

# Innovation through crises in the 2020s: survey evidence on digital, AI and net zero innovation in UK firms

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## Summary

- We report results from the third wave of the CEP-CBI survey on technology adoption. The survey covers 373 UK firms, focusing on the adoption of digital technologies (with a deep dive on artificial intelligence (AI)) and environmental sustainability actions in response to crises and change in the early 2020s.
- Covid-19, the energy and cost-of-living crises and Brexit negatively affected the majority of businesses in our sample: over 60% for Covid-19, the energy crisis and Brexit, and more so (over 70%) in the case of the cost-of-living crisis. Interestingly, over 20% of firms reported that the pandemic had a positive impact on business performance – a higher proportion than for other crises, which is consistent with our previous survey in 2021.
- Over 90% of firms reported investing in at least one digital technology since the pandemic. Looking at specific technologies, adoption was highest in videoconferencing tools, online sales and marketing, cloud computing and cyber security, where around 55-70% of firms reported having made investments.
- Around a quarter of firms in our sample stated that they have invested in AI technologies during the 2020s, and another 23% said that they have not yet invested, but plan to do so. So far, AI has been most likely to be applied to marketing and sales, and IT functions where nearly 30% of firms are using or trialling AI and 18% have plans to use it.
- When asked for the motivation for adopting AI, firms were more likely to cite creating new or improved processes, products or services (over 40%) versus replacing tasks previously carried out by people (20%). While the largest share of firms reported no impact across business performance measures (profits, resilience, turnover, workforce size and training) so far, more businesses reported positive impacts versus negative. Looking forwards, 40% of firms expect AI to

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improve turnover, profitability and business resilience in 5-10 years. More firms expect positive employment effects (22%) than negative (13%).

- As in our previous surveys, we found that adoption patterns are uneven. Firms that were already more digitised, and larger firms were more likely to adopt digital technologies in general. And these results hold for AI in particular. Older firms, and those in manufacturing were less likely to adopt AI.
- In general, financial, information and skills constraints are the key barriers to general digital and AI adoption, but patterns differ slightly for AI. Information gaps are the most significant constraint for AI adoption, and a lack of management skills also seems to be a particular issue for AI.
- Two-thirds of firms have, or are developing, an environmental strategy. The energy crisis has prompted or accelerated sustainability actions for 40% of firms, with key motivations being to improve resource efficiency and save costs, or meet customer expectations. There are differences across types of firms – in general smaller firms are less likely to have an environmental plan in place, and firms in manufacturing or with a more educated workforce more likely.
- Sustainability considerations influence decision-making in a range of areas, including in the adoption of digital technologies. In terms of impacts so far, most firms report no impact on turnover, profitability and workforce size – a smaller share of firms report either positive or negative impacts, but overall these balance each other out. Looking forwards, a higher share of businesses expects positive impacts across areas of business performance than negative.

## **Introduction**

The crises and changes of the early 2020s provided many challenges for UK firms, set against a background of stagnant productivity since the financial crisis. But disruptions can also lead to opportunities for performance-enhancing change in businesses (Valero and Van Reenen, 2021).

In this policy brief, we present new data from a survey of 373 UK firms conducted in May 2024 in partnership with the Confederation of British Industry (CBI). This is a follow-up to our two earlier surveys which revealed that firms adopted more new digital technologies in response to the Covid-19 pandemic (Riom and Valero, 2020 and Oliveira-Cunha et al, 2021). The surveys showed that such innovative activity had persisted, but that innovation patterns were uneven – with larger and more digitised businesses being more likely to adopt new technologies since the pandemic. Since then, UK businesses and consumers have faced significant challenges, including the cost-of-living and energy crises, while continuing to adapt to changes brought about by Brexit. This survey wave provides an updated view on business innovation through crises and change in the early 2020s.

As in our first surveys, our focus remains on process innovation: in particular, the adoption of digital technologies that are typically considered productivity-enhancing. In this wave, we focus on artificial intelligence (AI). Recent years have seen rapid advances in AI, with the proliferation of generative AI based on large language models such as ChatGPT (which launched in 2022). Micro evidence on the use of generative AI tools at work suggests that it can substantially increase productivity, but that effects vary across workers (Brynjolfsson et al, 2023). But there is still widespread debate on the likely macroeconomic effects of AI as it diffuses through the economy, and what this means for policy (see, for example, Aghion and Bunel, 2024; Acemoglu, 2024; and Baily et al, 2023). Some argue that it will unleash a transformative era of productivity growth, while others claim it will primarily displace workers and increase inequality. Still others are sceptical, arguing the overall productivity and labour market effects will be a longtime coming. A conclusion emerging in the literature suggests that AI has growth and employment potential but that this will depend on having the appropriate policies and institutions in place, in particular to “direct” AI use towards enhancing and complementing workers, rather than simply replacing them (see, for example, Acemoglu and Johnson, 2023).

To shed some light on this debate in a UK context, we ask a series of detailed questions on how and why AI is being used in UK businesses, as well as impacts on firms and workers. We examine the drivers and barriers to AI adoption, and consider how these may differ from digital technology adoption more broadly.

We build on our previous analysis on environmental sustainability action in firms. The ongoing climate crisis and the drive towards net-zero targets have prompted many firms to accelerate sustainability initiatives and embrace new technologies this decade (Oliveira-Cunha et al, 2021). Moreover, the intersection of digital technologies and environmental sustainability has become increasingly relevant in this context. Research by Kesidou and Ri (2021) shows that UK SMEs adopting advanced digital technologies, such as AI, in combination with net-zero practices, achieve synergistic effects. This survey explores how the energy crisis impacted on environmental sustainability action, the extent to which such action has interacted with innovation activity and other key areas of business strategy, as well as impacts and determinants.

This paper is structured as follows. Section 1 gives an overview of our survey and describes the sample. Section 2 sets out our results on digital technology adoption, with a focus on AI, the stated drivers of adoption and its perceived impacts in firms. It then summarises the determinants of technology adoption, as well as barriers. Section 3 describes our results on sustainability actions in firms, and whether there are any links between action on net zero and innovation more broadly. Section 4 concludes.

## 1. Our survey and sample

In May 2024, we conducted a third wave of our survey – designed and disseminated in collaboration with the Confederation of British Industry (CBI) – a leading business organisation in the UK, representing businesses across sectors and regions. Nearly all survey respondents were invited to participate through emails sent by the CBI to its survey panel, which includes both members and non-members. Additionally, the survey was distributed to firms on purchased sample lists, and our distribution efforts combined direct email invitations with social media promotion by both the CBI and the London School of Economics.

Building on previous waves, we explored the lasting impacts of digital adoption following Covid-19. But this wave also included many more detailed questions on how other major events and challenges from the early 2020s – such as Brexit, the cost-of-living crisis and the energy crisis following Russia’s invasion of Ukraine – have impacted firms and their innovation decisions. In this wave, we also asked detailed new questions on the use of AI and actions related to the net zero transition.

We achieved a sample of 373 firms spanning the size distribution, and many sectors and regions.<sup>2</sup> As in our previous waves, businesses in our sample tend to be well-established, with 86% of them over 10 years of age. The majority are small in size: 77% have fewer than 50 employees, and 79% are small in revenue terms (defined as having under £10mn of turnover a year). This size distribution is slightly more skewed towards small firms than in previous waves (52% and 44% for waves 1 and 2, respectively). 13% of firms are located in London, compared with 15% in wave 1 and 18% in wave 2. In the Appendix, we report how our sample compares to a representative sample of UK businesses for transparency on possible biases. Despite being relatively well-balanced, compared to the UK economy, our sample overrepresents manufacturing firms, firms outside of London, and larger firms.

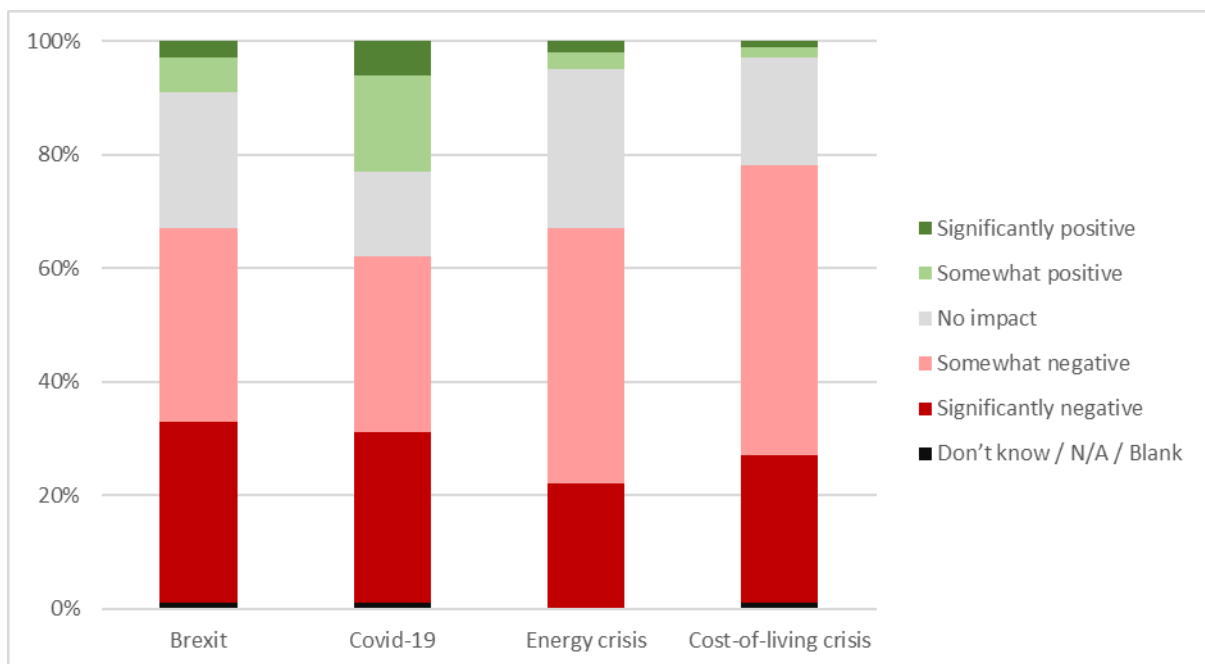
We collected additional information to understand innovation patterns. In terms of baseline technology adoption, 46% reported that digital technologies were already embedded in their business operation before the onset of the Covid-19 pandemic. 50% of businesses reported to serve customers overseas; 57% reported facing intense or very intensive competition; and 30% said that the majority of their employees have a university degree. These patterns were broadly similar to our previous waves.

