Office for National Statistics

Article

Management practices and the adoption of technology and artificial intelligence in UK firms: 2023

Investigating how technology adoption and use of artificial intelligence by businesses vary with management practices using the latest data from the third wave of the Management and Expectations Survey. These are official statistics in development.

Contact:
Management and Expectations Survey team
mes@ons.gov.uk
+44 3000 682563

Release date:
24 March 2025

Next release:
To be announced

Table of contents

1 . Main points

- In 2023, artificial intelligence (AI) was adopted by 9% of firms while cloud-based computing systems and applications were adopted by 69% of firms in the UK.
- While 88% of firms in the top decile of management practice scores adopted at least one of AI, cloud-based computing systems and applications, robotics, specialised software or specialised equipment, only 51% of firms in the bottom decile did so.
- Large service sector firms were the most likely to adopt AI and large manufacturing firms were most likely to adopt robotics.
- The most common barriers to AI adoption reported by firms in 2023 were difficulty identifying activities or business use cases (39%), cost (21%) and level of AI expertise and skills (16%).
- Technology adopters were associated with 19% higher turnover per worker, after controlling for management practice scores and firm characteristics.
- Firms with higher management practice scores were more likely to follow through in adopting AI in 2024, given that they planned to adopt AI in 2023.

2 . The importance of technology and artificial intelligence adoption in UK firms

Understanding the adoption of technology and artificial intelligence (AI) in UK firms is crucial for understanding UK productivity and the increasing disparity in firm-level productivity, as noted in Office for National Statistics (ONS) research on business dynamism and productivity. One potential reason for this disparity is if the most productive firms are effectively using technology, but these advances are less likely to be adopted by less productive firms.

There is a keen interest in understanding the internal dynamics of firms, including the role of management practices as part of a firm's organisational capital – how they transform inputs into outputs and the strategies they use to enhance productivity. The marked disparity between the most and least productive firms underscores the need to understand the relationship between management practices and technology adoption.

This article investigates the ways in which technology adoption and AI vary with management practices in UK firms. Specifically, we address the following research questions:

1. How do management practices influence the adoption of technology and AI in UK firms?
2. What are the main factors driving AI adoption and the barriers faced by businesses?
3. What are the productivity outcomes and future plans for AI adoption in firms?

The ONS conducted the third wave of the Management and Expectations Survey (MES) between November 2023 and March 2024, sampling approximately 55,000 businesses. Inspired by the United States Management and Organisational Practices Survey (MOPS), the MES is one of the largest voluntary business surveys in the UK.

The MES evaluates business management practices by asking firms a series of structured questions on various management aspects, then assigning a score based on their responses. This survey introduced a new module on AI and Technology to explore the relationship between management practices, technology adoption and productivity. The module focuses on the adoption of AI, robotics, specialised equipment, specialised software, and cloud-based computing systems and applications. Advanced technology definitions that were provided in the survey questionnaire are in Section 11: Glossary.

3 . The adoption of technology and artificial intelligence

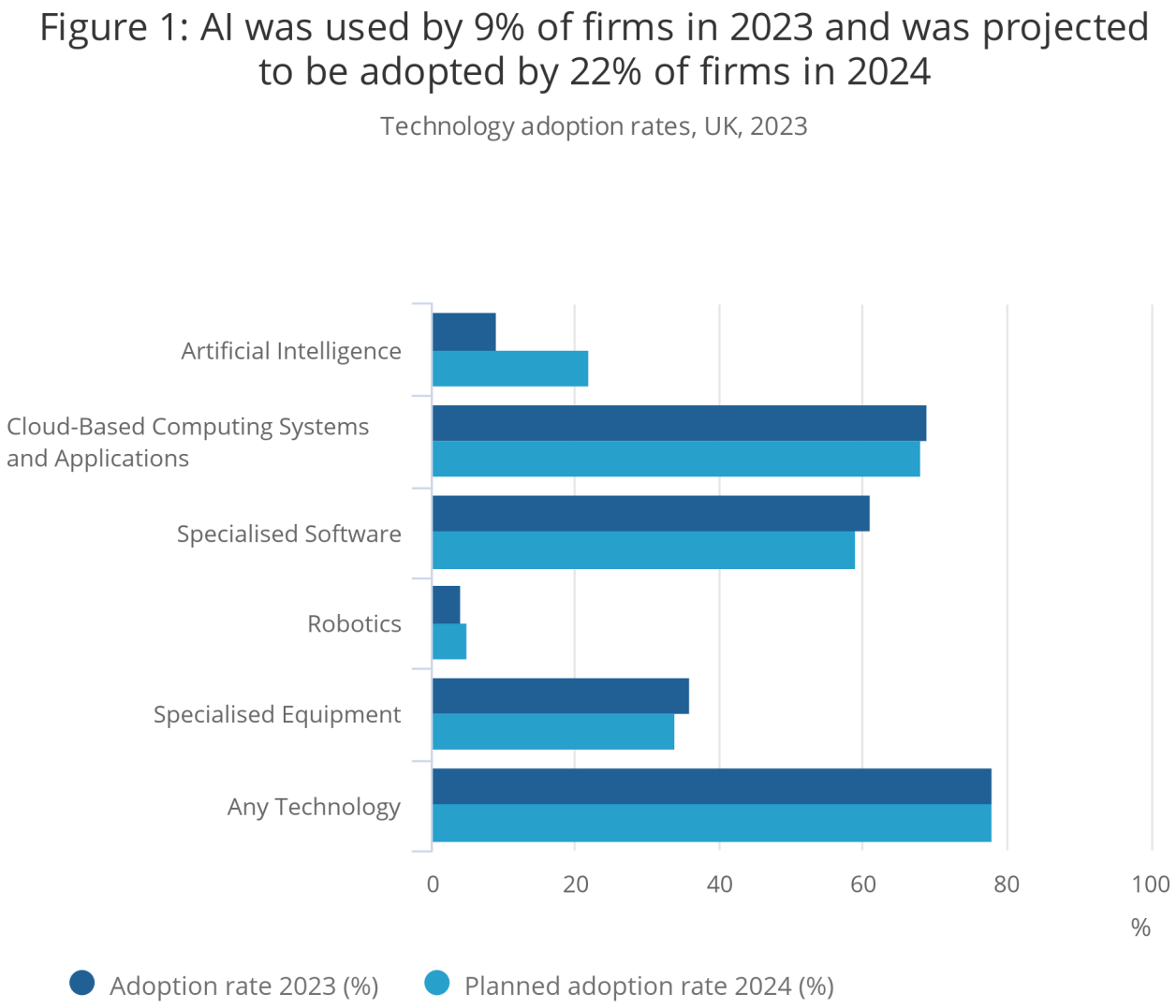
This section presents technology adopters as firms that use an advanced technology as part of their methods or processes, so excludes firms that have tested advanced technologies but are yet to implement them.

