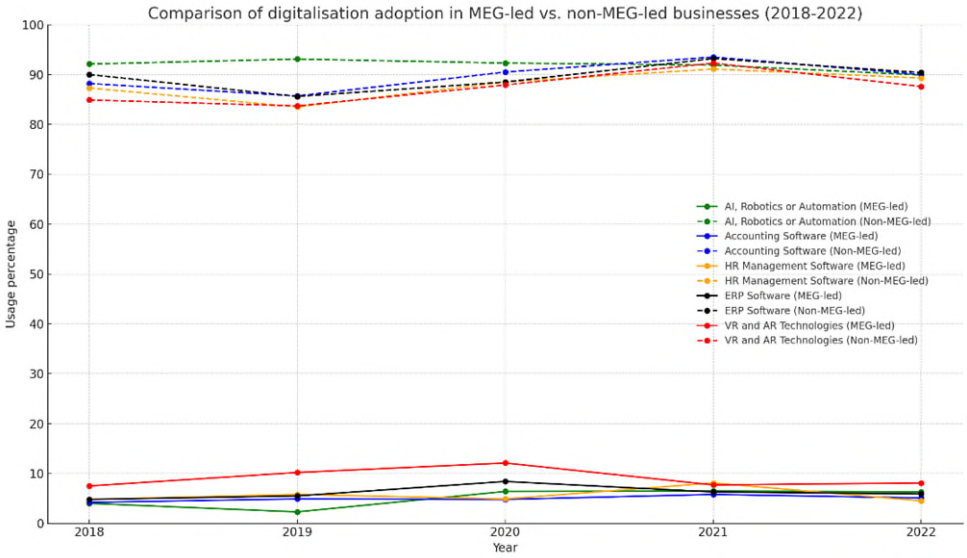
5.3. Ethnicity-based disparities in digitalisation among UK businesses

5.3.1 Digital Technology adoption trends between MEG-led and non-MEG-led businesses

In this section, we analyse the adoption rates of digital technologies as reported by UK businesses in the LSBS from 2018 to 2022, comparing businesses led by individuals from Minority Ethnic Groups (MEG-led) with those led by non-MEG individuals. The findings reveal that non-MEG-led businesses consistently exhibited higher adoption rates across all examined digital technologies and software. For example, in areas such as **AI, Robotics, and Automation**, non-MEG-led businesses maintained adoption rates above 89% throughout the period, while MEG-led businesses showed significantly lower rates, peaking at only 6.5%. Similarly, in categories like **Accounting Software** and **HR Management Software**, non-MEG-led businesses achieved adoption rates approaching or exceeding 90%, whereas MEG-led businesses demonstrated much lower adoption rates, typically below 8% (Fig 8). These results suggest a substantial digitalisation gap

between MEG-led and non-MEG-led UK businesses, underscoring the need for policy interventions to promote equitable access to digital technologies across all business sectors in the UK.

Figure 8: Comparative adoption rates of digitalisation technologies between MEG-led and non-MEG-led UK businesses (2018-2022)



5.3.2 Digital technology adoption among MEG-led and non-MEG-led businesses

To gain a clearer insight into the digitalisation adoption by MEG-led and non-MEG-led businesses, we adjusted the adoption rates to reflect the total number of businesses in each group. The analysis of digitalisation adoption from 2018 to 2022 reveals distinct trends among MEG-led (Minority Ethnic Group-led) and non-MEG-led businesses across various technologies.

AI/Robotics/Automation: Both MEG-led and non-MEG-led businesses showed relatively low and stable adoption rates from 2018 to 2020, with minimal increases in the adoption of AI/Robotics/Automation technologies. MEG-led businesses saw their adoption rates increase from 0.67% in 2018 to 9.79% in 2022, while non-MEG-led businesses grew from 0.89% to 8.64% during the same period. Starting in 2021, MEG-led businesses will adopt AI/Robotics/Automation technologies at a slightly faster rate. Although MEG-led businesses started with a slightly lower adoption

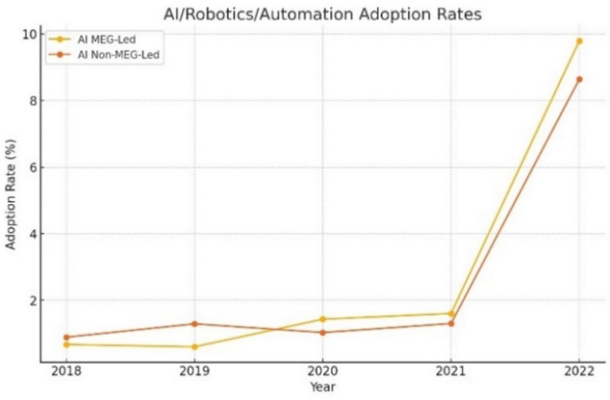


Figure 9: Adoption rates of AI/Robotics/Automation technologies in MEG-led vs. non-MEG-led businesses from 2018 to 2022

rate, they surpassed non-MEG-led businesses by 2022 (Fig 9). It suggests that both MEG-led and non-MEG-led businesses pursued technology adoption to stay competitive, leveraging AI and automation to enhance operational efficiency and drive innovation.

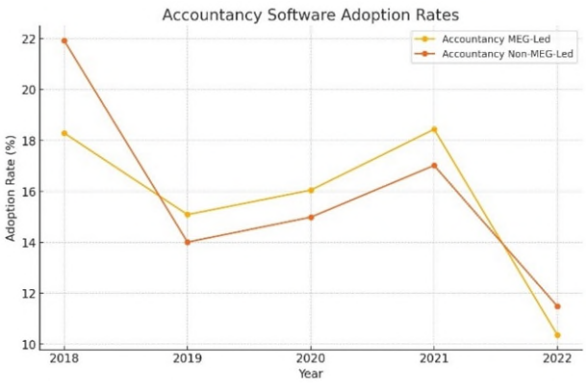


Figure 10: Adoption rates of Accountancy Software in MEG-led vs. non-MEG-led businesses from 2018 to 2022

Accountancy Software: The adoption rates for Accountancy Software fluctuated for both MEG-led and non-MEG-led businesses. MEG-led businesses saw a decrease from 18.3% in 2018 to 10.4% in 2022, while non-MEG-led businesses experienced a similar decline from 21.9% to 11.5%. The gap between the two groups remained relatively small throughout the years (Fig 10).

HR Management Software: HR Management Software adoption rates varied, with MEG-led businesses experiencing significant growth, peaking at 7.8% in 2021 before declining to 3.0% in 2022. Non-MEG-led businesses showed steadier adoption, reaching 3.7% by 2022. The data indicates a stronger initial adoption among MEG-led businesses, which then decreased, bringing the rates closer between the two groups by 2022 (Fig 11).

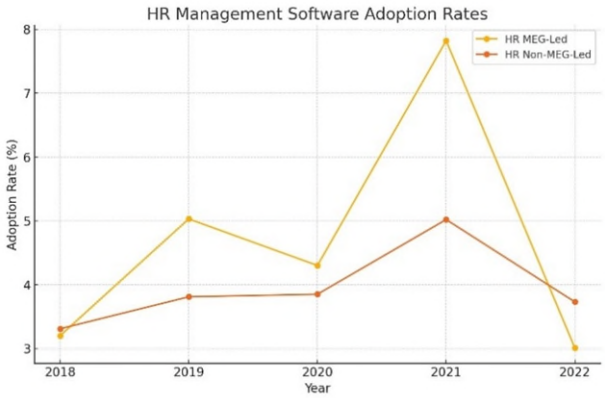


Figure 11: Adoption rates of HR Management Software in MEG-led vs. non-MEG-led businesses from 2018 to 2022

ERP Software: Adoption rates for ERP Software remained relatively low for both MEG-led and non-MEG-led businesses. MEG-led businesses had a higher adoption rate in 2020 and 2021 but fell behind by 2022. Non-MEG-led businesses had consistently lower but stable adoption rates, indicating a modest preference for ERP systems in non-MEG-led businesses (Fig 12).