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<sup>2</sup> Note that this is different from the sample reported in our blogs on [AI adoption](#) and [net zero action](#), where we analysed preliminary aggregated results based on the respondents to individual questions. Subsequent cleaning of the microdata slightly reduced the final sample such that it includes all respondents the completed the full survey.

We began our survey with some questions about the impacts of crises and change in the early 2020s on business performance. Unsurprisingly, we find that the Covid-19 pandemic, energy crisis, cost-of-living crisis and Brexit have negatively affected the majority of businesses in our sample (Figure 1): over 60% for Covid-19, the energy crisis and Brexit, and more so (over 70%) in the case of the cost-of-living crisis. Interestingly, over% of firms report a positive impact of pandemic on business performance. This is consistent with our previous survey in 2021 which showed a substantial share of firms reporting positive impacts on monthly turnover, workforce and productivity (Oliveira-Cunha et al, 2021). But, as the years since the pandemic have passed, there is likely to be an issue of selection bias towards surviving firms.

**Figure 1: Impacts of crises and change on business performance**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

Covid-19 stands out as a shock that has led to positive impacts for a relatively larger share of firms (perhaps this is related to the introduction of new products and services, and the adoption of new digital technologies, as documented in our previous surveys).

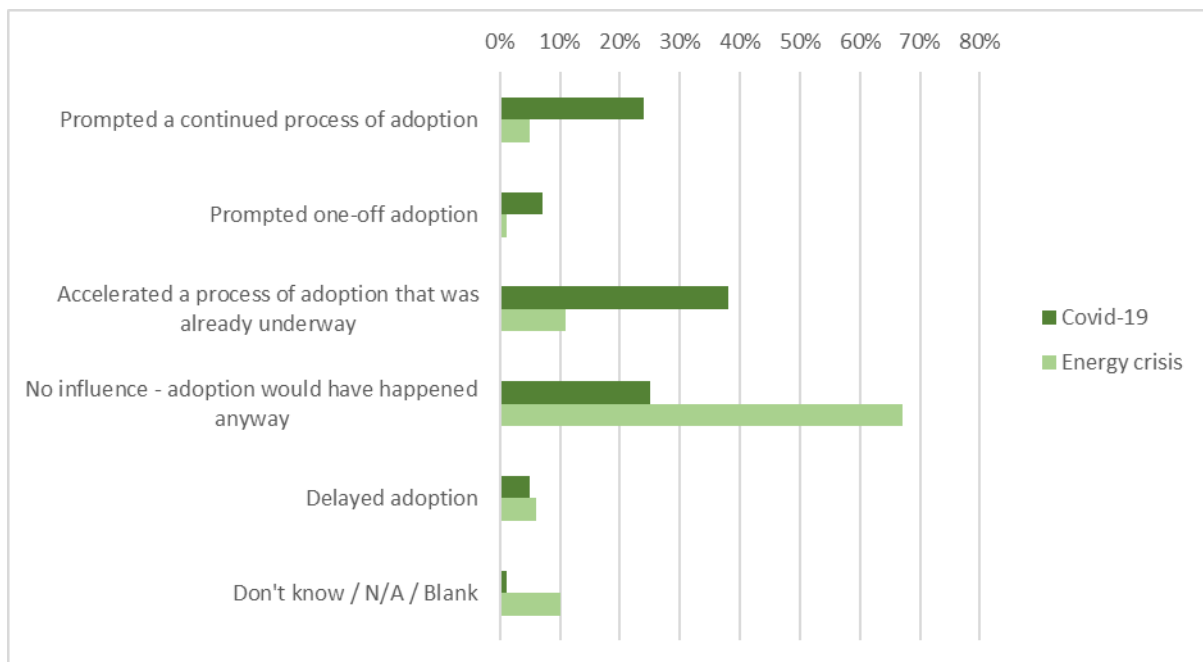
## 2. Technology adoption

### 2.1. General digital adoption

We began our survey with the same basic technology adoption question that we used in previous waves – which required a simple “yes-no” answer.<sup>3</sup> As before, we found that around two-thirds of firms had adopted new digital technologies since the pandemic.

In terms of reasons for adoption, 70% of these adopters said that this was prompted or accelerated by the pandemic. In fact, nearly a quarter of adopters considered that the pandemic had prompted a continued process of adoption – much higher than the share that considered this to be a one-off change (see Figure 2). In contrast, and as expected, given the different nature of the shock, the energy crisis in general had no influence on digital adoption. But it is interesting that a larger share of firms said that this crisis prompted or accelerated digital adoption (17%) than the share that said it delayed adoption (6%).

**Figure 2: Impacts of crises on digital adoption**



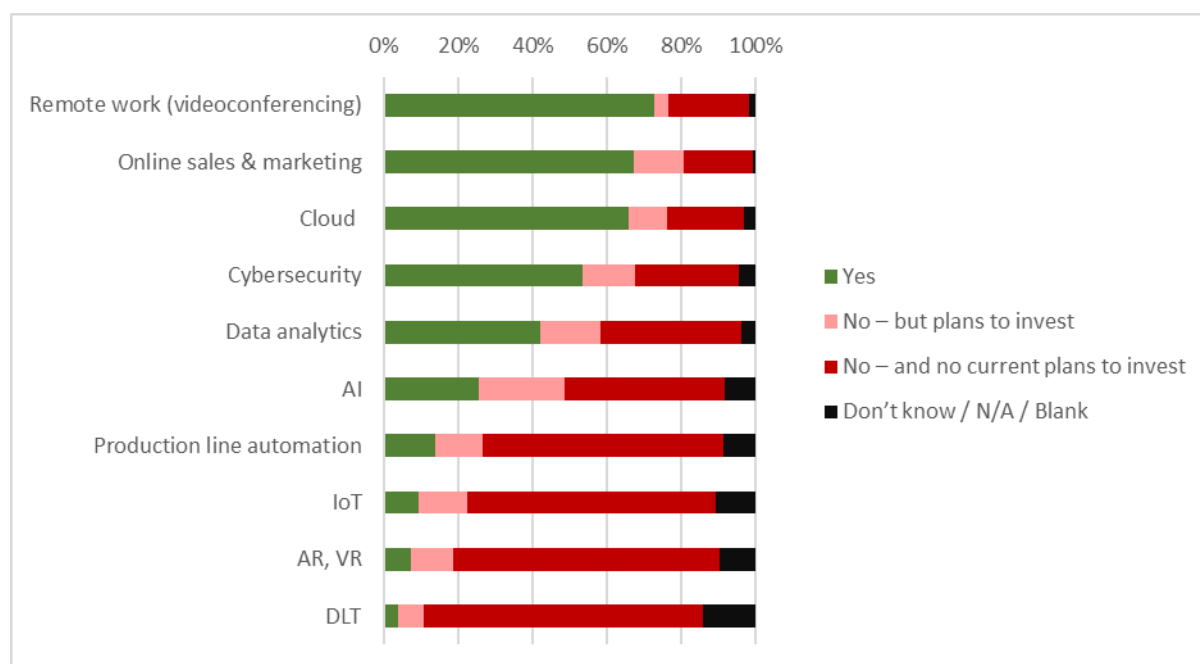
Notes: Unweighted aggregates, based on sample of 253 adopters that were presented with this question.

We asked more detailed questions about the types of technology adopted (or where there were plans for adoption), with a list of categories developed with the CBI and

<sup>3</sup> This question was as follows: “Since the Covid-19 pandemic (March 2020), has your business adopted any new digital technologies (examples include, but are not limited to: Enterprise Resource Planning, Customer Relationship Management systems, remote working technologies, cloud computing, mobile technology, automated machinery, AI applications, etc.)?”

broadly consistent with our previous survey in 2021. The most commonly adopted digital technologies relate to videoconferencing tools, online sales and marketing, cloud computing and cyber security, where around 55-70% of firms had made investments (see Figure 3). This pattern is consistent with the findings in our last survey. AI is less widespread, with only a quarter of firms in our sample stating that they have invested in AI technologies during the 2020s, and another 23% saying that they have not yet invested, but plan to do so.<sup>4</sup> These figures seem broadly consistent with other analyses on the UK, although since our survey was more up to date, AI adoption is unsurprisingly a little higher.<sup>5</sup>

**Figure 3: Investment in specific digital technologies**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question. “AR, VR” = Augmented and Virtual Reality; IoT = “Internet of Things”; and DLT = Distributed Ledger Technologies (including blockchain). Note that in the survey questions we set out a broad view of AI technologies, including chatbots, analysing documents using machine learning, and generative AI.

Based on the data presented in Figure 3, we developed our own, more expansive measure of general digital adoption, defined as respondents answering “Yes” to any of the listed technologies above. We believe this approach provides a more accurate

<sup>4</sup> Weighting the adoption rates for employment in our sample to get a measure of workers “exposed” to the different technologies generates higher adoption rates across technologies, apart from remote work and cloud computing which are similar with the basic unweighted adoption rates. The difference is particularly stark for AI. Heterogeneity in tech adoption across large and small firms and other characteristics is explored in Section 2.3.

<sup>5</sup> See, for example: AI activity in UK businesses: Executive Summary (January 2022), <https://www.gov.uk/government/publications/ai-activity-in-uk-businesses/ai-activity-in-uk-businesses-executive-summary>. This report finds that around 15 per cent of all businesses had adopted at least one AI technology, 2 per cent of businesses were piloting AI and 10 per cent planning to adopt at least one AI technology in the future.