In 2023, the adoption rate was high for cloud-based computing systems and applications, and specialised software (at 69% and 61%, respectively), moderate for specialised equipment (36%) and low for artificial intelligence (AI) and robotics (at 9% and 4%, respectively) (Figure 1). These adoption rates increase for all technologies when looked at by the share of employment, especially robotics and AI, as larger firms are more likely to adopt them. Adoption rates by share of employment are included in Table 1 of the accompanying dataset.

Figure 1 also compares the adoption rate in 2023 and planned adoption rates for the year ahead in 2024. This shows that AI adoption was projected to have increased from 9% in 2023 to 22% in 2024. However, there was less of a projected increase in adoption for the other technologies. Section 5 of this article provides more analysis of the future plans for technology adoption.

Figure 1: AI was used by 9% of firms in 2023 and was projected to be adopted by 22% of firms in 2024

Technology adoption rates, UK, 2023



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.

Conditional adoption rates

Table 1 shows the proportion of firms adopting a technology Y conditional on having adopted technology X.

Table 1 provides some indication of how the adoption of different technologies complement each other, particularly the importance of cloud-based computing systems and applications. For instance, we find that 91% of the firms using AI also used cloud-based computing systems and applications, and 83% of the firms using AI also used specialised equipment. However, only 12% of firms that have adopted specialised software had used AI.

Table 1: Conditional adoption rates of advanced technologies
Percentage of firms adopting technology (column) conditional on having adopted technology (row), UK, 2023

	Share of firms using technology Y (column) conditional on using X (row)					
Technology	**Y = Artificial intelligence (AI)**	**Y = Cloud-based computing systems and applications**	**Y = Specialised software**	**Y = Robotics**	**Y = Specialised equipment**	**Only one technology**
X = Artificial intelligence (AI)	-	91	83	12	43	4
X = Cloud-based computing systems and applications	11	-	78	5	44	17
X = Specialised software	12	88	-	6	53	5
X = Robotics	25	87	86	-	78	2
X = Specialised equipment	10	86	91	9	-	2

Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes

1. MES covers businesses in production and services industries with employment of at least 10 in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.

4 . Adoption by firm characteristics

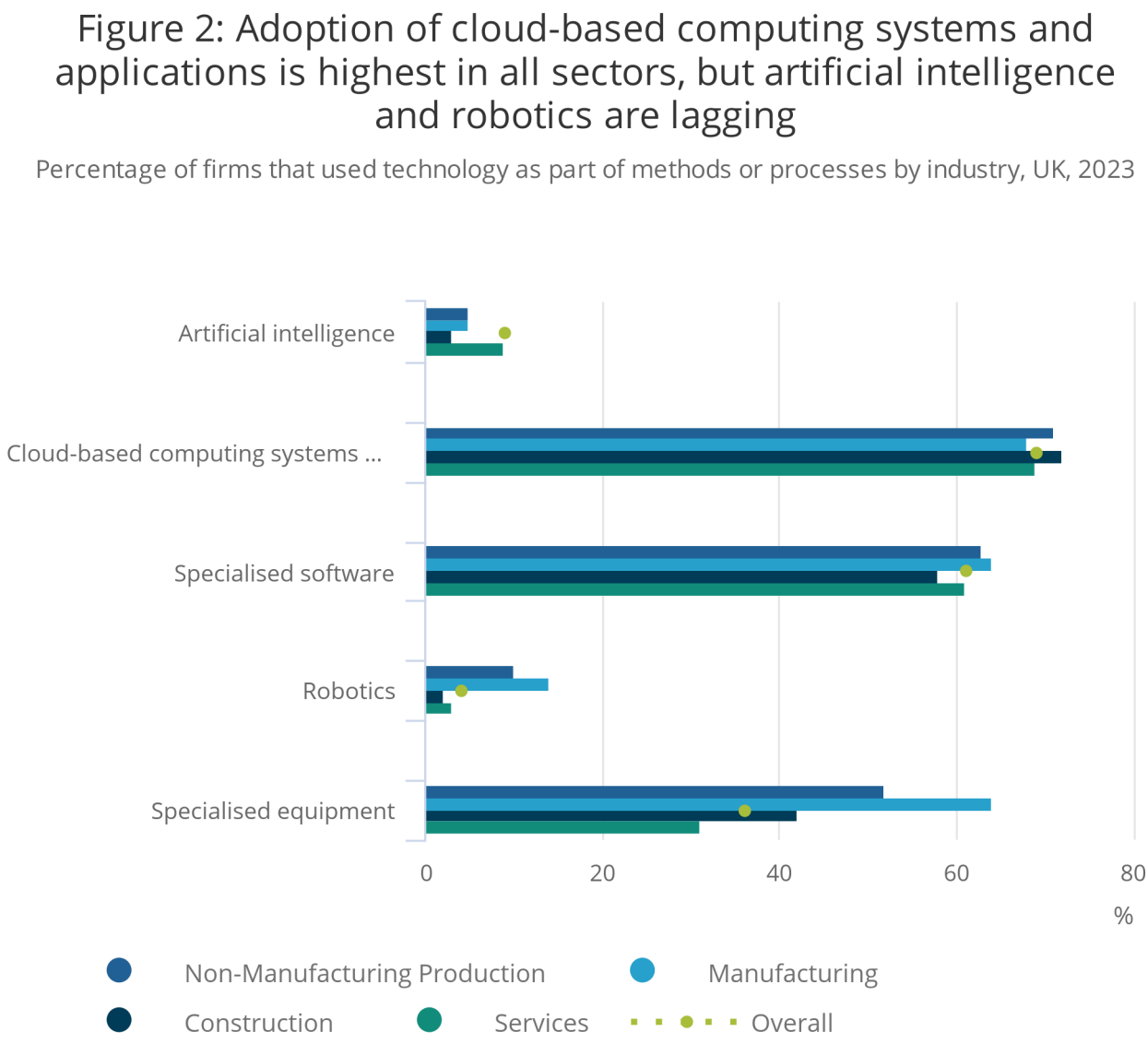
Industry

Technology adoption rates vary by industry. There is limited industry dispersion for certain technologies; however, technologies such as artificial intelligence (AI), robotics, and specialised equipment show substantial variation in adoption across industries.