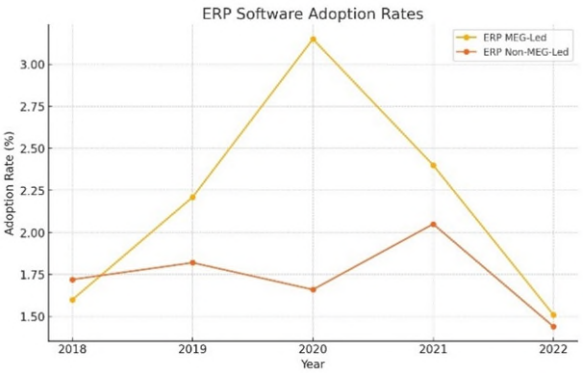


Figure 12: Adoption rates of ERP Software in MEG-led vs. non-MEG-led businesses from 2018 to 2022

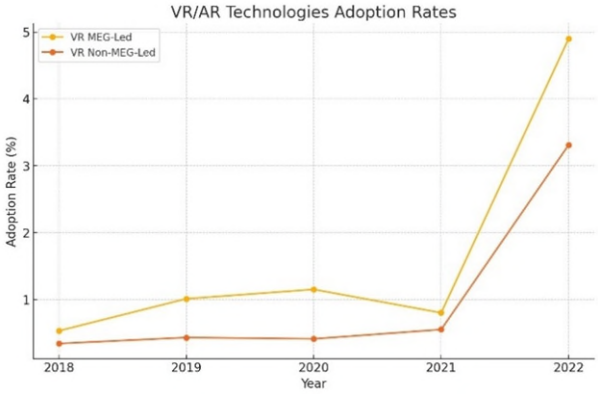


Figure 13: Adoption rates of VR/AR Technologies in MEG-led vs. non-MEG-led businesses from 2018 to 2022

VR/AR Technologies: VR/AR technologies saw the most significant increase among MEG-led businesses, with adoption rates rising from 0.53% in 2018 to 4.9% in 2022. Non-MEG-led businesses also increased their adoption, from 0.34% in 2018 to 3.31% in 2022. The higher adoption rate among MEG-led businesses by 2022 highlights a growing interest in these emerging technologies within this group (Fig 13).

These findings are particularly interesting when considering the composition of the two groups: MEG-led businesses represent only 525 firms, accounting for a mere 5% of the total, whereas non-MEG-led businesses constitute 9,351 firms, making up the remaining 95% (Table 1). It is important to note that the relatively small number of MEG-led businesses adopting these technologies may influence the observed differences. For instance, the number of AI adopters among MEG-led businesses was as low as 3 in 2019, and even in 2020, only 5 businesses had adopted AI. Similarly, adoption rates for other technologies such as ERP and VR/AR are based on very few businesses, often fewer than 10 in certain years. Due to this small sample size, the findings may exhibit greater variability and should be interpreted with caution. However, this does not diminish their relevance; instead, it underscores the need for careful consideration when making broader generalisations about these trends.

The standardisation of data indicates that even though the percentage rates appear similar or higher for MEG-led SMEs, the actual number of businesses adopting these technologies

might be low due to their smaller total size. Therefore, while the graph indicates a strong commitment to AI or VR/AR adoption among MEG-led SMEs relative to their total number, the findings should be interpreted with an understanding that the adoption remains limited due to the small number of MEG-led businesses overall. This suggests a more targeted or selective approach to digitalisation within MEG-led SMEs compared to a broader but more distributed adoption among non-MEG-led SMEs.

5.4 Regional trends in digitalisation Adoption

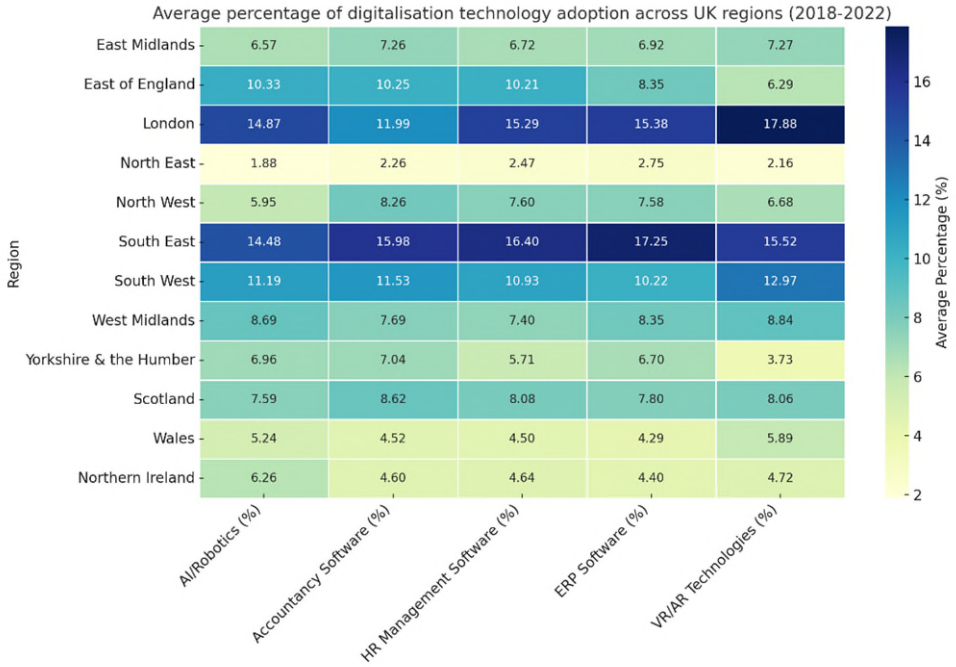
5.4.1 Digital technology adoption by UK regions

In this section we discuss the distinct regional disparities in the adoption of digitalisation technologies across the UK from 2018 to 2022[5], reflecting a varied technological landscape (Fig 14). **London** emerges as a leader in embracing these technologies, with particularly high usage rates in EPR Software (15.4%) and Virtual Reality/Augmented Reality Technologies (17.9%). This indicates London's significant inclination towards innovative solutions to enhance business operations and customer engagement.

The **South East** also shows substantial engagement, especially in HR Management Software (16.4%) and ERP Software (17.3%), suggesting the region's focus on optimising business processes and resource management. On the other hand, the **North East** presents the lowest engagement levels across most technologies, with percentages not surpassing 3%, possibly indicating limited industrial diversity or investment in digital infrastructures.

[5] proportion of SMEs in a specific region that have adopted digital technology relative to the total number of SMEs across all regions that have adopted digital technology.

Figure 14: Average percentages of digitalisation technology usage by UK regions (2018-2022)



Accountancy Software is notably prevalent in the South East (16.0%), reflecting the dense concentration of businesses that prioritise financial management tools. Conversely, regions like **Wales and Northern Ireland** show more modest adoption rates across all technologies, suggesting potential areas for targeted digital growth initiatives.

In the **West Midlands**, the adoption of digitalisation technologies presents a mixed landscape. HR Management Software and ERP Software have moderate adoption rates at 7.4% and 8.4% respectively, reflecting the region's focus on operational efficiency. However, adoption of advanced technologies like VR/AR is lower, under 9%, indicating the potential for growth in digital innovation. Overall, while some regions are rapidly integrating digital technologies into their business ecosystems, others lag behind, highlighting a need for policies that encourage uniform digital growth across all regions (for more information check Appendix 1).

5.4.2 Digital technology adoption peer effect among UK regions

The analysis of digitalisation adoption rates across UK regions from 2018 to 2022 reveals significant trends, particularly in the adoption of AI/Robotics/Automation and VR/AR technologies. These adoptions are measured as a proportion of the total number of businesses within each region providing a clear comparison across peers within the same regional context.

AI/Robotics/Automation and VR/AR: In the initial years (2018-2020), adoption rates are generally low across all regions, typically around 2% in AI/Robotics/Automation and 1% in VR/AR technologies. This indicates a cautious or gradual approach to adopting AI, robotics, automation technologies and VR/AR technologies during these early years, which might be due to higher costs, limited awareness, or insufficient infrastructure.

However, from 2021 onwards, there is a noticeable increase in adoption rates across all regions, highlighting a significant acceleration in digitalisation efforts. London, the West Midlands, and the South East show the most substantial growth in both AI/Robotics/Automation and VR/AR technologies. By 2022, adoption rates in London reached 12.6% for AI/Robotics/Automation and 5% for VR/AR; in the West Midlands, 10.6% for AI/Robotics/Automation and 4% for VR/AR; and in the South East, 8.0% for AI/Robotics/Automation and 3.7% for VR/AR, respectively. (Figures 15 and 16).