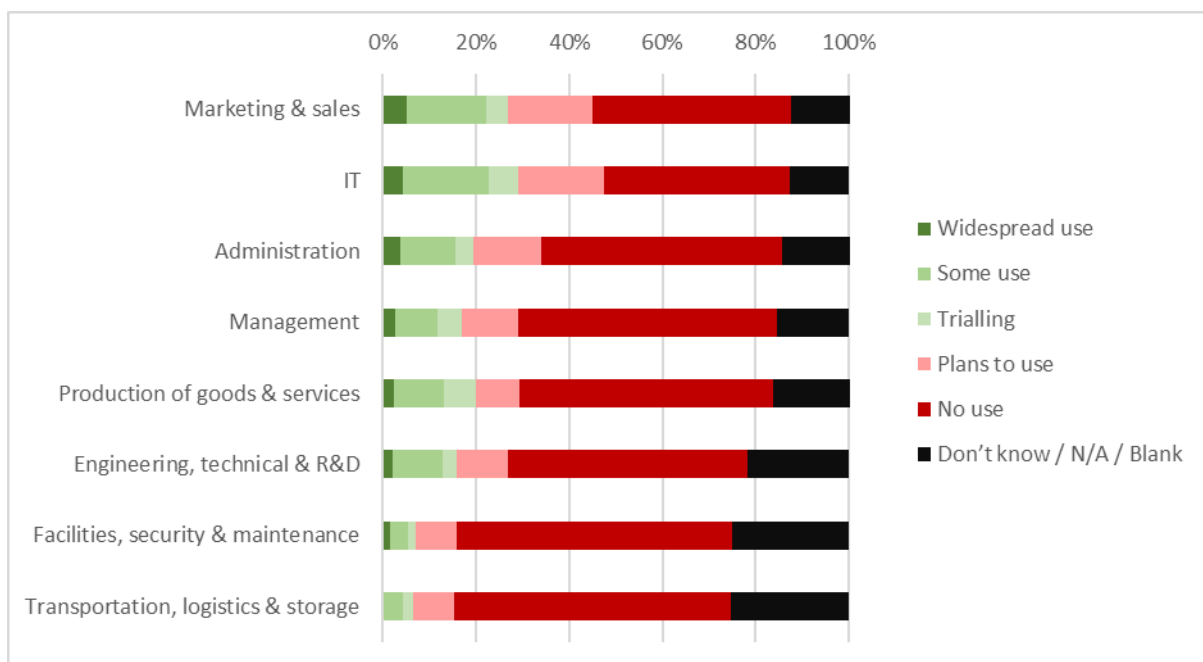


representation of adoption, as many firms that answered “No” to the high-level question on adoption still reported “Yes” for one or more specific technologies – perhaps because they were prompted to do so by these examples. Using this more expansive measure, we found that over 90% of firms reported having invested in digital technologies since the pandemic. We use this measure to explore how the determinants of general technology adoption compare to AI adoption in Table 1.

## 2.2. AI adoption

We sought to understand the extent to which AI use is embedded in different business functions, going beyond the “extensive margin” (that is, whether or not firms are using AI), which tends to be the focus in many standard business surveys. Figure 4 shows that AI penetration appears highest in marketing and sales, and IT functions, where over a quarter of businesses are using or trialling AI, and 18% have plans to use it. Around 20% of firms said they were using or trialling AI in core business functions such as administration and management, production and engineering activities. So far, AI appears less widespread in facilities maintenance, and transportation, logistics and storage.

**Figure 4: Adoption of AI by business function**



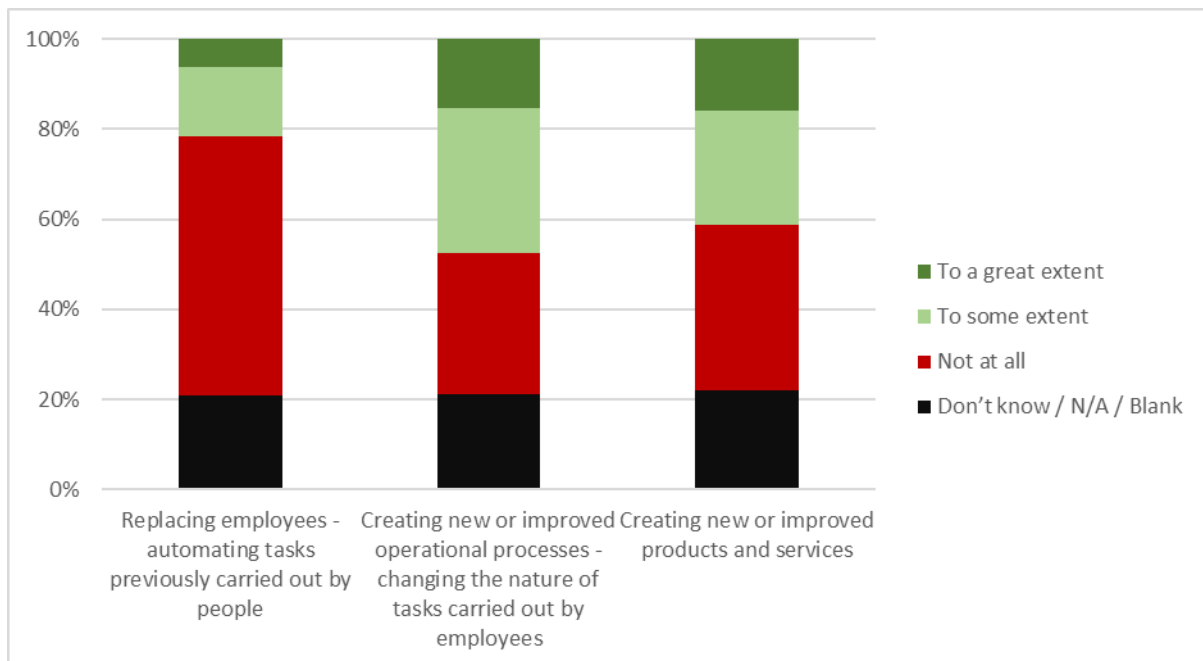
Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

A widespread concern in the debates about AI is that it will lead to largescale layoffs of staff as firms replace workers with cheaper AI tools. Others argue that AI will make workers more productive by reducing the amount of time spent on procedural

tasks, freeing them to focus on more conceptual tasks and therefore augmenting labour.

We asked our sample of firms about their reasons for adopting AI. Around 20% stated that replacing tasks previously carried out by people was a consideration (to “some” or to a “great” extent). But twice as many as this said that creating new or improved processes, or products and services were key considerations (Figure 5). This suggests that, for our sample of firms, we can take a more positive view of AI when it comes to workers.

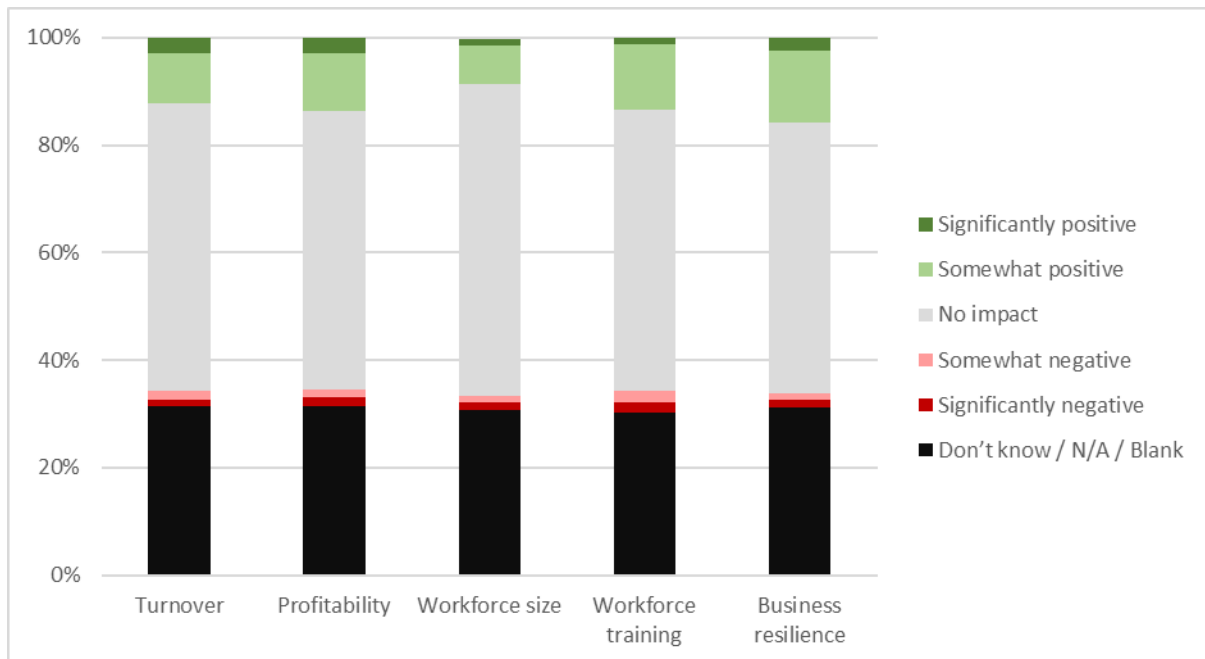
**Figure 5: Considerations affecting decisions to adopt AI**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

We asked businesses what they consider to be the impacts of AI so far on turnover, profitability, workforce size, training and overall business resilience. Across all of these areas, Figure 6 shows that the largest share of businesses say that there has been no impact yet. Interestingly, a higher share of firms reports positive impacts across these areas, including workforce size and training, compared to those reporting negative impacts on these outcomes.

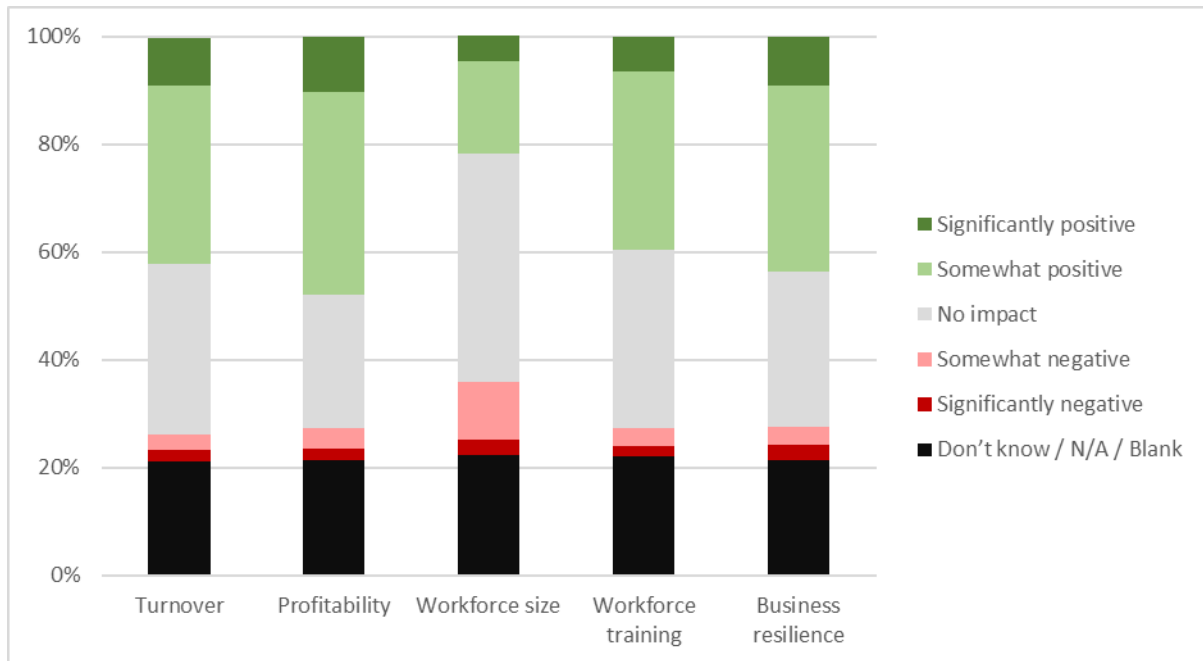
**Figure 6: Impacts of AI on business performance and workforce**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

Given that AI use is still at a relatively early stage across the economy, we also asked about expected impacts. A more positive impact across all areas seems to be anticipated over the coming years. Over 40% of firms expect a positive impact on turnover, profits, training and resilience (Figure 7). As discussed above, improved profitability could come at the expense of fewer workers. About 22% of all firms expected a positive impact on employment. Although this is lower than for profitability, turnover, resilience and training, there were still more firms expecting a positive jobs effect than a negative effect. “Jobs pessimists” made up 13% of firms, 9 percentage points fewer than the job optimists. Note that most firms were either unsure or expected zero impact of AI on jobs.