In 2023, AI was adopted by 9% of firms in the services sector but only 5% of firms in the manufacturing sector. Conversely, the adoption rates for specialised equipment and robotics were highest among firms in the manufacturing sector, at 64% and 14%, respectively, but lowest among firms in the services sector, at 31% and 3%, respectively. This suggests that the adoption decision depends on the applicability of tasks and functions that vary by industry.

Figure 2: Adoption of cloud-based computing systems and applications is highest in all sectors, but artificial intelligence and robotics are lagging

Percentage of firms that used technology as part of methods or processes by industry, UK, 2023



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.
4. Counts for non-manufacturing production were low, thus should be treated with caution.

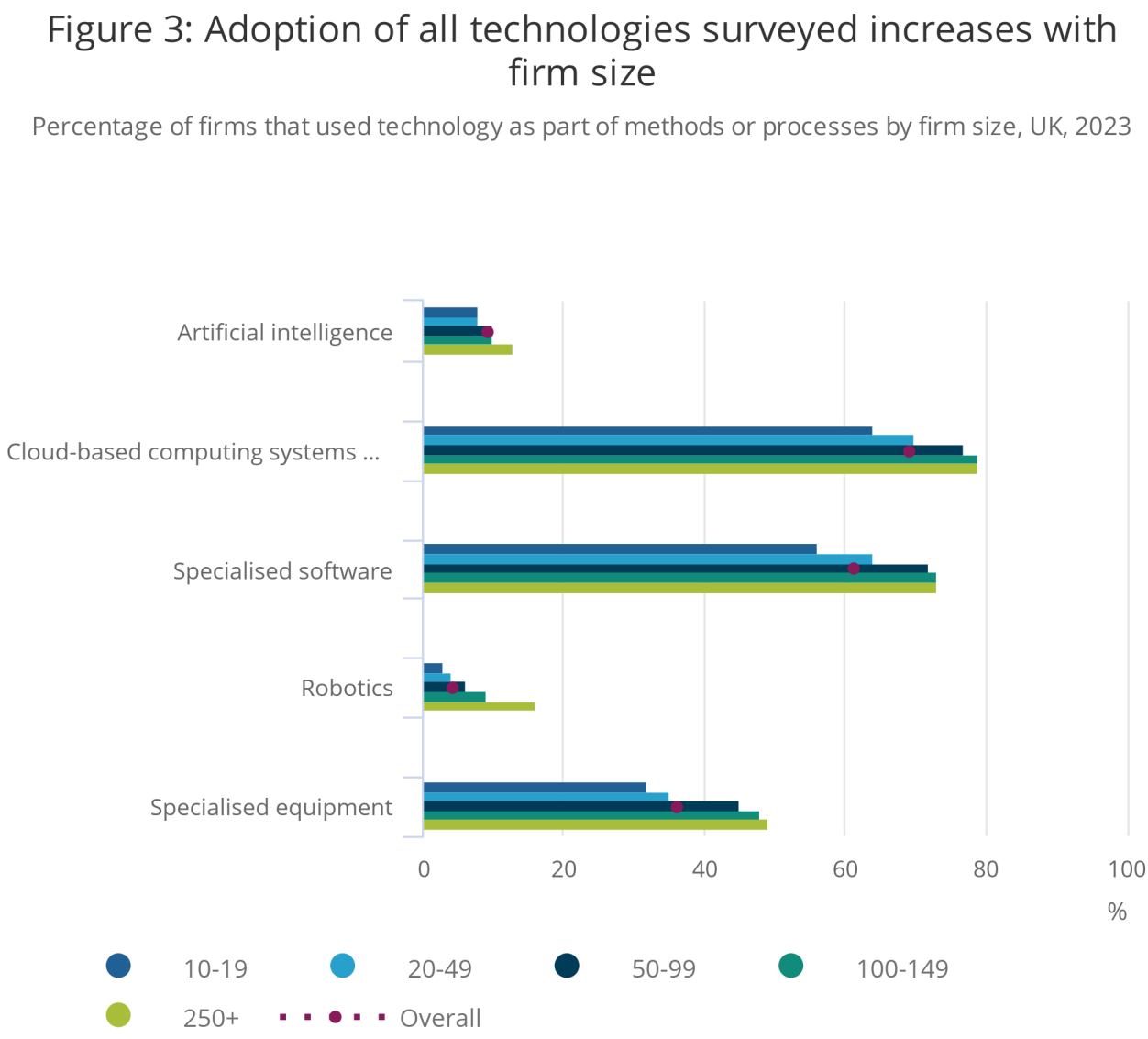
Within the services sector, where AI adoption is strongest, the highest industry adoption rates in 2023 were 27% for firms in information and communication and 12% for firms in the business services subsectors. The manufacturing sector with the highest AI adoption rate was the manufacture of textiles (11%).

Firm size

Adoption of the five technologies surveyed increases with firm size (Figure 3). In 2023, only 3% of firms with 10 to 19 employees adopted robotics, compared with 16% of firms with 250 employees or more. The adoption of ubiquitous technologies such as cloud-based computing systems and applications, and specialised software increases less with firm size.

Figure 3: Adoption of all technologies surveyed increases with firm size

Percentage of firms that used technology as part of methods or processes by firm size, UK, 2023



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.

2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.