Figure 15: AI/Robotics/Automation Adoption Rates by Region (2018-2022)

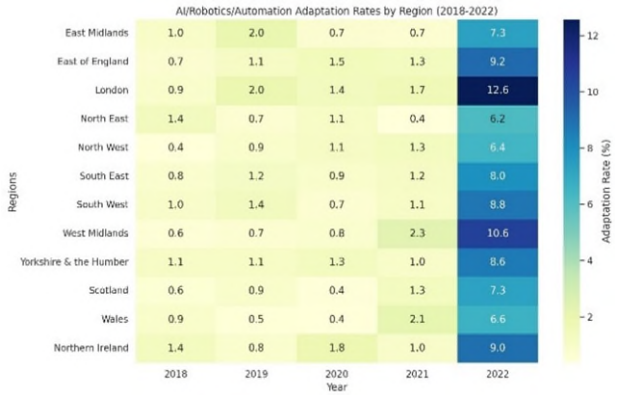
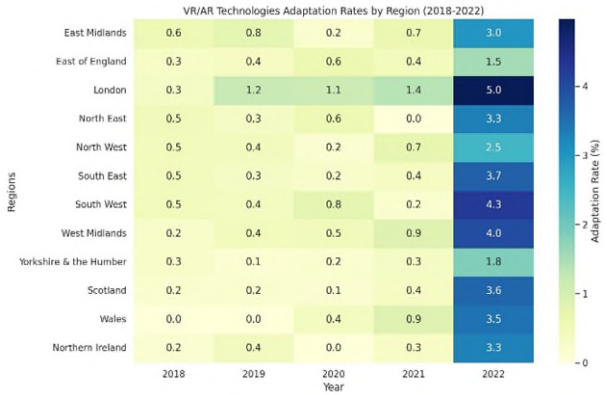


Figure 16: VR/AR Technologies Adoption Rates by Region (2018-2022)



HR Management, EPR and Accountancy Software:

The adoption rates for HR management and EPR software show significant regional variations across the UK from 2018 to 2022 (Figures 17, 18 and 19). London consistently exhibits the highest adoption rates for both software. The results suggest a strong initial uptake followed by a slight reduction. The overall trend shows some regions increasing their adoption rates before a slight decline or stabilisation in 2022, potentially indicating market maturity or shifts in technology focus. When comparing adoption rates relative to the total number of businesses within each region, regions like Wales, East Midlands, and Northern Ireland consistently show lower rates. This suggests potential barriers to adoption, or different regional priorities compared to their peers.

Figure 17: HR Management Software Adoption Rates by Region (2018-2022)

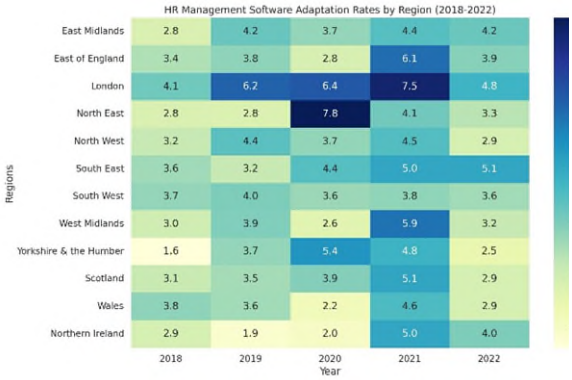
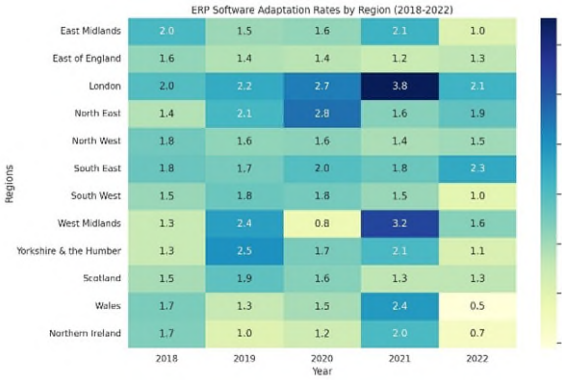


Figure 18: ERP Software Adoption Rates by Region (2018-2022)



For accountancy software, any regions, such as the East Midlands, Scotland, North West and London, show relatively high adoption rates in 2018 (e.g., East Midlands at 23.5%, Scotland at 23.1%. North West at 22.8%, London at 21.1%). However, these rates generally decline over time, with most regions experiencing a decrease by 2022. This indicates a general trend of declining adoption rates across all regions from 2018 to 2022, particularly when considering the adoption rates relative to the total number of businesses within each region.

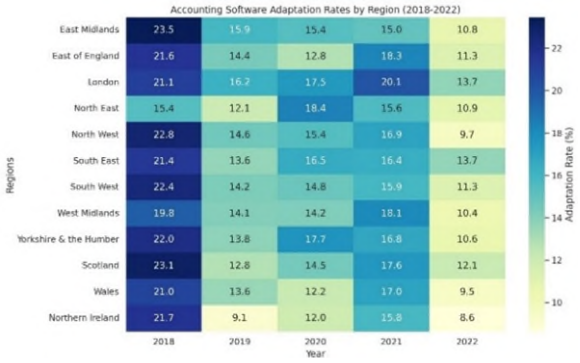


Figure 19: Accountancy Software Adoption Rates by Region (2018-2022)

These findings highlight the importance of regional policies that encourage digital adoption, particularly in lagging areas. Regions with lower adoption rates may benefit from increased investment in digital infrastructure and targeted training programmes to enhance their digital capabilities. The analysis underscores the necessity for a balanced approach to digitalisation across the UK, ensuring that all regions can participate in and benefit from the ongoing technological transformation.

5.5 Trends in digitalisation adoption across UK business sectors

5.5.1 Digital technology adoption by UK business sectors

This analysis shows the sectoral adoption rate for digital technology among SMEs[6]. It helps in understanding how significant a particular sector's contribution is to the overall adoption of digital technology among SMEs.

Manufacturing and Professional/Scientific sectors show high adoption rates for AI, Robotics, or Automation technologies (22% and 20%, respectively). Manufacturing also leads in the adoption of ERP software (24%), indicating a strong focus on integrating advanced management systems.

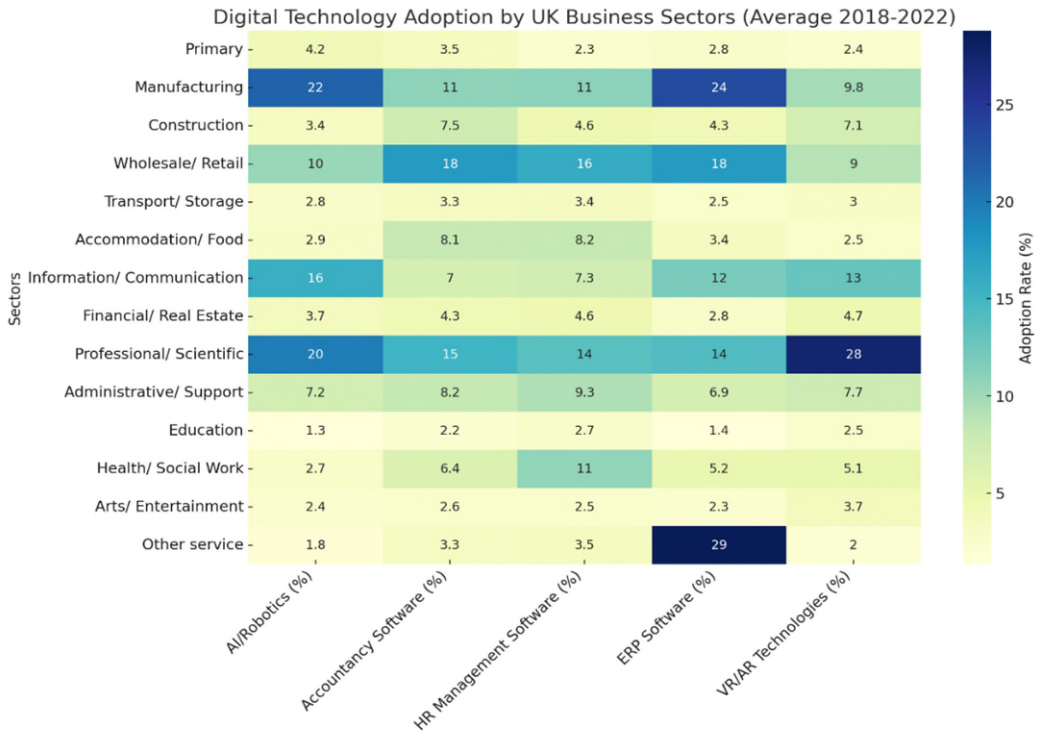
Wholesale/Retail has notable adoption rates in both Accountancy software and ERP software (18%), reflecting the importance of financial management tools in this sector.

The Professional/Scientific sector exhibits a high adoption rate for VR/AR technologies (28%), possibly due to their use in simulation and advanced training. The Other Service sector shows a significant adoption rate for ERP software (29%), suggesting an emphasis on comprehensive management solutions in this diverse category.

Figure 20 highlights the average adoption rates of different digital technologies across UK business sectors between 2018 and 2022. It highlights which sectors are leading in digital adoption and where there may be opportunities for increased technology integration (for more information check Appendix 2).

[6] proportion of SMEs in a specific sector that have adopted digital technology relative to the total number of SMEs across all sectors that have adopted digital technology.

Figure 20: Digital Technology Adoption by UK Business Sectors (Average 2018-2022)[7]



5.5.2 Digital technology adoption peer effect among UK business sectors

To assess the adoption rates of various digitalisation factors across different sectors, we measure the level of adoption of AI technology among SMEs within a single sector[8]. It helps to understand how prevalent AI technology usage is within that specific sector.

The analysis shows significant differences in how industries have adopted digitalisation technologies. In AI/automation/Robotics, the Information/Communication sector saw a significant increase in adoption, reaching a peak adoption rate of 22.8% in 2022. The Manufacturing sector also showed notable growth in AI use, with its rate increasing to 20.3% by 2022.