**Figure 7: Expected impacts of AI (next 5-10 years) on business performance and workforce**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

Overall, these results indicate that businesses expect the impacts of AI across all areas to be more positive in the future, and to apply to different areas of business performance. There will perhaps be some labour-replacing activity in some firms, but positive effects in others. Taking the results on profits, workforce size and training together, the overall picture seems consistent with a relatively high share of businesses expecting labour productivity to improve due to AI.

### 2.3. Determinants of technology adoption

We consider heterogeneity in adoption by different firm characteristics separately (in Appendix Table A2) and all together in a regression (Table 1), where column one has the adoption of at least one of the specific technologies as the dependent variable (“any digital”), and the second column is just AI. We include basic firm characteristics: firm age, an indicator for being in the manufacturing sector, or headquartered in London. We also include a set of firm characteristics which, based on the wider literature and our previous surveys, we would expect to influence technology adoption. These are: pre-Covid digitisation, firm size (dummy equal to one if less than 50 employees), the intensity of competition faced by the business, and a measure of human capital (dummy equal to one if the degree share is over 50%).<sup>6</sup>

<sup>6</sup> Results hold for non-linear estimation.

**Table 1: OLS regressions – Technology adoption and business characteristics**

	Adoption of	
	Any Digital	AI
Pre-covid digital technologies embedded	0.054* (0.029)	0.109** (0.046)
Firm > 10 years old	-0.037 (0.041)	-0.150** (0.073)
Manufacturing	0.052 (0.036)	-0.097** (0.047)
London HQ	0.017 (0.034)	0.157** (0.077)
Competition intense	0.017 (0.030)	0.005 (0.045)
Small (<50 employees)	-0.133*** (0.022)	-0.151*** (0.055)
Share degree >50%	0.126*** (0.029)	0.074 (0.052)
Observations	373	373
Adjusted R-squared	0.071	0.079

Notes: OLS regressions with robust standard errors in parentheses, \*\*\* denotes significance at the 1% level, \*\* 5% level and \* 10% level.

This analysis shows that, all else equal, firms that were more digitised pre-Covid are significantly more likely to have adopted any digital technologies since, and this is particularly the case for AI. Smaller firms are less likely to have adopted across the board. Older firms, and those in manufacturing are less likely to have adopted AI.

Interestingly, human capital seems to matter more for digital technologies in general, rather than AI in particular in these regressions. This is likely due to the inclusion of the London dummy – which is positive and significant in the AI regression, and also correlated with a higher degree share.<sup>7</sup> Appendix Table A2 shows the simple correlations which reveal that firms with higher human capital are significantly more likely to have adopted AI. These results on AI are broadly consistent with other recent work that analyses the relationship between regional human capital and AI adoption in firms (as proxied by mention in job advertisements), which also showed that London firms have been more likely to adopt AI (Draca et al, 2024).

In Appendix Table A3, we set out the equivalent regressions for the other digital technologies from Figure 3. Smaller firms are less likely to adopt new technologies across the board. Other significant relationships are intuitive. Firms are more likely to

<sup>7</sup> Of the firms with an HQ in London 61 per cent report having a degree share over 50 per cent. The equivalent number for non-London HQ firms is 28 per cent.

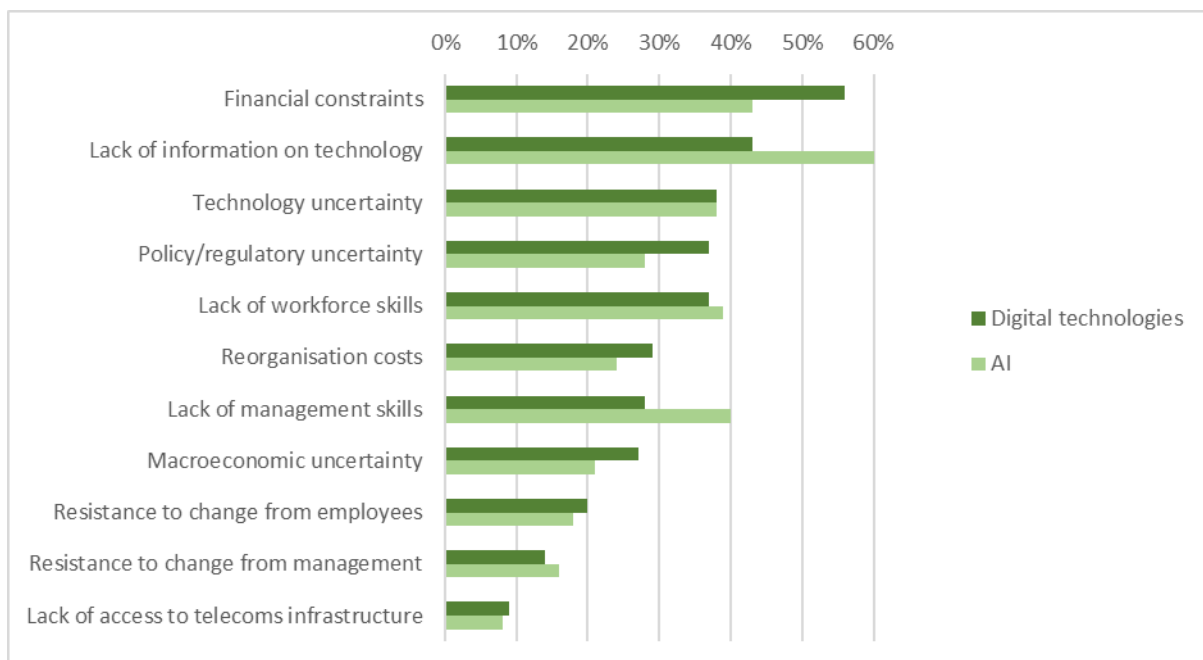
adopt online sales and marketing tools when they face more intense competition. Manufacturing firms are more likely to have adopted production line automation and internet of things. The human capital variable is significantly associated with videoconferencing/collaboration technologies (which tend to apply more to “white collar” jobs), data analytics and cyber security, and pre-Covid digitisation is significantly associated with cloud and cyber.

## 2.4. Barriers to technology adoption

A key question for researchers and policymakers is why firms do not adopt technologies and practices that are expected to improve productivity. As in our previous surveys, we asked firms what they consider to be barriers to adoption, both for digital technologies in general, and AI technologies in particular. The results are in Figure 8.

For digital technologies, financing constraints come out top, with 56% of firms citing this as a barrier. Next comes a lack of information, technological/policy uncertainty, and skills constraints. These constraints seem to matter for AI too, but for AI a lack of information seems to be a bigger issue, and financing constraints much less so, perhaps reflecting the launch of easily accessed AI-enabled applications in recent years.

**Figure 8: Barriers to adoption – Digital versus AI technologies**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

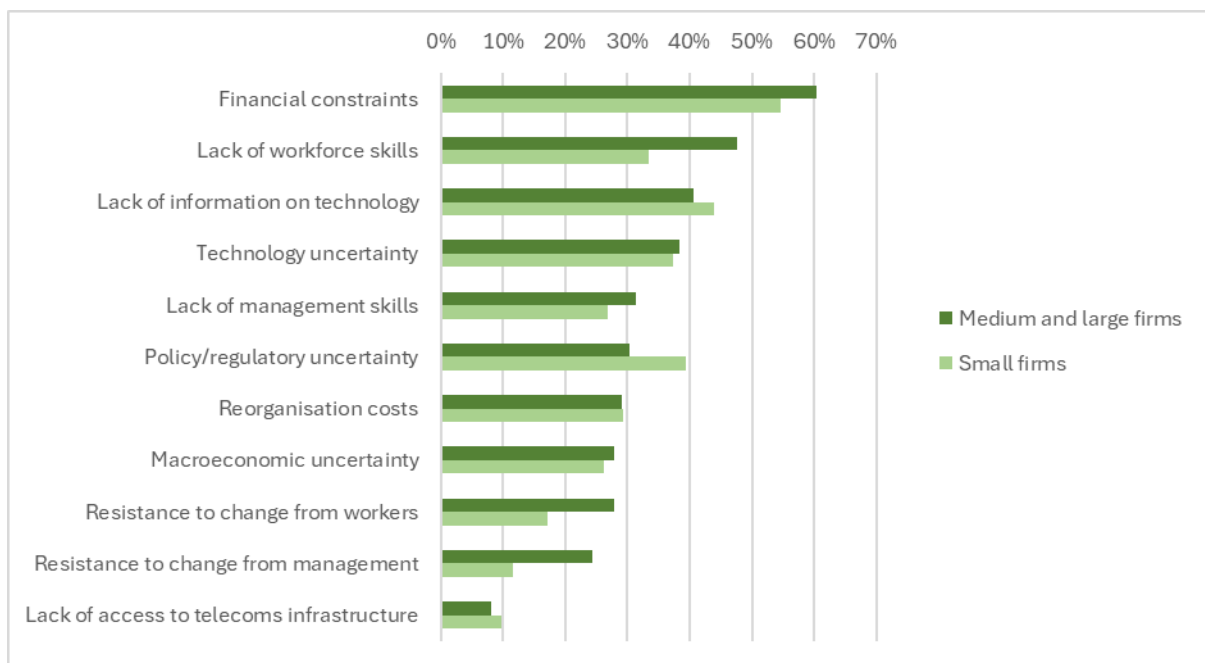
There are, however, differences across firm size (see Figure 9). For digital technologies (Panel A), financial constraints are the most cited barrier for both larger

and smaller firms, and larger firms are more likely to highlight skills constraints. While less important overall, larger firms are more likely to cite resistance to change among employees and managers, presumably due to the fact that it is harder to reorganise larger, more complex organisations.