3. Definitions of each technology can be found in Section 11: Glossary.

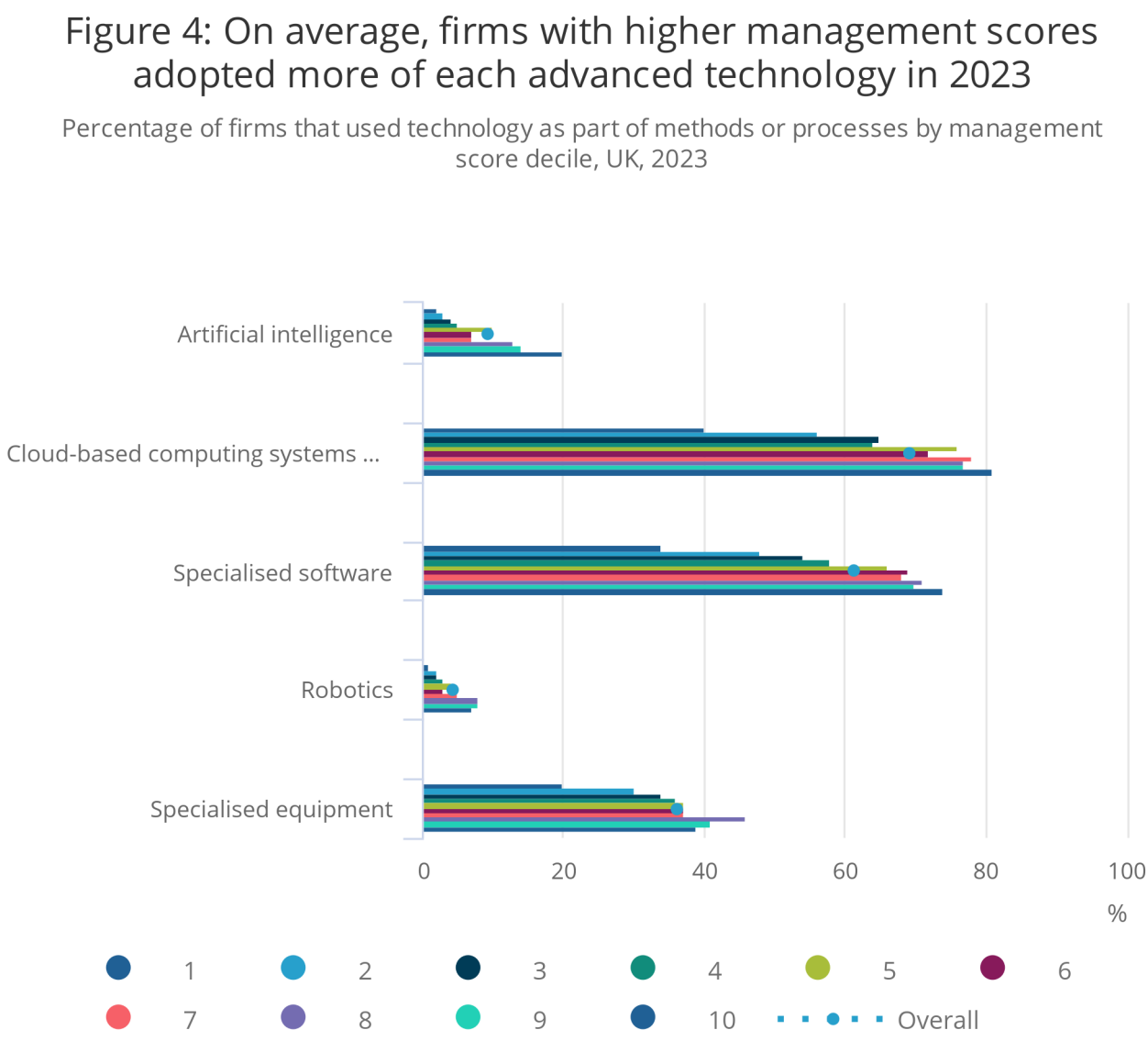
5 . The role of management practices in technology adoption

Firms with higher management practice scores are more likely to adopt advanced technologies (Figure 4). While 88% of firms in the top management score decile adopted one or more technologies, only 51% did so in the bottom decile. The result is in line with the idea that general purpose technologies require complementary investments that are often intangible, like management practices (Brynjolfsson and others, 2021).

For most technologies, adoption rates increase minimally between the middle and top of the management score distribution; however, artificial intelligence (AI) adoption rates in the top decile are twice the UK average.

Figure 4: On average, firms with higher management scores adopted more of each advanced technology in 2023

Percentage of firms that used technology as part of methods or processes by management score decile, UK, 2023



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.
4. Decile 1 represents the one-tenth of the sample with the lowest management scores while decile 10 represents the one-tenthof the sample with the highest management scores.

Figure 5 explores the impact of management practices on the probability of adopting each advanced technology when looking at various characteristics together: firm age, firm size, industry and region. This helps us control for these characteristics in understanding the differences in technology adoption rates.

An increase in the management score is associated with an increase in the probability of adoption of all advanced technologies. For example, our regression results show that a 1% increase in a firm's management practice score is associated with a 0.0017 change in the probability of adopting specialised software compared with only a 0.0009 change in the probability of adopting AI.

Figure 5: Management score predicts higher adoption rates even when controlling for firm characteristics

Probit regression average partial (marginal) effects and confidence intervals on the probability of adopting advanced technologies, UK, 2023

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.
4. Confidence intervals reported have been calculated using robust (Huber-White) standard errors. For more information on standard errors see Section 12: Data sources and quality.
5. The specifications include industry fixed effects at the two-digit (division) level, based on the 2007 Standard Industrial Classification and location fixed effects, at the International Territorial Level 1 regions.
6. Detailed regression results are included in the accompanying dataset.

Table 2 takes the regression results from Figure 5 and shows the probability of adoption at different management practice score percentiles, given all other predictors are set to their mean values. Firms in the 10th management practice score percentile are predicted to have a 2% adoption rate for AI compared with a 10% predicted adoption rate in the 90th management percentile, based on the characteristics of the average firm.

Table 2: Moving from the 10th to 90th management score percentile is associated with higher adoption rates across all advanced technologies even after controlling for firm characteristics
Probability of adopting a technology by percentile of management practice score, with other predictors set at their mean values

Advanced technology	10th percentile	50th percentile	90th percentile
Artificial intelligence (AI)	2	8	10
Robotics	1	3	3
Cloud-based computing systems and applications	58	73	77
Specialised software	48	66	70
Specialised equipment	23	37	41

Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes

1. MES covers businesses in production and services industries with employment of at least 10 in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.
4. The results represent the partial effects at the average at three management practices score percentiles of interest: 10th, 50th and 90th.
5. Figures are rounded.
6. Detailed regression results are included in the accompanying dataset.