Figure 21 highlights the growth of AI adoption across various sectors over the period from 2018 to 2022, with sectors like Manufacturing, Information/Communication, and Professional/Scientific leading the adoption rates. The rise in AI adoption rates in these

[7] Note: The heatmap illustrates the adoption rates of various digital technologies across different sectors. The colour intensity represents the proportion of businesses in each sector that have adopted specific technologies, ranging from low (light yellow) to high (dark blue).
[8] The proportion of businesses that reported adopting a specific technology relative to the total number of businesses within each sector.

sectors suggests that sectors with higher data handling needs or those looking to optimise operations are more likely to adopt AI technologies.

Figure 21: AI/Robotics/Automation Adoption Rates by Sectors (2018-2022)

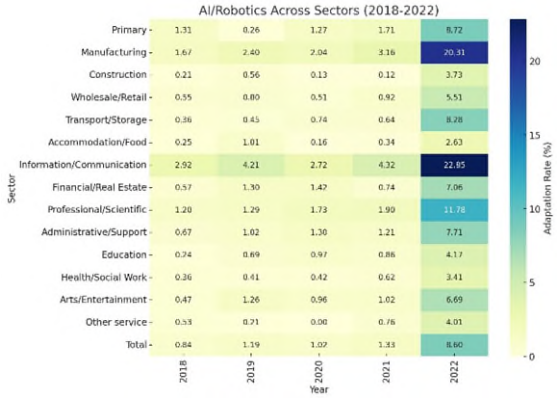
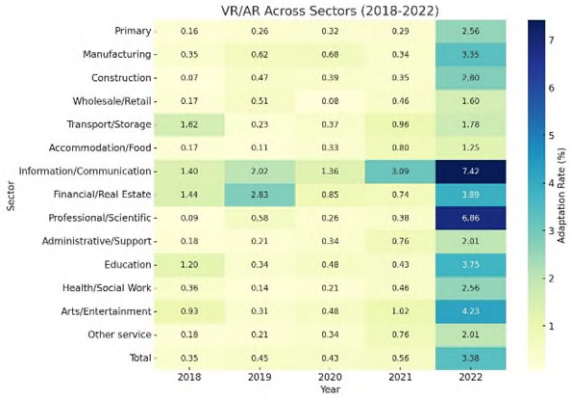


Figure 22: VR/AR Technologies Adoption Rates by Sectors (2018-2022)



VR/AR technologies have become increasingly popular in sectors Information/Communication and Professional/Scientific sectors are clearly at the forefront, indicating a strong trend towards adopting immersive technologies. For instance, the adoption rate for VR/AR in the Information/Communication sector climbed to 7.4% by 2022. Across many sectors, there is a general trend of increasing adoption of VR/AR technologies from 2018 to 2022. This steady growth suggests a broadening interest and applicability of VR/AR technologies across various sectors over time (Fig. 22).

Figure 23 shows the higher adoption rates of ERP software, such as Manufacturing (increase from 4.05% in 2018 to 4.74% in 2021) and Information/Communication (increase from 3.51% in 2018 to 4.69% in 2022). The Financial/Real Estate sector saw a steady increase in ERP use, peaking at 1.98% in 2021. This growth shows the sector's ongoing effort to use technology to improve financial management and real estate planning. The general trend across most sectors indicates a gradual increase in ERP software adoption over the years from 2018 to 2022.

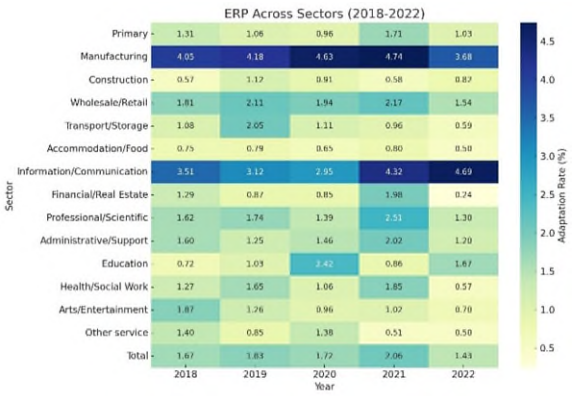


Figure 23: ERP Software Adoption Rates by Sectors (2018-2022)

Figure 24 highlights the sectors with higher adoption rates of HR management software, such as Health/Social Work, Education, and Information/Communication. The Health/Social Work sector experienced a significant increase in HR Management technology adoption, particularly highlighted during health crises, with the rate rising to

8.9% by 2021. This rise likely reflects the sector's need for efficient management systems to handle the demands during challenging periods.

Moreover, Figure 25 illustrates accountancy software adoption trends across various sectors where the general trend across most sectors shows varying patterns of adoption rates. Overall, these trends indicate that technology adoption is driven by the specific needs and priorities of each sector.

Figure 24: HR Management Software Adoption Rates by Sectors (2018-2022)

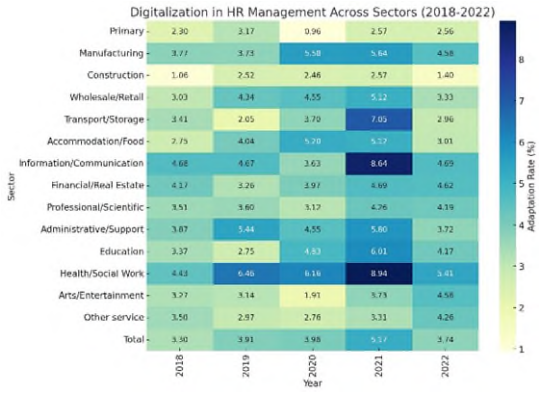
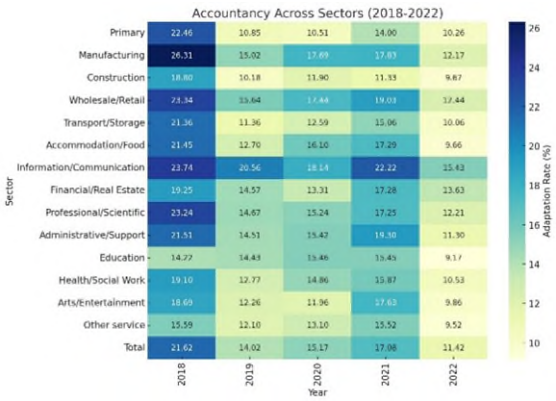


Figure 25: Accountancy Software Adoption Rates by Sectors (2018-2022)



6. ANALYSIS AND RESULTS FROM PANEL DISCUSSION

The panel discussion is organised in a symposium related to the topic of inclusivity in SME digitalisation and AI adoption. It involves the CEO and founder of an SME manufacturing company, one expert a knowledge transfer manager in advanced manufacturing at Innovate UK Business Connect and academics in the research area of SME financing, Sustainable Finance and Digitalisation. A variety of questions about the experiences and difficulties of using AI and digital technologies in SMEs, especially from a financial standpoint, have been asked to the panellist. They are prompted to weigh the advantages of adopting digital technology against its drawbacks and to offer suggestions to those who are still hesitant to do so. Specific questions explore the significance of financial factors and potential inequalities in explaining why women, older business owners, and SMEs in rural areas embrace digital technologies in comparison to men, younger business owner or their urban counterparts. The topic of whether small business owners from ethnic minorities are less willing to adopt AI than their white counterparts or if they have different obstacles to overcome is also discussed. Additionally, the panellist is asked about the impact of digital technologies on business competitiveness, the effectiveness of various

support programmes like Innovate UK and Made Smarter, and the policies in place to assist SME owners with digitalisation and AI adoption.

The following parts summarised the discussion related to the panel discussion on inclusivity in SME digitalisation.

6.1 General Challenges and Advantages:

Several benefits and challenges associated with the adoption of digitalisation were discussed during the panel. The panellists identified COVID-19 as a turning point for digitalisation, noting that it has since become central to business operations. The benefits of adopting digitalisation were categorised as either customer and supplier-driven or cost reduction-driven. Digital tools that track inventory, enhance security by safeguarding customer information, and provide real-time visibility of suppliers are contributing to improved decision-making processes within businesses. These tools also facilitate clearer and more streamlined communication with suppliers and customers, thereby enhancing operational efficiency. Additionally, digitalisation can help reduce staffing costs by minimising the need for additional hires.

However, the panellists also highlighted several challenges that SMEs face in adopting digitalisation. Key obstacles include the high costs associated with acquiring digital tools, such as AI technologies or websites, and the shortage of skilled personnel with technical expertise. Furthermore, established businesses often lack awareness of more affordable alternative financing options, especially when banks are hesitant to provide funding. Additional barriers to digitalisation and AI adoption include a lack of training and support to understand the value of these technologies and a perception that there is no immediate return on investment, given the time required for digital innovations to pay off. One panellist also mentioned a psychological barrier stemming from generational differences as some people are more reluctant to adopt them.