On AI in particular (Panel B), both larger and smaller firms most frequently cited information constraints, and there was little difference in the shares highlighting financial constraints (though this was lower than for digital technologies in general as shown in Figure 8). Again, larger firms were more likely to cite employee skills, and this time also manager skills as being barriers to adopting AI.

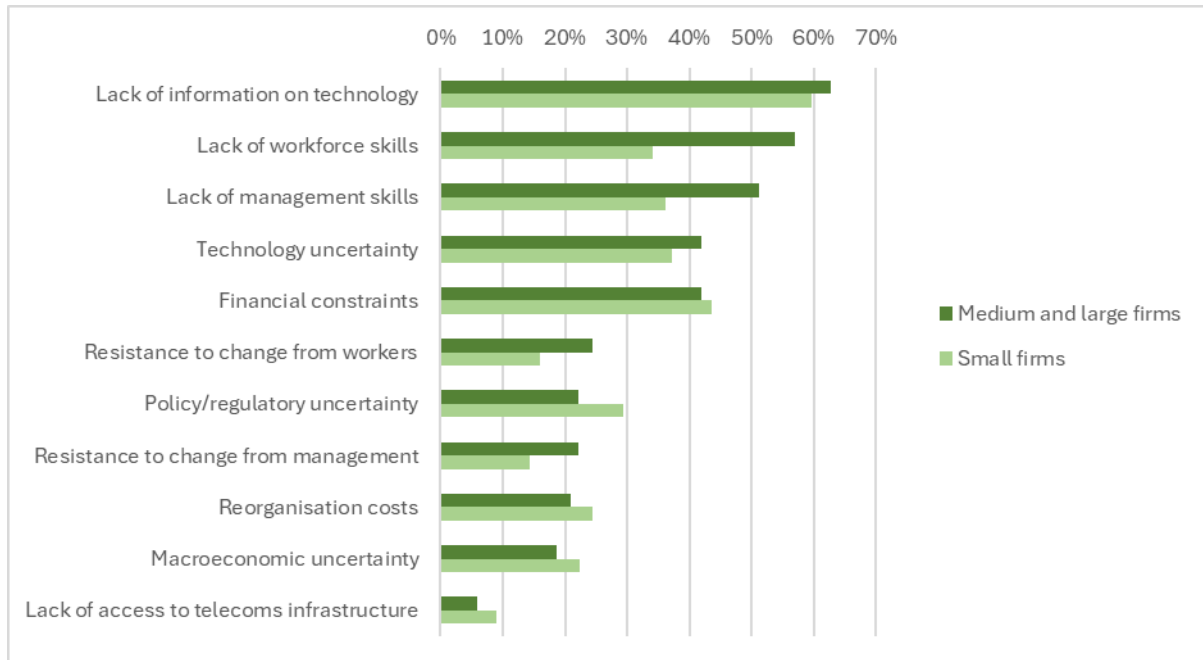
**Figure 9: Barriers to adoption across larger and smaller firms**

**Panel A: Digital technologies**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

## Panel B: AI

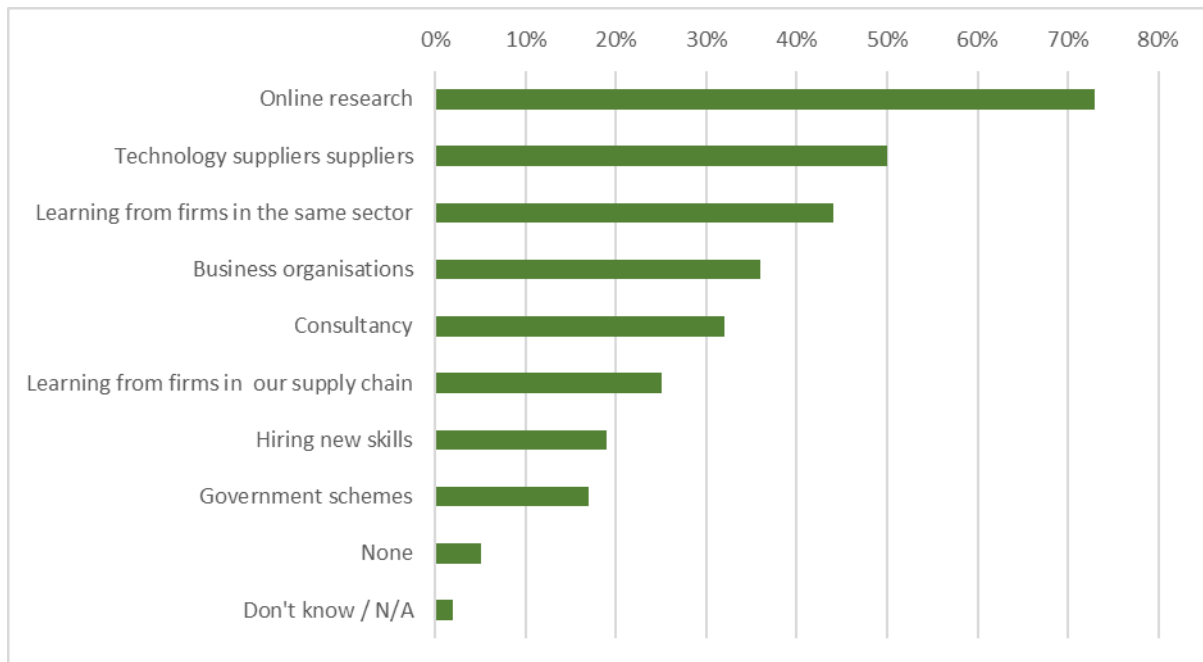


Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

Given the prevalence of information barriers, we asked firms where they tend to get information or guidance on technology related issues. Figure 10 shows that businesses seem to primarily learn about technology adoption online (over 70%), or from other firms (technology suppliers or competitors, both over 40%). Government schemes are the least cited source of information, with only 17% of firms accessing these.



**Figure 10: Sources of information and guidance on digital technology related issues**

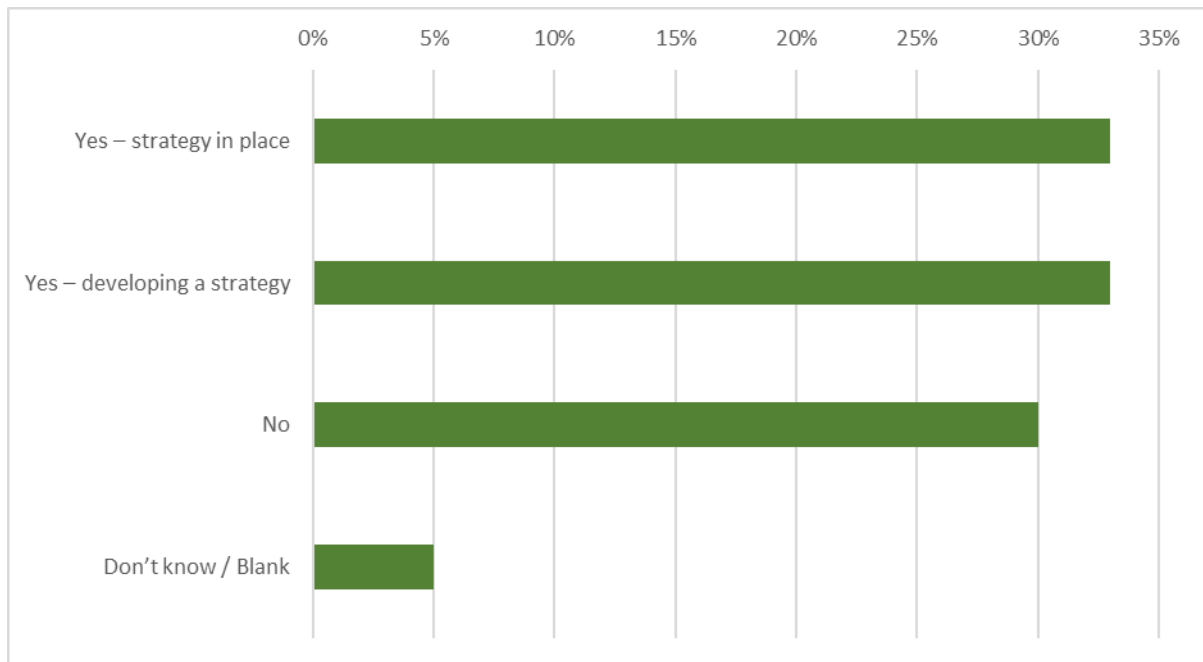


Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

### **3. Action on environmental sustainability**

In 2019, the UK became the first advanced economy to make the legal commitment to reduce greenhouse gas emissions to net zero by 2050. Delivering this requires change across sectors. Such change is reflected in our survey, with a third of our sample reporting that they have an environmental sustainability or decarbonisation strategy in place, and another third currently developing such a strategy (Figure 11).