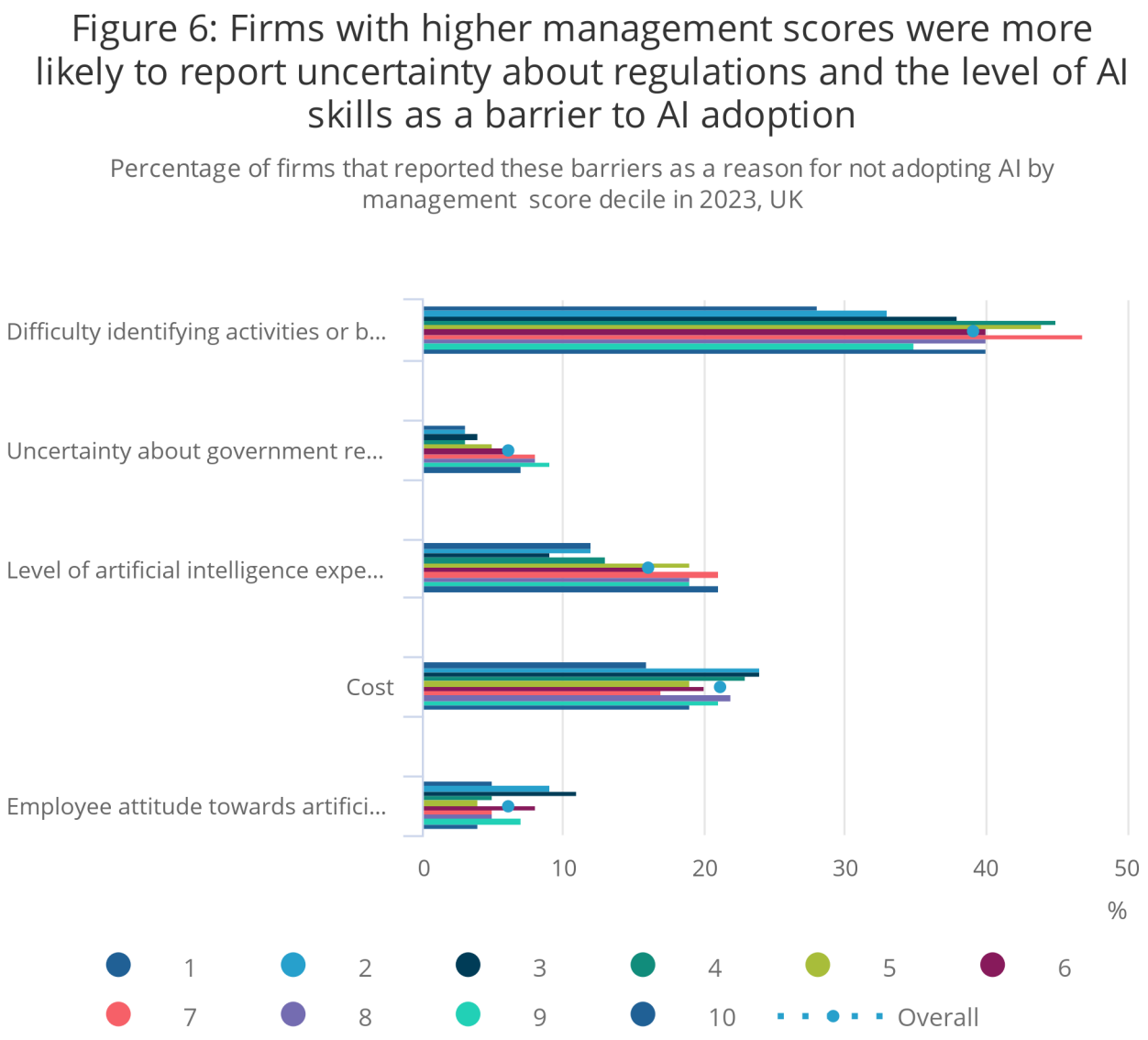
6 . Barriers to artificial intelligence adoption

In 2023, UK firms reported that the most common barrier to artificial intelligence (AI) adoption was difficulty identifying activities or business use cases (39%), followed by the cost (21%) and level of AI expertise or skills (16%). Furthermore, there is evidence that the barriers perceived vary by management practices.

Firms with higher management scores were more likely to report uncertainty about government regulations or industry standards, and level of AI expertise or skills as a barrier, compared with firms with lower management scores (Figure 6). Only 3% of firms in the bottom decile of management scores reported uncertainty about government regulations or industry standards as a barrier compared with 7% in the top decile. Similarly, only 12% of firms in the bottom decile reported level of AI expertise or skills as a barrier compared with 21% of firms in the top decile.

Figure 6: Firms with higher management scores were more likely to report uncertainty about regulations and the level of AI skills as a barrier to AI adoption

Percentage of firms that reported these barriers as a reason for not adopting AI by management score decile in 2023, UK