The panellists also discussed several strategies to enhance the adoption of digital and AI technologies by SMEs. One key strategy is to foster a better understanding of AI tools and their application within businesses, which can be achieved through improved education on digitalisation and AI technologies that should be integrated into society for all. Additionally, the panellists suggested focusing on a "triple win" scenario as highlighted by ERC, (2021), where digitisation is promoted to achieve sustainability goals and improve productivity. ERC, (2021) argued that for SMEs to tackle the persistent issue of low productivity, they must adopt both digitisation and practices that support the green economy. Based on the above discussion, we emphasise the importance of long-term investment in skills

development and advocate for sustained upskilling and reskilling initiatives to ensure the workforce is well-prepared to support the transition to a low-carbon, digital economy.

6.2 Specific Challenges and Effective Strategies:

6.2.1 Gender-Specific:

The panellists acknowledged specific challenges faced by women entrepreneurs that act as barriers to the adoption of AI and digital technologies. These challenges include financial constraints and a reluctance to take on loans and make investments in digital tools due to risk aversion. Women entrepreneurs are often at a disadvantage because most investors are men who tend to invest in male-led businesses. This cautious investment approach, coupled with a lack of training and support to appreciate the benefits of digitalisation and AI adoption, further exacerbates the issue. Moreover, societal beliefs and stereotypes that suggest women lack technological understanding persist, partly because STEM education and the digital world are still biased towards men. Contrary to findings in the literature that highlight ongoing challenges related to work-life balance due to digital stress or burnout among women entrepreneurs (Olsson and Bernhard, 2021), the panellists identified an improvement in work-life balance facilitated by digital tools.

The panellists suggested several strategies to overcome the challenges faced by women-led businesses, such as accessing the right networks for funding and obtaining better funding advice from business support agencies and growth hubs. They also recommended providing training and support to enhance understanding of AI, including guidance on cost estimation, timelines, and optimising investments. Furthermore, a long-term strategy proposed by the panellists involves encouraging girls and women to pursue education, training, and mentorship in STEM subjects and AI technology.

Based on this discussion, we highlight the significance of establishing grant programmes specifically for women-led startups in AI, mandating diversity training and gender equity policies in tech firms and boosting national campaigns to promote women's participation in STEM and AI fields.

6.2.2 Ethnic Minority

The panel discussion thoroughly examined the issues faced by minority-led small and medium businesses in the implementation of digitalisation and AI technology. These challenges are rooted in the inequalities experienced by first-generation minority-led businesses, such as limited access to finance, and cultural and language barriers, which have often relegated them to retail businesses serving their own ethnic communities. This

situation has, in turn, affected their ability to adopt AI and Internet technologies. First-generation ethnic minority entrepreneurs often feel disconnected or excluded from adopting AI technology due to a reluctance to invest in technology and training, which is compounded by cultural factors and past experiences, further exacerbating resource inequalities. Moreover, the panellists pointed out that the third generation faces financial challenges similar to those of the indigenous population due to a lack of property to use as collateral and limited family and friend networks as compared to the first generation. The panellists also stressed that new immigrants running micro businesses are lagging behind in adopting technology, machinery, and AI.

However, the panellists noted that these businesses have recently started to overcome some of these barriers, with an increased uptake of technology driven by the COVID-19 pandemic. The strategies outlined by panellists to improve the AI adoption by minority-led businesses include enhancing training in technology and AI across generations and building stronger financial networks and access to capital by specifically addressing resource inequalities with targeted support

Based on this discussion, we highlighted the significance of targeted funding programmes for minority-led businesses and community-based training initiatives focused on digital literacy. For minorities and new immigrants, micro-loan initiatives and alternative funding sources could help overcome barriers to digitalisation in their businesses.

6.2.3 Region-specific

The panel discussion, while not specifically addressing all UK regions, highlighted several barriers to digital adoption in rural areas compared to urban regions. These barriers include infrastructure challenges, such as inadequate broadband connectivity, and a lack of business networks that could encourage competitiveness and the use of digital technologies. Additionally, a panellist identified a significant issue regarding high investment in digital adoption within manufacturing industries, which predominantly takes place in urban areas, leaving rural regions behind.

Furthermore, another panellist noted that some regions, such as the West Midlands, experience high levels of energy poverty, which further complicates digital adoption.

The panellists suggested the need for enhanced business support and reliable broadband communication to better address the specific needs of rural sectors and activities. They also noted that challenges like energy poverty in a region can create opportunities through national, regional, and local funding and grants, which can foster the development of a

robust collaborative ecosystem in the region *(see Table 3 for more details on various support programmes for SMEs to adopt AI and digital technologies).* Consequently, we emphasised the importance of promoting the ongoing development and support of collaborative ecosystems in regions facing significant challenges, such as energy poverty. These ecosystems can leverage pooled resources and expertise to address complex issues more effectively, thereby supporting the goal of inclusive digitalisation for businesses in all regions, particularly those with lower rates of AI and digital technology adoption.

Table 2: Various Support Programmes for SMEs to adopt AI and digital technologies

Various Support Programmes for SMEs to adopt AI and digital technologies
UK-Wide Support Initiatives: • The UK government has established several grants to promote digital technology innovation and digitalisation across businesses. • Innovate UK provides various programmes, such as Knowledge Transfer Partnerships, to facilitate collaboration between businesses and academia. Specialised Hubs and Programmes: • Smart Manufacturing Data Hub: Offers Lighthouse funding for demonstrators of digital solutions. • Digital Supply Chain Hub: Runs the Launch Connect programme, focusing on SMEs across the UK. • Digital Catapult: Manages the Made Smarter Innovation Sustainability Accelerator and the Investment Readiness Programme.
Regional Collaborative Ecosystem: • These funds have helped to foster a collaborative ecosystem involving universities, catapults, local councils, and organisations. • The funding and grants have resulted in the development of a strong collaborative ecosystem in the regions such as in West Midlands key players include the Technology Centre, Energy Systems Catapult, Sustainability West Midlands, and the West Midlands Combined Authority. The Coventry and Warwickshire Growth Hub, in partnership with Warwick Manufacturing Group, offers bespoke advice, workshops, and small grants to companies in the West Midlands to support digital technology adoption
Local Grants and Programmes: • In addition to the innovative ecosystem, local governments have been issuing grants aimed at upskilling people and promoting decarbonisation. • The Made Smarter adoption programme is highlighted, offering workshops and grants of up to £20,000 to help businesses adopt digital technology solutions. Support Programmes: • These programmes provide impartial advice, tailor solutions to the specific needs of companies, and play a significant role in promoting digital technology adoption.
Fostering Diversity in Manufacturing: • Efforts are being made to increase diversity in the manufacturing sector, exemplified by the upcoming "Women and Manufacturing Changing Perceptions" conference aimed at bringing together diverse stakeholders to promote inclusion.

Source[9]

[9] Panel discussion (2024) and Other sources:

6.2.4 Sector-wise

The panellists highlighted the challenges faced by businesses in various sectors that continue to rely on traditional methods, particularly for well-established, older businesses where adopting new technologies is challenging due to ingrained mindsets. One panellist specifically pointed out these issues within the transport sector. They further mentioned that many small businesses in the transport sector may not be fully aware of the value of digital technology.

Similarly, traditional manufacturing and heavy industry companies, in contrast to startups, often resist change due to the age of the company, an unknown fear of job loss, a lack of understanding about the benefits of digital transformation, or a reluctance to disrupt the status quo, making it challenging to change the mindset of established businesses. Consequently, these companies tend to focus on short-term survival rather than investing in technology for long-term progress. Additionally, in these traditional sectors, digital technologies sometimes fail to meet the Technology Readiness Level (TRL) due to compatibility issues or inefficiencies within existing systems. The panellists also stressed that we should not overlook the fact that manufacturing companies have already faced staffing challenges due to Brexit, supply chain disruptions caused by the pandemic, and high energy prices.

The panellists emphasised the importance of demonstrating cost savings as a key motivator for digital technology adoption. One of the panellists provided an example of a business that developed software which significantly reduced their monthly costs by saving thousands of pounds on printing and paper. This cost-saving innovation allowed them to market the software to other businesses in their sector by highlighting these financial benefits. The panellists also noted that the manufacturing and food sectors are actively seeking collaborations with digital technology providers to develop solutions specifically tailored to their needs, enabling them to become technology providers themselves. Once

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Made Smarter Adoption – digital technologies adoptions support https://www.madesmarter.uk/adoption/in-my-region/west-midlands/workshops & match-funded grants up to £20k
Women in Manufacturing conference 19 Sept - https://engage.ifm.eng.cam.ac.uk/events/59-women-in-manufacturing-changing-perceptions/
UK-wide: Innovate UK has several programmes that support the advancement of digitalisation.
Made Smarter Innovation Smart Manufacturing Data Hub's Lighthouse https://smdh.uk/lighthouses
Digital Supply Chain Hub – Launch Connect https://digitalsupplychainhub.uk/event/digital-supply-chain-hub-launch-connect/
Made Smarter Investment Readiness Programme – extended to 21 July https://iuk.ktn-uk.org/opportunities/made-smarter-investment-readiness-programme/
Accelerated Knowledge Transfer 3 https://apply-for-innovation-funding.service.gov.uk/competition/1962/overview/b99b8969-8d81-4bb4-81fc-dc6ba1df036d

SMEs experience the benefits of digital technology, they are more likely to engage in further innovation.