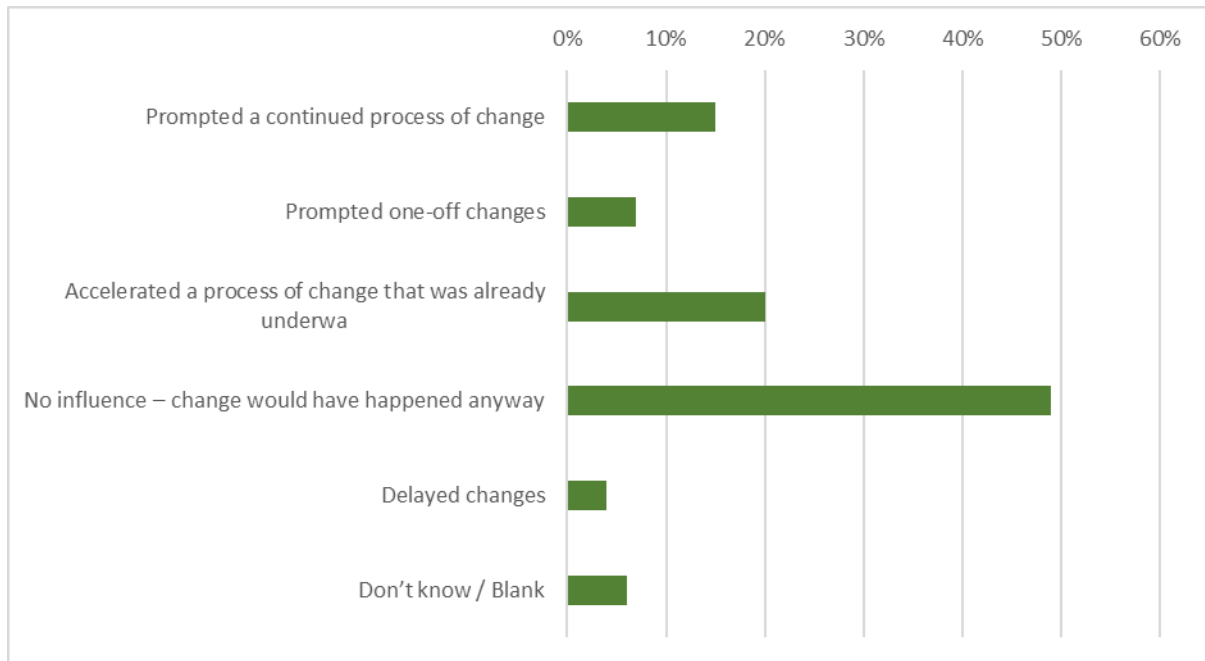
**Figure 11: Adoption of environmental plan**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

In our 2021 survey, we found that nearly half of firms reported being more likely to act on net zero since the onset of Covid-19 (and a further 50% reported no change). In this wave, we were particularly interested in the impact of the energy crisis. One might expect that high energy costs could have induced more firms to invest in energy efficiency, for example. But it might have also diverted managerial time and resource from making investments in longer-term resilience. Figure 12 suggests that the former applies: for a substantial share of firms (around 40%), the energy crisis has either accelerated a process of change that was already underway or prompted either a one-off or continued process of change. The majority of firms report that it had no influence, and a small minority (4%) consider that it delayed sustainability actions.

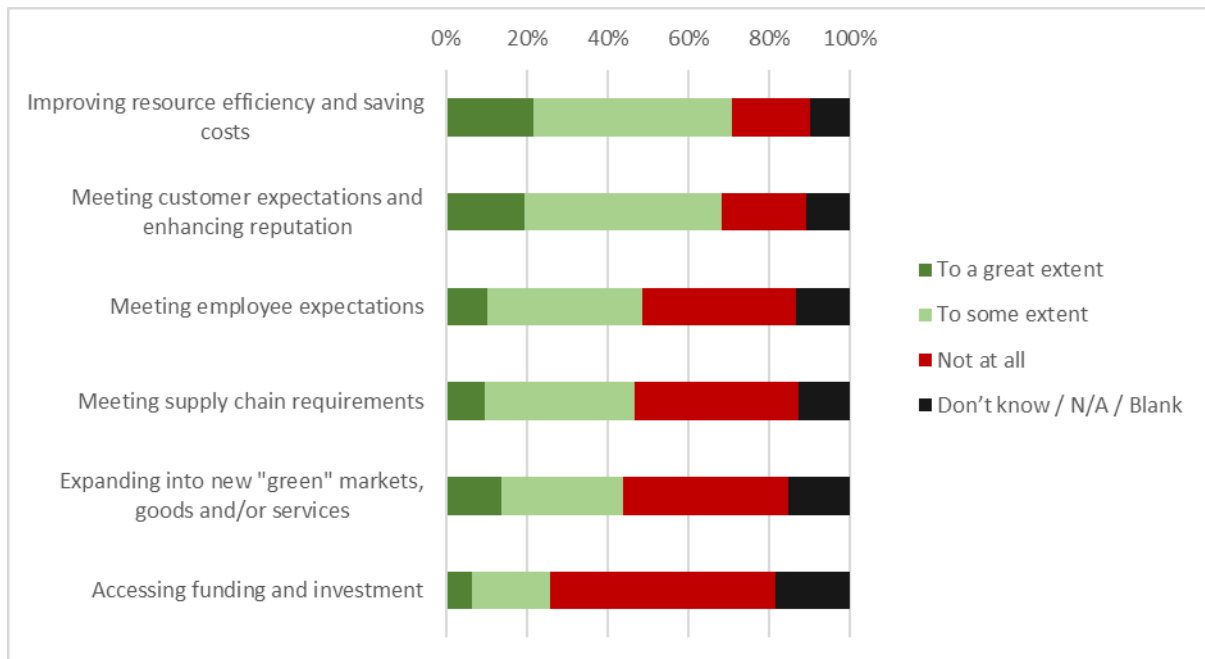
**Figure 12: Impact of the energy crisis on actions and changes to improve environmental sustainability**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

Consistent with the impacts of the energy crisis on sustainability actions we have documented, a key motivation for making net-zero changes was improving resource efficiency and saving costs. This consideration was chosen by over 70% of our sample as affecting decisions to improve sustainability to some extent or a great extent (Figure 13). Meeting customer expectations also appeared to be particularly important, as well as a range of other considerations which featured prominently.

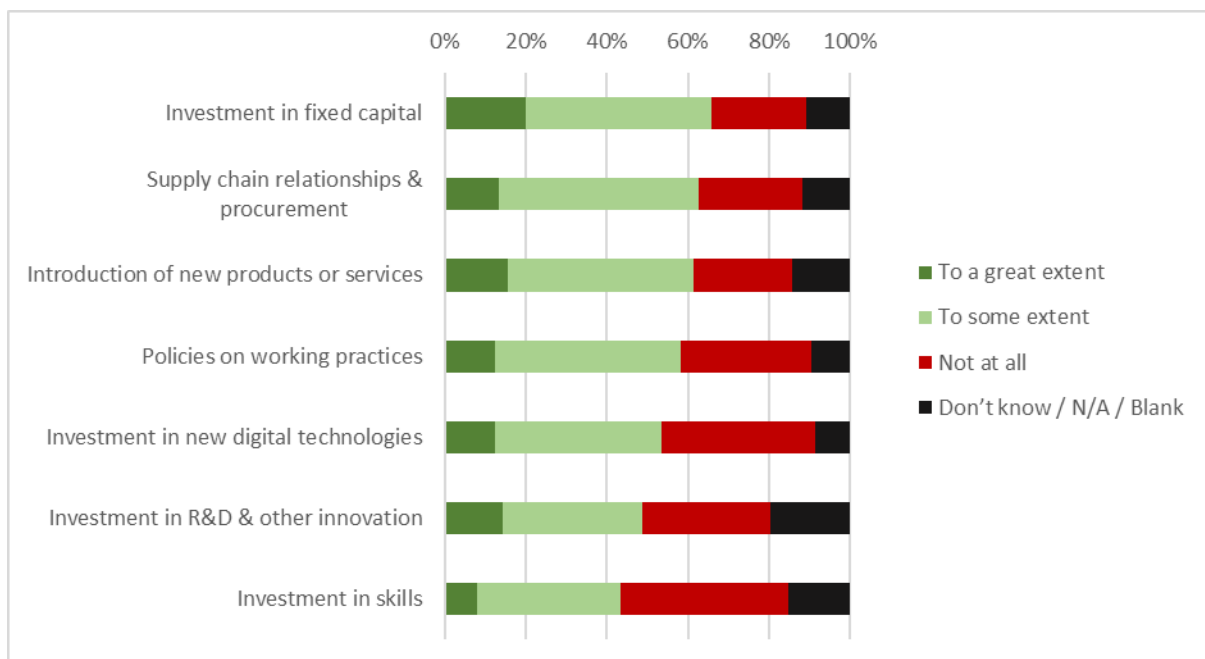
**Figure 13: Considerations affecting decisions to make net-zero changes**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

We also found that sustainability considerations feature across different areas of business decision-making (Figure 14), in particular decisions on capital investment, supply chain relationships, the introduction of new products and services, and working practices.

**Figure 14: Environmental sustainability considerations in business decision-making**



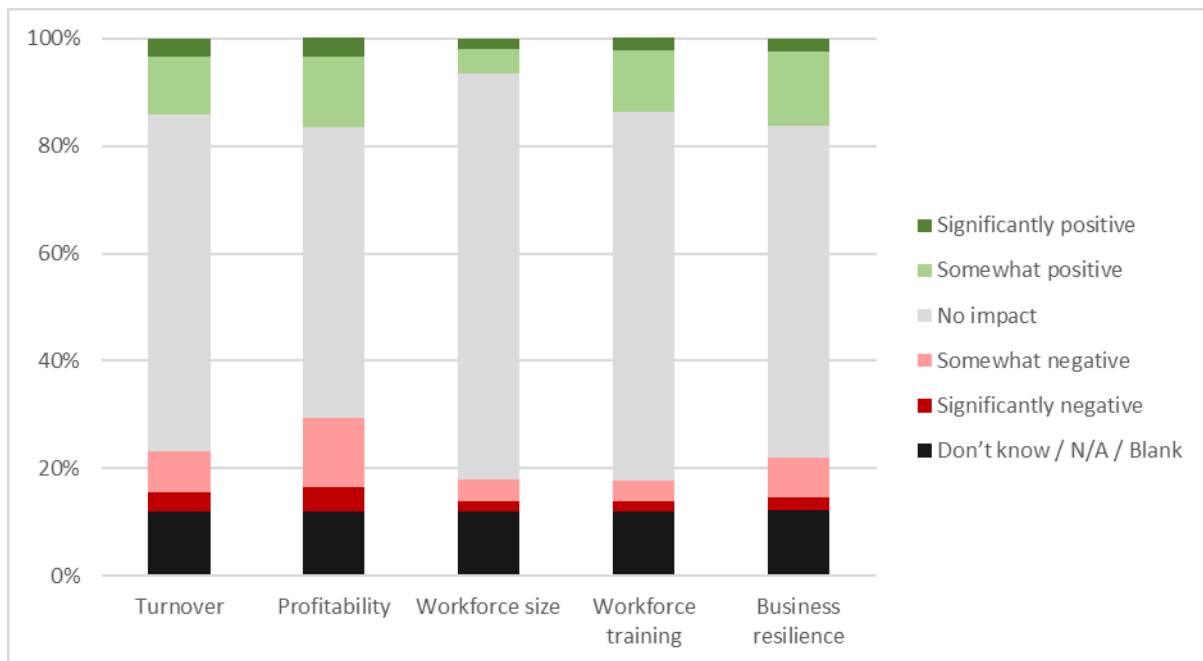
Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

Sustainability also features in decisions to invest in new digital technologies – where 54% of respondents considered that such considerations feature in decision making to a some or a to a great extent. We explore more directly whether there is evidence of a complementarity between digital adoption and net zero action – finding a positive and significant relationship between our digital adoption variable and firms having an environmental sustainability strategy in place, even after controlling for key firm characteristics.