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

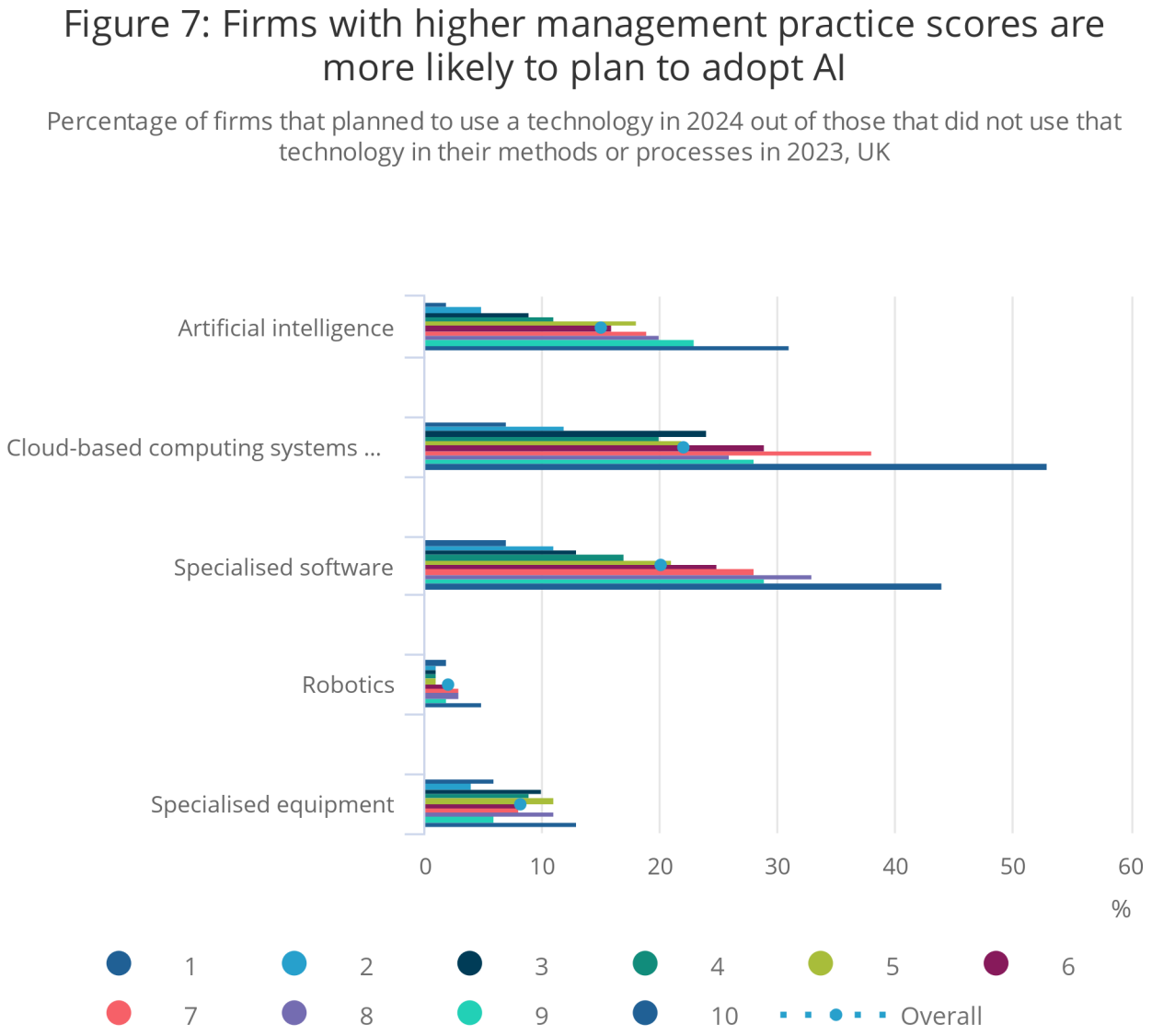
1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.
4. Decile 1 represents the one-tenth of the sample with the lowest management scores while decile 10 represents the one-tenth of the sample with the highest management scores.

7 . Future plans for technology adoption

Of the firms that did not adopt artificial intelligence (AI) in 2023, 15% said they planned to adopt it in 2024. Across all technologies except specialised equipment, planned adoption increases with management practice score decile (Figure 7).

Figure 7: Firms with higher management practice scores are more likely to plan to adopt AI

Percentage of firms that planned to use a technology in 2024 out of those that did not use that technology in their methods or processes in 2023, UK



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.

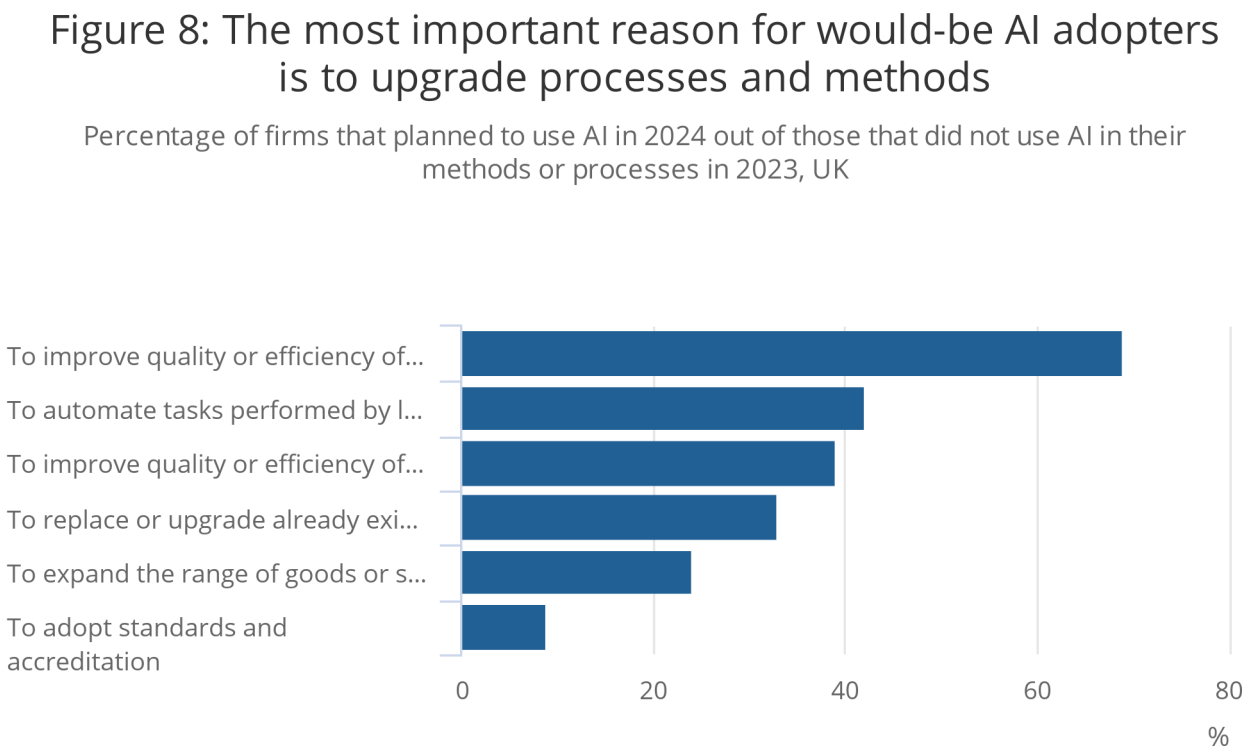
Motivations and barriers for future adopters

The motivations for adopting a general purpose technology can have important implications for welfare, labour and productivity. While AI is suggested to have a positive impact on wages (and labour demand) because it increases productivity, through automation, complementary improvements in different tasks (of AI), and the creation of new tasks, it simultaneously reduces labour demand by displacing workers from their old tasks (PDF, 1.02MB) (Acemoglu, 2024).