Based on the above discussion, we underscore the necessity of offering tailored advice and solutions to businesses, ensuring that support programmes are designed to meet the specific needs of different companies and industries.

7. INSIGHTS FROM LSBS DATA AND PANEL DISCUSSION

The data analysis of LSBS (2018-2022) and panel discussion results show significant disparities in digital technology adoption based on gender, ethnicity, region, and sector. These disparities are influenced by a mix of cultural, financial, and infrastructural factors. Common challenges across all categories include financial and psychological barriers, such as high costs, lack of funding, perceived low ROI, and generational gaps. To improve digital adoption, there is a need for targeted interventions that address the specific barriers faced by each group. These interventions could include providing training, improving access to financing, and fostering a supportive culture for innovation. This analysis suggests that increasing digital adoption requires addressing both tangible barriers (like costs and infrastructure) and intangible barriers (like perceptions and cultural attitudes). Table 3 provides an overview of the disparities, challenges, and effective strategies for adopting digital technologies by UK SMEs.

Table 3: Digital and AI Technology Adoption Across Business Demographics: Insights from Survey and Panel Discussion on Disparities, Challenges and Effective Strategies

	LSBS	Panel Discussion results		
	Survey analysis results	**Challenges/Disparities**	**Effective Strategies**	**Recommendations**
General	• Digital technology adoption is high for Accountancy software and lowest in AI, Robotics, and Automation and Virtual Reality (VR) and Augmented Reality (AR)	• High cost of tools and training • Skill shortages • Lack of funding and alternative financing options • Lack of information about cheap alternative financing options • Limited training on the value of digitalisation • Perception of low ROI • Psychological barriers (age/generation gaps)	• Educate on AI tools and their business applications • Promote digital and AI literacy at all levels • Highlight Triple win scenario: productivity, digitalisation and green economy (ERC, 2021)	• Establish public-private partnerships to enhance digital and AI literacy programmes • Implement awareness campaigns on the long-term ROI of digital investments
Gender	• Men-led businesses consistently have higher adoption rates of AI/Robotics and VR/AR technologies compared to women-led businesses. • Men-led and Women-led businesses demonstrated an increase in the adoption of AI, Robotics, Automation, and VR/AR technologies in 2022 within their respective groups.	• Risk aversion towards loans and investments in digital tools • Male-dominated culture • Few women investors • Lack of support for understanding digital innovation • Cautious investment behaviour combined with a lack of training	• Offer training/webinars before AI development • Improve access to alternative financing through brokers • Strengthen networks for funding and support • Encourage STEM education and mentoring for women	• Create grant programmes specifically for women-led startups in AI • Mandate diversity training and gender equity policies in tech firms • Boost national campaigns to promote women in STEM and AI fields
Ethnic Minority	• Non-MEG-led businesses consistently exhibited higher adoption rates across all examined digital technologies and software as compared to MEG-led businesses • There is no evidence that MEG-led businesses lag behind in digital adoption relative to the total of MEG-led businesses. However, the overall number of MEG-led businesses and those adopting digitalisation is relatively lower compared to non-MEG-led businesses.	• Inequality in the business landscape • Reluctance to invest in AI due to cultural and past experiences of 1st generations of ethnic minorities • Financial challenges faced by 3rd generations of ethnic minority due to lack of collateral • Weakening family support networks for investment faced by 3rd generations of ethnic minority • New immigrants' businesses are lagging behind the technology, the machine and AI	• Enhance training in technology and AI across generations • Address resource inequalities with targeted support • Build stronger financial networks and access to capital	• Introduce targeted funding programmes for minority-led businesses • Develop community-based training programmes for digital literacy • Support micro-loan initiatives and alternative funding sources for minorities and new immigrants

Region	• There are regional disparities in technology adoption, with London and South East leading in AI/Robotics and VR/AR adoption rates. • Since 2021, there has been a noticeable increase in adoption rates across all regions. London, the West Midlands, and the South East have shown the most substantial growth in AI, Robotics, Automation, and VR/AR technologies within their respective regions.	• Poor infrastructure (e.g., broadband) • Limited business networks in rural areas • Urban focus on manufacturing investments • High energy poverty in certain regions	• Invest in broadband and communications • Tailor business support for rural sectors • Leverage energy poverty as an opportunity for funding and collaboration	• Increase government funding for rural broadband infrastructure • Develop region-specific business support hubs • Establish energy transition grants and incentives in high energy-poverty areas
Sector	• Professional/Scientific and Other Services show a significant adoption rate for ERP and VR/AR technologies respectively. Manufacturing and Professional/Scientific sectors show high adoption rates for AI, Robotics, or Automation technologies compared to other sectors. • Manufacturing, Information/ Communication, and Professional/Scientific sectors are leading in the adoption rates of AI, Automation, and Robotics within their respective industries. • Information/ Communication and Professional/Scientific sectors are at the forefront of VR/AR adoption within their sectors.	• Resistance to change in traditional sectors • Compatibility issues with digital technologies • Staffing and supply chain disruptions • Short-term focus on manufacturing • Lack of understanding of digital benefits	• Encourage digital adoption as a first step • Promote collaborations with tech providers • Support the Made Smarter Adoption Programme for SMEs	• Implement digital adoption grants for traditional sectors • Foster industry-academic partnerships for tech development • Expand the Made Smarter Adoption Programme with additional resources

8. POLICY RECOMMENDATION

8.1 Promote Gender Equity in Tech through Grants and National Campaigns

Though the technology sector in the UK is growing fast, it remains marred by gender inequality. Women contribute only 17% of the total tech workforce (Women in Tech, 2023) but 51% of the population. In 2022, around 700,000 women were employed in the UK manufacturing sector, representing only 26% of the total workforce (Castañeda-Navarrete, 2023). This contrasts sharply with sectors like education, human health, and social work, where women's participation exceeds 60%. Promoting gender equity in the technology sector is vital not only for social justice but also for the economic health of the industry.

a. *Establish Targeted Grants for Women in Tech:* Create dedicated funding opportunities for women-led tech startups and initiatives focused on gender equity. These grants could be awarded to companies, nonprofits, or educational institutions that are actively working to increase female participation in technology fields. Include incentives for organisations that demonstrate measurable progress in recruiting, retaining, and promoting women in tech roles, particularly in leadership positions.

b. *Launch a National Awareness Campaign:* Implement a nationwide campaign to raise awareness about gender disparities in the tech industry, highlighting the importance of diversity and inclusion. This campaign should target schools, universities, workplaces, and the general public. Partner with media outlets, influencers, and tech companies to amplify the message, showcasing success stories of women in tech and providing resources for girls and women interested in pursuing tech careers.

c. *Support STEM Education for Girls:* Increase funding for STEM education programmes in schools, with a specific focus on encouraging girls to pursue technology-related subjects. This could include scholarships, mentorship programmes, and partnerships with tech companies to provide real-world experience. Promote coding boot camps, AI courses, and other tech skills training programmes aimed at women, with additional support for those from underrepresented backgrounds.

d. *Incentivise Gender Diversity in Hiring Practices:* Offer tax incentives or other financial benefits to tech companies that demonstrate a commitment to gender diversity in their hiring practices. This could include meeting specific benchmarks

for hiring and promoting women in tech roles. Encourage companies to implement transparent reporting on gender diversity, with government support for those who publicly commit to closing the gender gap.

e. *Create a National Gender Equity in Tech Task Force:* Establish a task force to oversee and coordinate efforts to promote gender equity in the tech industry. This body could include representatives from government, industry, academia, and advocacy groups, working together to develop and monitor the effectiveness of policies and initiatives aimed at closing the gender gap in tech.

8.2 Support for Minority-Led Businesses

The UK government and policymakers can foster an inclusive business environment that uplifts minority-led enterprises and encourages their growth and sustainability. According to the House of Common Library (2023), approximately 16% of the UK population was from a minority ethnic background. In 2021, this percentage varied across regions, ranging from 3% in Northern Ireland to 18% in England. However, Ethnicity Facts and Figures (2023) indicated that only 6.1% of SME employers were led by ethnic minorities (excluding white minorities), with the human health sector having the highest percentage. Northern Ireland had the most white-led SME employers. Additionally, 4.9% of non-employer SMEs were majority-led by ethnic minorities, with the "other services" sector leading in this category. This data shows that only 37% of minority ethnic backgrounds are related to SMEs which perhaps identifies the issue of inclusivity.