There are many debates about the impacts of net zero on firms. Our work has provided evidence of likely benefits for firms able to develop clean products and services to serve growing domestic and global demand, as well as opportunities to improve resource efficiency, and offer good quality, skilled jobs. But it is also clear that the transition requires investment and change, which implies costs that need to be met in the short run.

When asked about the overall impact of net-zero-related changes on different aspects of business performance, the majority of our sample stated that there has been no impact (Figure 15). While a minority of firms report positive or negative impacts, these are balanced in the case of turnover, profits and size of the workforce. A higher share of firms reports positive impacts on training and resilience compared to negative impacts.

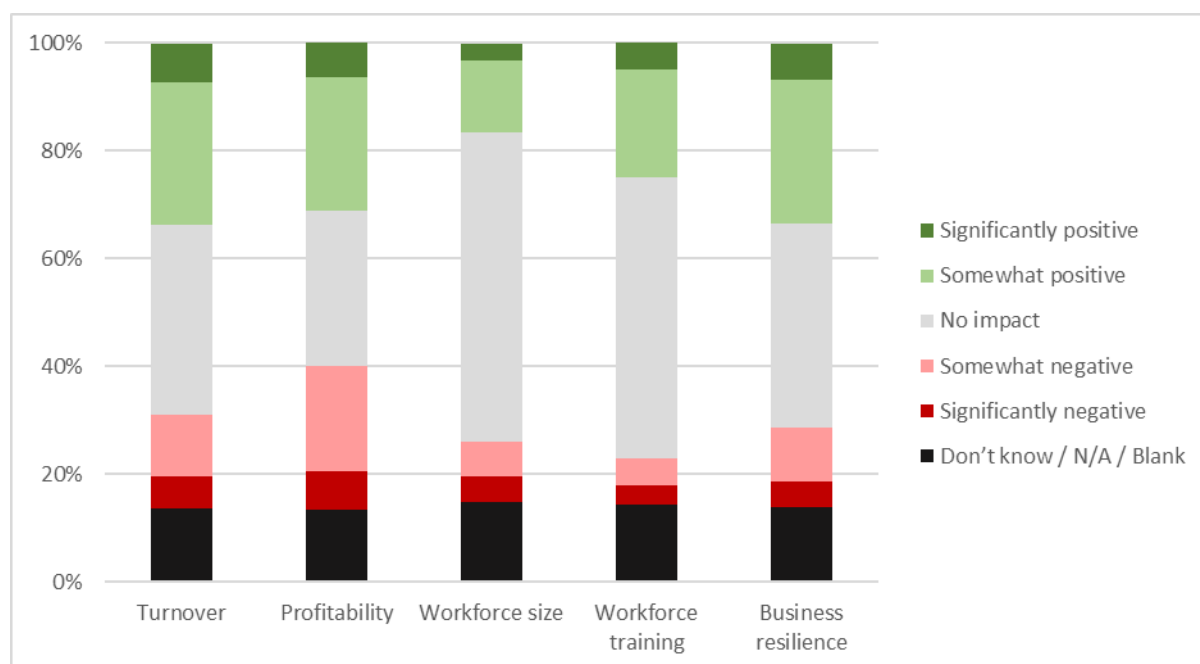
**Figure 15: Impacts of net-zero changes on business performance and workforce**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question.

For many firms, the transition to more sustainable operations is in early days, so it is interesting to ask about expected impacts too. A clear pattern emerges with fewer firms anticipating there to be no impact, and across areas of business performance, larger shares expecting positive rather than negative impacts (see Figure 16).

**Figure 16: Expected impacts of net-zero changes (next 5-10 years) on business performance and workforce**



Notes: Unweighted aggregates. Based on sample of 373 firms that were presented with this question

Overall, our results suggest that crises in the 2020s have not led firms to waver when it comes to sustainability actions, and that the energy crisis in particular has prompted or accelerated actions in a large share of firms. The opportunity to improve resource efficiency and save costs is an important driver of change and so are demand-side factors. We find evidence that environmental sustainability features across key areas of business decision-making, including to some extent in digital and skills investments. But, as of now, the impacts have not yet been felt by most businesses. Businesses generally paint a positive picture when asked about how they expect actions taken on environmental sustainability to impact different aspects of performance in the next 5-10 years.

### 3.1. Determinants of action on environmental sustainability

Table 2 replicates our previous technology adoption regressions, but this time the dependent variable is whether or not a firm has an environmental plan in place. We find that this is significantly more likely in manufacturing firms, and those with a more educated workforce, controlling for other factors. Smaller firms (as with

technology adoption) are less likely to have an environmental plan, as well as those in London (perhaps reflecting broader sectoral factors not captured with our manufacturing dummy).

**Table 2: OLS regression – Adoption of environmental plan and business characteristics**

	Environmental plan
Pre-covid digital technologies embedded	0.049 (0.048)
Firm > 10 years old	0.102 (0.075)
Manufacturing	0.097* (0.052)
London HQ	-0.139* (0.074)
Competition intense	0.077 (0.049)
Small (<50 employees)	-0.280*** (0.044)
Share degree >50%	0.182*** (0.053)
Observations	356
Adjusted R-squared	0.102

Notes: OLS regressions with robust standard errors in parentheses, \*\*\* denotes significance at the 1% level, \*\* 5% level and \* 10% level.

#### 4. Conclusions

On technology adoption in general, our results confirm the findings in our previous surveys – the pandemic prompted or accelerated a process of digitisation, which has persisted. Also consistent with our previous work, and other studies, more digitised firms have been more likely to adopt digital, and AI in particular, while smaller firms have been less likely to adopt digital technologies across the board. When asked about reasons for adopting AI, some stated that replacing tasks previously carried out by people was a consideration (to “some” or to a “great” extent), but twice as many said that creating new or improved processes, or products and services were key considerations. Taking the results on profits, resilience, turnover, workforce size and training together, more businesses report positive impacts or expected impacts, than negative. The overall picture seems consistent with a relatively high share of businesses expecting labour productivity to improve due to AI.

The barriers to adoption of digital and AI are also consistent with previous surveys: financial, information and skills constraints. But it is also clear that information constraints are more of an issue of AI where technology is developing rapidly, and its applications area not yet fully understood. In terms of how they seek to overcome information constraints and seek guidance on technology adoption, businesses seem to primarily learn about technology adoption online, or from other firms – rather than via government support programmes.

On environmental sustainability, the energy crisis prompted or accelerated actions in a large share of firms, but smaller firms are less likely to have an environmental plan in place. The opportunity to improve resource efficiency and save costs is an important driver of change and so are demand-side factors. We find evidence that environmental sustainability features across key areas of business decision-making, including to some extent in digital and skills investments. Businesses generally paint a positive picture when asked about how they expect actions taken on environmental sustainability to impact different aspects of performance in the next 5-10 years. Overall, this analysis suggests that there is an opportunity for firms to develop strategies to maximise the positive impacts of ongoing digitisation and action on environmental sustainability on business performance and workforce.