Among would-be adopters, 69% planned to use AI to upgrade processes and methods, and 42% planned to use AI to automate tasks performed by labour. Only 24% of these firms planned to use AI to expand the range of goods and services (Figure 8). In this sense, motivations reported by would-be adopters are the same as those of actual adopters, as reported in Figure 12 of Management practices in the UK: 2016 to 2023.

Figure 8: The most important reason for would-be AI adopters is to upgrade processes and methods

Percentage of firms that planned to use AI in 2024 out of those that did not use AI in their methods or processes in 2023, UK



Source: Management and Expectations Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.

The top barriers to AI adoption reported by would-be adopters were level of AI expertise and skills, cost, and difficulty identifying activities and business use cases. The barriers perceived by would-be adopters are similar to those reported by non-adopters in the previous section.

8 . Additional insights from linking MES and BICS

The Business Insights and Conditions Survey (BICS) asked respondents questions on the adoption of artificial intelligence (AI) in: waves 92 and 98, corresponding to the Management and Expectations Survey (MES) 2023 sampling period; as well as in waves 105, 111 and 117, one period after in 2024.

We link BICS with MES to leverage questions posed in BICS on artificial intelligence (AI) that were not in MES 2023; and to interrogate future outcomes of firms in MES 2023. Datasets were linked using reporting units to create two datasets: MES 2023 linked to waves 92 and 98 of BICS (2,655 observations); and MES 2023 linked to waves 105, 111 and 117 of BICS (2,895 observations) in 2024. The following results are based on unweighted data.

Type of artificial intelligence adopted in 2023

Using the MES-BICS linked data, Figure 9 shows that the most common type of AI adopted in 2023 was data processing using machine learning, which was adopted by 9% of firms, while the least common was AI-enabled robotics (3%).

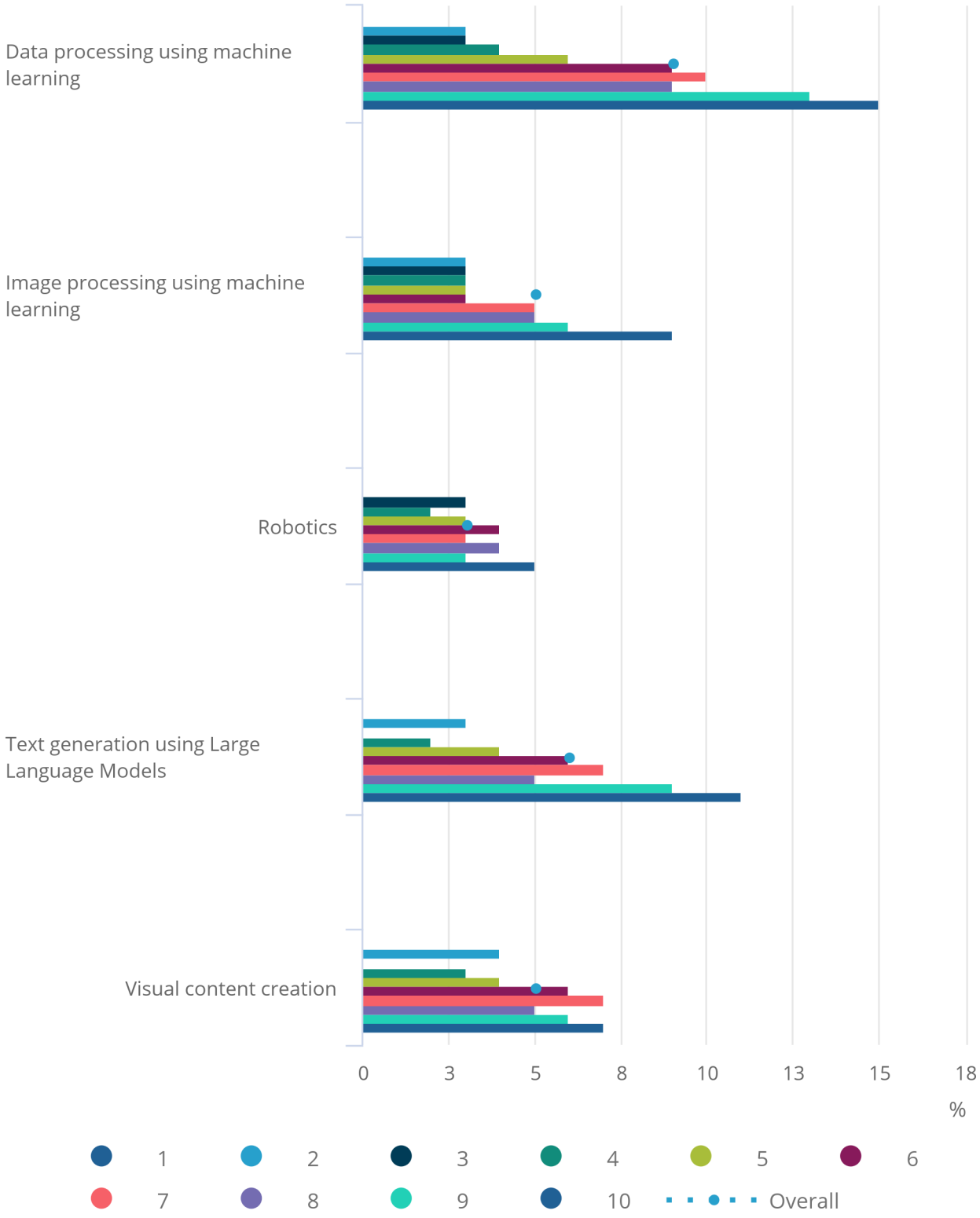
Across all AI types, firms with higher management scores had higher adoption rates.