Interestingly, this report did not find significant evidence that MEG-led businesses lag behind other businesses, indicating that further investigation may be needed. Like ensuring the reach and participation of minority-led businesses in the LSBS survey. There is evidence in the literature on the immigrants and ethnic minorities struggle to establish a small business. Government and policymakers can expand work on the following strategies in coordination with ongoing efforts to advance equity in the technology sector.

a. *Policy Advocacy and Representation:* Ensure minority business leaders are included in policymaking by creating advisory councils or committees that address their needs and influence funding decisions.

b. *Enhanced Grant Programmes:* Create targeted grants for minority-led businesses to provide capital and resources addressing their specific challenges, like existing programmes for women-owned businesses.

c. *Networking and Mentorship Initiatives:* Establish programmes to connect minority entrepreneurs with experienced business leaders through networking events, workshops, and peer support groups, fostering community and knowledge-sharing.

8.3 Enhance Digital Infrastructure and Support in Rural Regions

The government of the UK has developed a ten-year plan to make Britain a global AI superpower. According to Tech Nation (2024), the UK tech sector reached a $1.1 trillion market valuation, marking a key milestone in its growth story. London tech hub is at the top with a value of $648 billion followed by East of England ($169.4b), South-East ($64.9b), North West ($37.4b), East Midlands ($31.4b), Yorkshire and Humber ($27.7b), Scotland (21.4b), West Midlands ($20.1b), Wales (19.6b), South West ($18b), North East ($9.9b) and Northern Ireland ($2.9b). Regional disparity is obvious from these figures, London on one side and the rest of the UK even collectively can't match London.

a. *Policy Shift:* To support digital growth and investment in rural businesses post-Brexit, existing policies and strategies should be reconsidered with a stronger rural focus. This could include a digital-related fund, enhanced digital infrastructure, skills training, online business advice, IT support, and improved cybersecurity to ensure the UK remains a safe place to live and work online. Policymakers should consider the urban-rural divide and work to foster robust business environments in all areas. A favourable business environment can indirectly facilitate better access to digital technologies and encourage digital adoption, regardless of the SME's location.

b. *Public-Private Collaboration:* To resolve the territorial digital divide, policymakers can ensure effective public sector involvement in developing broadband infrastructure. The goal is to make digital and broadband services more affordable for rural businesses, improve broadband connections, address digital service gaps, enhance digital skills, attract young talent, and mitigate cyber risks.

c. *Access Management*: The government can aid rural capacity building by providing easier access to digital support and IT resources for rural businesses, including local guidance and identifying digital champions. Establishing digital enterprise hubs would enhance connectivity, offer workspace, and hot-desking, and provide digital training. The government can launch digital literacy campaigns across regions with lower adoption rates to increase awareness and understanding of the benefits of digital technologies such as AI, especially in regions like Wales and Northern Ireland.

d. *Training and coaching centres:* The UK government's National Cyber Security Centre provides extensive cybersecurity resources, including free training, cyber advisors, and certification, for UK businesses, including rural SMEs and those in agriculture. Rural businesses and residents, especially older and vulnerable individuals, should be encouraged to use these services to meet basic security standards and protect against cyber threats.

8.4 Sector-Specific Digital Adoption Grants and Partnerships

To enhance sector-specific digital adoption in the UK, the government and policymakers can take several key actions in the area of grants and partnerships:

a. *Targeted Funding Programmes:* Develop funding initiatives tailored to specific industries, particularly those heavily impacted by digital transformation. These programmes could prioritise sectors like retail, hospitality, and manufacturing, where digital tools have the potential to greatly enhance efficiency and customer engagement. Policymakers can encourage digital adoption among SMEs not only through direct investment support policies but also indirectly by investing in programmes that promote SME professionalisation and training.

b. *Collaboration with Tech Hubs and Innovation Centres:* Form partnerships with local tech hubs, accelerators, and innovation centres to foster digital adoption. These collaborations can provide businesses with mentorship and support in their digital transformation journeys. The UK Government has allocated £118 million towards AI-focused training, establishing twelve new UKRI Centres for Doctoral Training dedicated to the development and application of AI (Gov.UK, 2023b). Continuing such initiatives can support SMEs' digital transformation.

c. *Public-Private Partnerships:* Encourage collaboration between the government and private sector organisations to expand digital training and resources. By utilising the expertise of tech companies, the government can offer workshops and training sessions to help small businesses adopt digital technologies. The UK government's existing initiatives like innovative vouchers, Local Enterprise Partnerships (LEPs), R&D Tax Credits, and Creative Industry Tax Reliefs.

d. *Inclusive Approach:* Due to economic impact, competitiveness, and innovation, the UK government has prioritised manufacturing and Industry 4.0 when embarked on digital transformation. However, it is important to recognise the value of AI in other sectors such as healthcare, education, and services, which also hold significant

potential for growth and improvement through digital technologies. A more inclusive government approach should consider exploring AI applications across these diverse sectors.

e. *Continuation of existing programmes*: The UK government has taken great initiatives to support small businesses such as the Made Smarter Programme, Tourism Recovery Plan, Digital Growth Grant, Create Growth Programme etc., which are already transforming the future of SMEs. However, it is crucial that these programmes not only continue but also expand their support and resources to encompass a broader range of sectors, ensuring that businesses across the board can benefit from digital transformation efforts.

8.5 Targeted Subsidies and Incentives for Digital Literacy and AI Training

Policymakers can take initiatives to help SMEs develop industry and market-specific skills and competencies. Furthermore, they can foster SME growth by offering job creation incentives, providing fiscal advantages for investments, and extending financial support.

a. *Subsidised Training Programmes:* The government can provide financial support to organisations that offer training in digital literacy and AI skills. By helping to cover the costs of these programmes, the government can make them more affordable for individuals and businesses, especially those from underrepresented communities, and enhance overall accessibility. During the Spring Budget 2024, the UK Government introduced a £7.4m upskilling fund pilot. This fund will help SMEs in learning and developing AI skills. This will complement the SME digital adoption task force (HM Treasury, 2024). However, there is a need for more such initiatives as the gap is big.

b. *Collaboration with Educational Institutions:* Partner with universities and technical colleges to develop and deliver training programmes focused on digital literacy and AI. The government can provide funding for curriculum development that targets skill gaps in these areas, ensuring that training meets industry needs. Since 2019, DSIT has invested around £38 million in postgraduate AI conversion courses, aiming to increase diversity within the AI workforce and equip students with the skills needed for the AI era.

c. *Community Programmes:* Support community-based training initiatives that offer digital literacy and AI courses to diverse populations, including women, minorities,

and low-income individuals. This can help bridge the digital divide and ensure equitable access to technology skills.

d. *Micro-Credentialing Initiatives:* Create programmes that provide micro-credentials in digital skills and AI. With government subsidies, these programmes can offer affordable, pay in instalments or free qualifications, making it simpler for individuals to enter or advance in the tech sector.

e. *Simplification of Access to Services:* Create a centralised single platform where businesses can easily access information about available grants, funding, training resources, digital support, digital tools, off-the-shelf software and solutions tailored to their industry needs. Ensuring that this information is straightforward can help drive participation.

f. *Feedback Channels:* It is crucial to establish feedback channels for participants and businesses to share their experiences with existing training programmes. This feedback will help guide policy enhancements and ensure that the programmes remain relevant and effective.

9. CONCLUSION

The study suggests that gender, ethnicity, regional differences, and sectoral variations all play significant roles in the adoption of digital technologies within UK businesses. These findings highlight the need for tailored policies and support mechanisms to address the unique challenges faced by different business demographics and regions, ensuring a more inclusive and equitable digital transformation across the UK.

Key findings indicate that women-led businesses often lag behind men-led counterparts in adopting advanced digital technologies such as AI, Robotics, and Automation. This gap is likely influenced by several factors, including access to resources, varying levels of digital literacy, and socio-cultural barriers. Moreover, regional disparities reveal that businesses in economically stronger regions, such as London and the South East, exhibit higher adoption rates compared to those in less prosperous areas. The sector-specific analysis also shows significant differences, with technology-intensive sectors like Information/Communication Manufacturing and Professional/Scientific leading in digital adoption, while more traditional sectors such as Transport/Storage and Construction are slower to integrate new technologies.

These findings underscore the necessity for tailored policies and support mechanisms that address the unique challenges faced by different business demographics, regions, and sectors. To foster a more inclusive and equitable digital transformation across the UK, policymakers must consider targeted interventions that promote digital literacy, provide financial incentives, and support infrastructure development, especially in underrepresented or lagging regions and sectors.

Limitations:

In this study, we are limited to using the digital technology adoption variables such as social media usage and e-commerce, which were only collected in 2015. This means analysis may not fully capture current digitalisation trends across different business sectors. Given the significant impact of social media on SMEs, particularly in areas such as advertising and product sales, other digital variables such as social media usage must be thoroughly examined to provide a more comprehensive picture of digital adoption trends.