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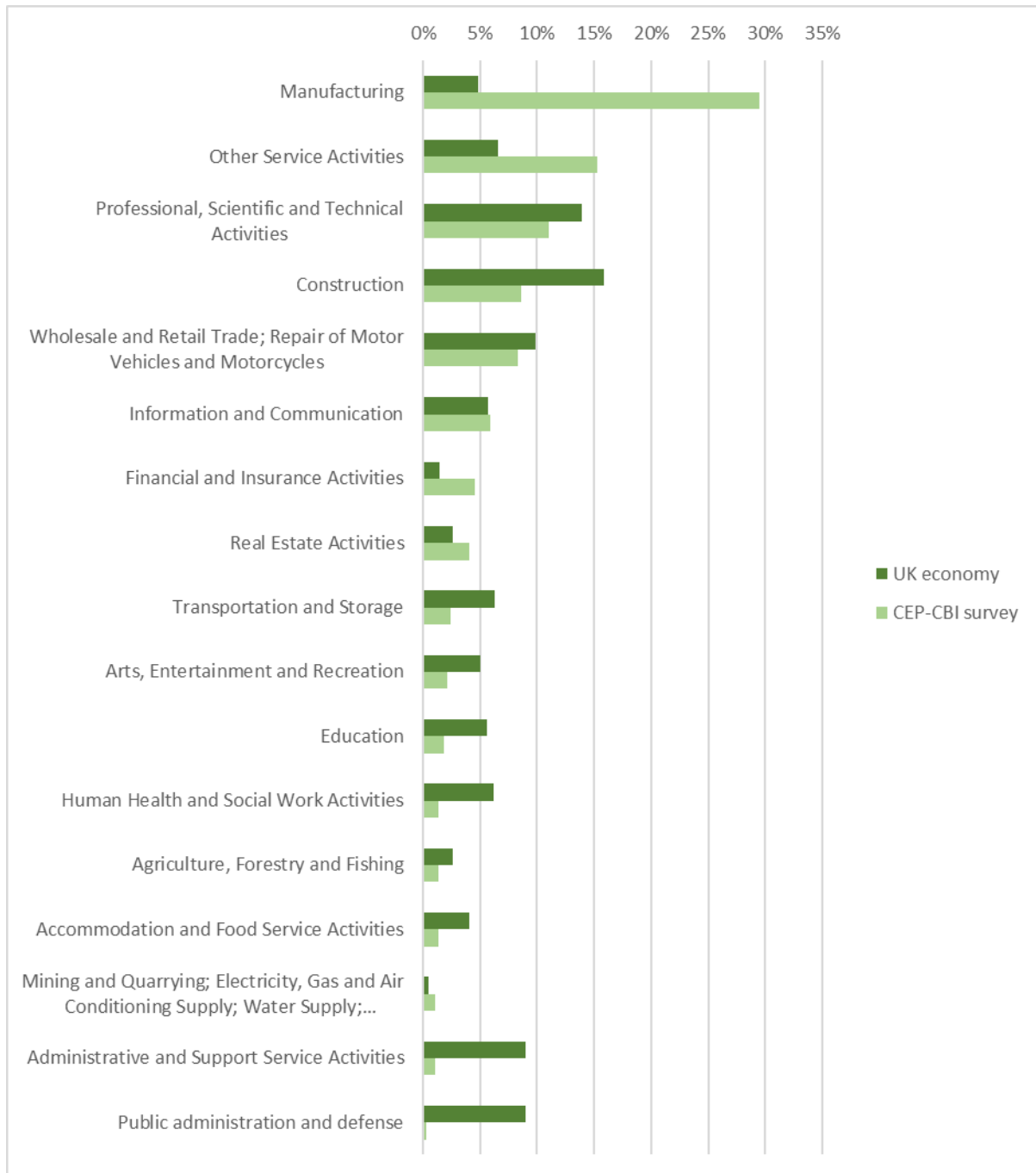
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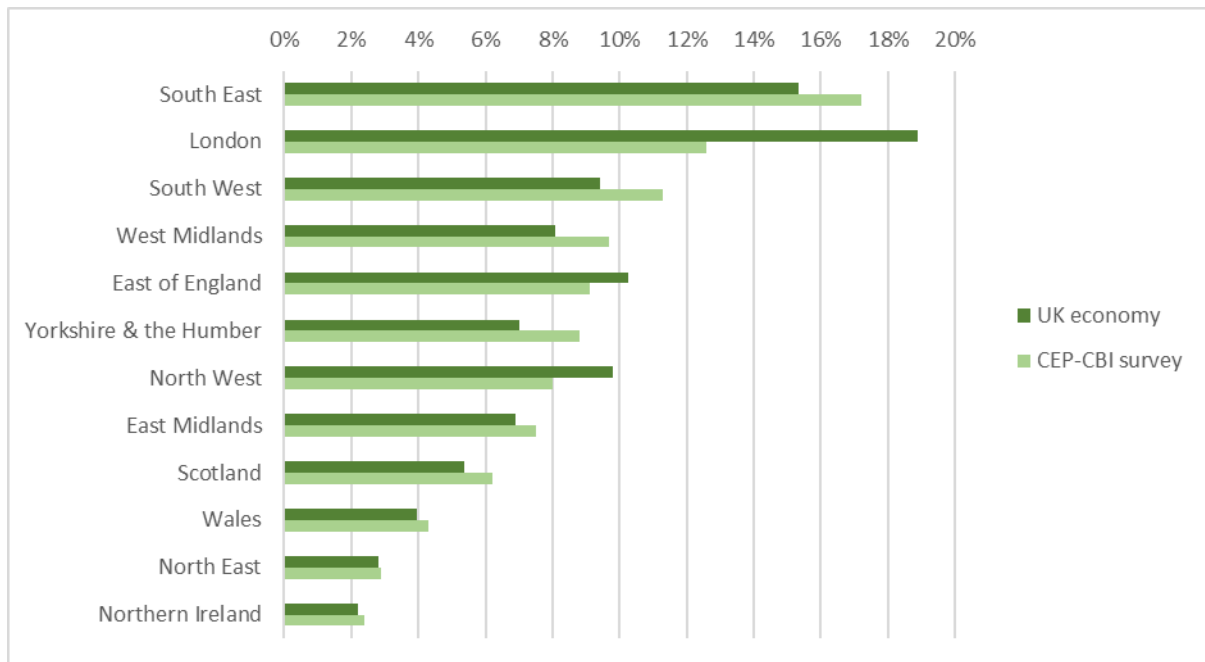
## Appendix figures

**Figure A1: Firms by sector – UK economy versus survey**



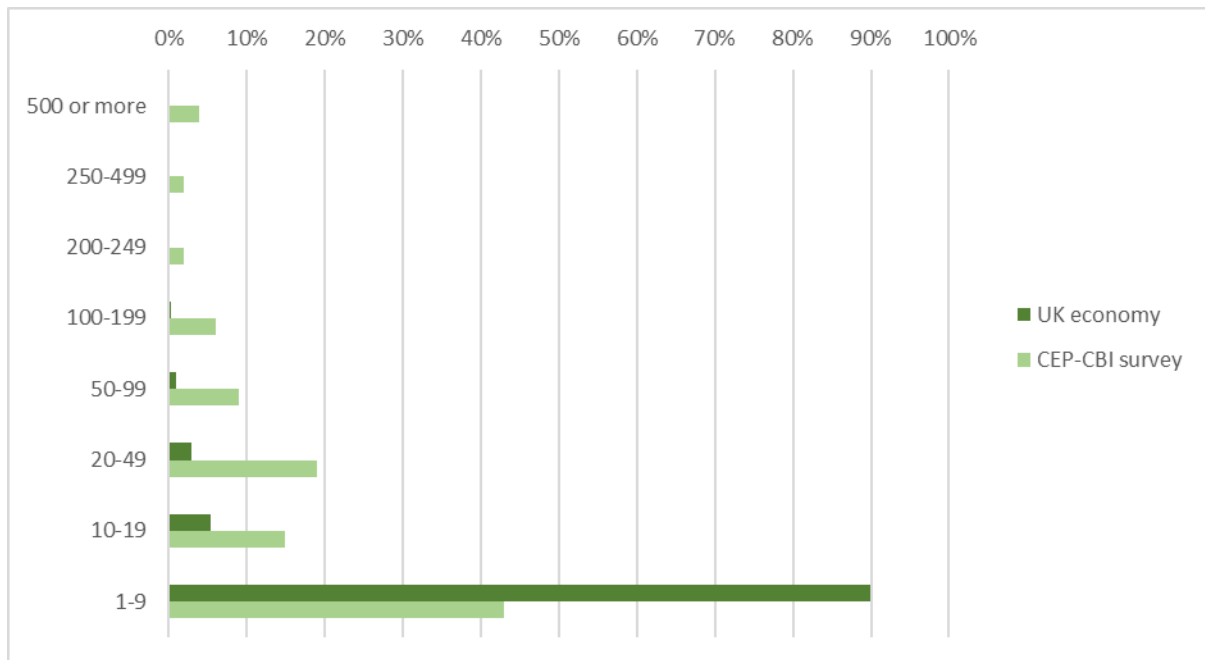
Notes: Data on the UK economy based on the Business Population Estimates for 2023.

**Figure A2: Firms by location – UK economy versus survey**



Notes: Data on the UK economy based on the Business Population Estimates for 2023.

**Figure A3: Firms by size – UK economy versus survey**



Notes: Data on the UK economy based on the Business Population Estimates for 2023.

## Appendix tables

**Table A1: Basic descriptives of sample (N=373)**

Registered address is London	0.13
Manufacturing	0.3
Small (<50 employees)	0.77
Small (<10m turnover)	0.79
Firm > 10 years old	0.86
Exporter (customers overseas)	0.5
Competition intense	0.57
Share degree >50%	0.32
Pre covid digital technologies embedded	0.46

**Table A2: Correlations – Technology adoption and business characteristics**

	Adoption of	
	Any Digital	AI
Pre-covid digital technologies embedded	0.071** (0.030)	0.132*** (0.045)
Firm > 10 years old	-0.021 (0.041)	-0.137* (0.072)
Manufacturing	0.021 (0.032)	-0.142*** (0.045)
London HQ	0.062* (0.034)	0.220*** (0.076)
Competition intense	0.017 (0.031)	0.008 (0.046)
Small (<50 employees)	-0.125*** (0.020)	-0.122** (0.057)
Share degree >50%	0.118*** (0.025)	0.149*** (0.051)
Observations	373	373

Notes: Each cell represents a separate regression of the innovation outcome named in the column on the variable named in the row. OLS regressions with robust standard errors in parentheses. \*\*\* denotes significance at the 1% level, \*\* 5% level and \* 10% level.

**Table A3: Regressions – Technology adoption and business characteristics, by detailed technology**

	Adoption of								
	Online sales and marketing tools	Videoconferencing /collaboration technology	Cloud technology	Data analytics	Cybersecurity technology	Production line automation	Augmented and Virtual Reality	Internet of Things	Distributed ledger technology
Pre-covid digital technologies embedded	0.063 (0.049)	0.018 (0.047)	0.100** (0.050)	0.025 (0.050)	0.175*** (0.051)	0.016 (0.036)	0.006 (0.026)	0.041 (0.031)	0.032 (0.021)
Firm > 10 years old	-0.114* (0.069)	0.063 (0.070)	0.056 (0.075)	-0.044 (0.075)	-0.022 (0.075)	-0.038 (0.047)	-0.094* (0.051)	0.015 (0.033)	-0.031 (0.037)
Manufacturing	0.065 (0.053)	0.089 (0.055)	0.007 (0.057)	0.088 (0.058)	0.038 (0.057)	0.196*** (0.047)	-0.043* (0.026)	0.073* (0.038)	-0.019 (0.024)
London HQ	0.001 (0.074)	-0.004 (0.070)	0.087 (0.069)	0.158** (0.075)	0.053 (0.073)	-0.032 (0.046)	0.027 (0.050)	-0.027 (0.040)	0.016 (0.040)
Competition intense	0.111** (0.049)	-0.007 (0.047)	0.002 (0.050)	0.054 (0.050)	0.004 (0.051)	0.007 (0.035)	0.042* (0.023)	0.020 (0.028)	0.036* (0.020)
Small (<50 employees)	-0.233*** (0.049)	-0.127** (0.051)	-0.137** (0.055)	-0.314*** (0.059)	-0.308*** (0.056)	-0.177*** (0.050)	-0.179*** (0.044)	-0.200*** (0.048)	-0.026 (0.028)
Share degree >50%	0.051 (0.055)	0.181*** (0.054)	0.045 (0.055)	0.123** (0.056)	0.109** (0.055)	-0.058* (0.034)	0.054 (0.034)	-0.022 (0.028)	-0.010 (0.022)
Observations	373	373	373	373	373	373	373	373	373
Adjusted R-squared	0.054	0.034	0.020	0.091	0.097	0.127	0.100	0.100	0.005

Notes: OLS regressions with robust standard errors in parentheses, \*\*\* denotes significance at the 1% level, \*\* 5% level and \* 10% level.