Given the growing importance of AI in business, as evidenced by the increase in AI adoption in 2022, it is crucial to assess AI, Automation, and Robotics separately in future surveys. These technologies have different characteristics and applications, making it essential to distinguish between them to gain a clearer understanding of their adoption patterns and impact. The current approach of grouping AI, Automation, and Robotics in the survey questions may lead to confusion. Respondents might be reporting the use of Automation technologies rather than AI, which could skew the data and conclusions about AI adoption in this study. Therefore, it is better to include more specific questions that differentiate between these technologies. For instance, additional questions could focus on assessing specific aspects of AI usage, such as generative AI like ChatGPT, machine learning, and natural language processing, as well as their impact on business productivity and efficiency.

In our results the high adoption rate might suggest a strong peer effect, however, there is a need to consider other factors, such as sector-specific needs, government policies, or economic conditions, which could also influence adoption. Additionally, peer effects might vary across sectors or regions due to differences in industry dynamics, cultural factors, or institutional arrangements. But to overcome these limitations we have combined the quantitative analysis with qualitative methods (e.g., panel discussion) to gain deeper insights into the underlying reasons for adoption decisions and the role of peer effects.

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APPENDIX

Appendix 1: Digital technology adoption by UK regions (2018-2022)

		East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire & the Humber	Scotland	Wales	Northern Ireland	
Artificial Intelligence, Robotics or Automation	2018	8.7	9.5	12.7	4.8	4	15.9	13.5	5.6	9.5	5.6	4	6.3	100
	2019	12.2	9.9	17.6	1.5	6.1	16	13.7	4.6	6.1	7.6	1.5	3.1	100
	2020	5.1	15.4	14.1	2.6	9	14.1	7.7	6.4	9	3.8	1.3	11.5	100
	2021	3.2	9.7	12.9	0.8	7.3	12.9	8.9	12.9	4.8	8.9	12.1	5.6	100
	2022	6	10.1	15.1	1.6	5.7	14.3	11.1	9.4	6.8	8.1	5.4	6.3	100
Accountancy software	2018	7.8	10.8	11.8	2	9.1	15.7	12.1	7.7	7.5	7.7	3.8	3.9	100
	2019	8	10.6	12.2	2.3	8.8	15.7	12.1	8.1	6.7	9.1	3.4	2.9	100
	2020	7.5	9	11.8	2.8	8.2	17.4	11.6	7.4	7.9	8.4	2.8	5.1	100
	2021	5.7	10.2	12.1	2.4	7.3	14.1	10.3	7.8	6.2	9.1	7.5	7.3	100
	2022	6.6	9.4	12.4	2.1	6.5	18.4	10.8	7	6.3	10.1	5.8	4.6	100
HR management software	2018	6.1	11.3	15.2	2.4	8.3	17.4	13.1	7.7	3.6	6.9	4.4	3.4	99.8
	2019	7.7	10	16.7	1.9	9.5	13	12.1	8.1	6.5	9.1	3.3	2.1	100
	2020	6.9	7.6	16.4	4.6	7.6	17.8	10.9	5.3	9.2	8.6	2	3.3	100
	2021	5.6	11.2	14.9	2.1	6.4	14.3	8.1	8.5	5.8	8.7	6.6	7.7	100
	2022	7.9	9.8	13.2	2	5.9	20.8	10.4	6.5	4.5	7.3	5.3	6.5	100
ERP software	2018	8.8	10.4	14.4	2.4	9.2	17.6	10.8	6.4	5.6	6.4	4	4	100
	2019	6	8	12.9	3	7.5	15.4	11.9	10.4	9.5	10.4	2.5	2.5	100
	2020	6.9	8.4	16	3.8	7.6	18.3	12.2	3.8	6.9	8.4	3.1	4.6	100
	2021	6.8	5.7	18.8	2.1	5.2	13	8.3	11.5	6.3	5.7	8.9	7.8	100
	2022	5.1	8.8	15.4	2.9	8.1	24.3	7.4	8.8	5.1	8.8	2.2	2.9	100
VR and AR technologies	2018	11.3	9.4	11.3	3.8	11.3	20.8	15.1	5.7	5.7	3.8	0	1.9	100
	2019	12.2	8.2	28.6	2	8.2	12.2	10.2	8.2	2	4.1	0	4.1	100
	2020	3	15.2	27.3	3	3	9.1	21.2	9.1	3	3	3	0	100
	2021	7.7	7.7	25	0	9.6	9.6	3.8	11.5	3.8	5.8	11.5	3.8	100
	2022	6.2	4.3	15.2	2.2	5.6	16.8	13.7	9	3.7	10.2	7.1	5.9	100

Appendix 2: Digital technology adoption by UK business sectors

		ABDE	C	F	G	H	I	J	KL	M	N	P	Q	R	S	
Artificial Intelligence, Robotics or Automation	2018	6.3	19	2.4	10.3	1.6	2.4	19.8	3.2	20.6	6.3	0.8	3.2	1.6	2.4	100
	2019	0.8	20.6	4.6	10.7	1.5	6.9	20.6	4.6	15.3	6.9	1.5	2.3	3.1	0.8	100
	2020	5.1	19.2	1.3	7.7	2.6	1.3	15.4	6.4	25.6	10.3	2.6	0	2.6	0	100
	2021	4.8	22.6	0.8	11.3	1.6	2.4	16.9	2.4	20.2	7.3	1.6	3.2	2.4	2.4	100
	2022	4.2	22.2	3.9	10.5	3.4	2.6	14.3	3.5	19.9	7.1	1.2	2.9	2.3	2	100
Accountancy software	2018	4.2	11.6	8.2	17.1	3.7	7.9	6.3	4.1	15.5	7.9	1.8	6.5	2.5	2.7	100
	2019	2.7	11	7.1	17.8	3.2	7.3	8.6	4.3	14.8	8.3	2.7	6	2.5	3.7	100
	2020	2.8	11.2	7.9	17.9	2.9	8.5	6.9	4.1	15.2	8.2	2.8	6	2.2	3.3	100
	2021	3.1	9.9	6.1	18.2	3	9.5	6.8	4.4	14.2	9	2.3	6.5	3.3	3.8	100
	2022	3.7	10	7.6	17.8	3.1	7.1	7.3	5.1	15.5	7.8	2	6.8	2.6	3.5	100
HR management software	2018	2.8	10.9	3	14.5	3.8	6.7	8.1	5.9	15.4	9.3	2.8	9.9	2.8	4	100
	2019	2.8	9.8	6.3	17.7	2.1	8.4	7	3.5	13	11.2	1.9	10.9	2.3	3.3	100
	2020	1	13.5	6.3	17.8	3.3	10.5	5.3	4.6	11.8	9.2	3.3	9.5	1.3	2.6	100
	2021	1.9	10.4	4.6	16.2	4.6	9.3	8.7	3.9	11.6	8.9	2.9	12	2.3	2.7	100
	2022	2.8	11.5	3.4	14.6	2.8	6.7	6.7	5.3	16.3	7.9	2.8	10.7	3.7	4.8	100
ERP software	2018	3.2	23.2	3.2	17.2	2.4	3.6	12	3.6	14	7.6	1.2	5.6	0	3.2	100
	2019	2	23.4	6	18.4	4.5	3.5	10	2	13.4	5.5	1.5	6	2	2	100
	2020	2.3	26	5.3	17.6	2.3	3.1	9.9	2.3	12.2	6.9	3.8	3.8	1.5	3.1	100
	2021	3.1	21.9	2.6	17.2	1.6	3.6	10.9	4.2	17.2	7.8	1	6.3	1.6	1	100
	2022	2.9	24.3	5.1	17.6	1.5	2.9	17.6	0.7	13.2	6.6	0	2.9	2.9	1.5	100
VR and AR technologies	2018	1.9	9.4	1.9	7.5	0	0	17	3.8	22.6	18.9	3.8	5.7	7.5	0	100
	2019	0	14.3	10.2	18.4	2	2	26.5	0	18.4	2	2	2	0	2	100
	2020	0	15.2	9.1	3	3	6.1	18.2	9.1	27.3	6.1	0	3	0	0	100
	2021	1.9	5.8	5.8	13.5	13.5	0	0	5.8	28.8	9.6	1.9	5.8	5.8	1.9	100
	2022	3.1	9.3	7.5	7.8	1.9	3.1	11.8	5	29.5	6.5	2.8	5.6	3.7	2.5	100

Note: ABDE - Primary; C – Manufacturing; F – Construction; G - Wholesale/ Retail; H - Transport/ Storage; I - Accommodation/ Food; J - Information/ Communication; KL - Financial/ Real Estate; M - Professional/ Scientific; N - Administrative/ Support; P - Education ; Q - Health/ Social Work; R - Arts/ Entertainment; S - Other service

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