Figure 9: The most popular AI type was data processing using machine learning

Percentage of firms that adopted various types of AI as part of their methods or processes, UK, 2023

Figure 9: The most popular AI type was data processing using machine learning

Percentage of firms that adopted various types of AI as part of their methods or processes, UK, 2023



Source: Management and Expectations Survey 2023 and Business Insights and Conditions Survey 2023 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.

2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.

3. Any missing decile bars indicate data have been suppressed to avoid disclosure.

4. Definitions of each technology can be found in Section 11: Glossary.

Follow through in 2024

Out of firms in the 2023 MES who said they were planning to adopt AI in 2024, 38% of those who also responded to BICS in 2024 said that they adopted AI that year, compared with 27% of firms who in 2023 said they were not planning to adopt.

Firms with higher management practice scores were more likely to follow through on AI adoption in the following year: 48% of those in the top management score decile and expected to adopt AI did so in 2024, compared with 31% with median scores and only 17% of firms in the second lowest management score decile (Figure 10).

Figure 10: Firms at the top of the management practices distribution were more likely to follow through in 2024 on their 2023 AI adoption plans

Percentage of firms that adopted various types of AI as part of their methods or processes, UK, Management and Expectations Survey 2023 and Business Insights and Conditions Survey 2024

Source: Management and Expectations Survey 2023 and Business Insights and Conditions Survey 2024 from the Office for National Statistics

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Decile 1 has been suppressed to avoid disclosure.
4. Definitions of each technology can be found in Section 11: Glossary.
5. Decile 1 represents the one-tenth of the sample with the lowest management scores while decile 10 represents the one-tenth of the sample with the highest management score.
6. Because of management score decile groupings being derived from the full-sample MES dataset rather than the linked MES-BICS dataset, the number of firms underlying each decile is not equal.The MES-BICS sample is notably biased towards firms with higher management practice scores.

9 . Estimating relationships between productivity, management practices and technology adoption

Adoption rates of advanced technologies and turnover per worker, a measure of labour productivity, are highly correlated. In 2023, artificial intelligence (AI) was adopted by 6% of firms in the bottom turnover per worker quartile compared with 10% in the top turnover per worker quartile.

Figure 11 explores the differences in turnover per worker between firms that adopt advanced technologies compared with firms that do not, while controlling for firm characteristics using an Ordinary Least Squares (OLS) regression.

After controlling for management practice scores and firm characteristics, technology adopters are associated with a 17.7 log points (19%) higher level of turnover per worker. Cloud-based computing systems and applications adopters were associated with 11.3 log points (12%) higher turnover per worker compared with non-adopters. AI and specialised equipment were statistically insignificant at the 10% level but the advanced technologies are all highly correlated as shown in Table 1.

Previous analysis by the Office for National Statistics (ONS) on management practices found a positive, statistically significant relationship between management practice scores and output per worker. Firms in the top management practice score quartile are associated with 36.0 log points (43.3%) higher turnover per worker compared with the bottom quartile. However, after controlling for technology adoption, the turnover per worker premium for the top management practice score quartile compared with the bottom quartile, falls to 32.3 log points (38.2%). Therefore, technology adoption accounts for around 5 percentage points of the 43 point difference in turnover per worker between the top and bottom management practice score quartiles.

Turnover per worker varies by the number of technologies a firm adopts. Compared with a firm that adopted no technology, a firm that adopts exactly one technology is associated with 14.9 log points (16%) higher turnover per worker and a firm that adopts two technologies is associated with 20.8 log points (23%) higher turnover per worker. Therefore, adopting a second technology increases turnover per worker by an additional 6%. This is less than the initial 16% increase from the first technology, indicating diminishing marginal product of advanced technology on turnover per worker. The results imply that, on average, adopting a fourth technology adds no additional turnover per worker.

Figure 11: Technology users are associated with 19% higher turnover per worker than non-adopters after controlling for management practice scores and firm characteristics

Ordinary least squares regression results for changes in the log of turnover per worker in 2023

Notes:

1. MES covers businesses in production and services industries with employment of at least 10, in the UK.
2. The MES sample excludes firms in section A (agriculture, forestry and fishing), and section K (financial and insurance activities) and results were weighted to reflect the population of firms.
3. Definitions of each technology can be found in Section 11: Glossary.
4. Confidence intervals reported have been calculated using robust (Huber-White) standard errors. For more information on standard errors see Section 12: Data sources and quality.
5. The specifications include industry fixed effects at the two-digit (division) level, based on the 2007 Standard Industrial Classification and location fixed effects, at the International Territorial Level 1 regions.
6. Turnover per worker is calculated using firm turnover and number of employees from the Management and Expectations Survey. The original regression takes output per worker in natural logs but for the purpose of this figure we have converted the coefficients from log points to percentages.
7. Detailed regression results are included in the accompanying dataset.

10 . Data on management practices and the adoption of technology

Management practices and technology adoption by firm characteristics
Dataset | Released 24 March 2025
Review of technology adoption among UK firms in 2023 by industry, firm size and management practices. These are official statistics in development.

11 . Glossary

The five technologies surveyed in the 2023 MES were defined as follows:

Artificial intelligence (AI)

AI is technology where computer programs or machines can learn from data and perform tasks usually done by humans. AI is currently used in a variety of ways, including:

- online product recommendations
- facial recognition
- self-driving vehicles
- medical diagnostic tools
- chatbots that interact in a conversational way and can answer complex questions

Cloud-based computing systems and applications

Cloud systems and applications are computing resources available on-demand via the internet. Cloud computing enables ubiquitous, convenient, on-demand internet access to a shared pool of configurable computing resources (such as networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Robotics

Robotic equipment (or robots) are automatically controlled, reprogrammable, and multipurpose machines used in automated operations in industrial and service environments. Robots may be mobile, incorporated into stand-alone stations, or integrated into a production line. A robot may be part of a manufacturing cell or incorporated into another piece of equipment.

Industrial robots may perform operations such as: palletising, pick and place, machine tending, material handling, dispensing, welding, packing and repacking, and cleanroom.

Service robots are commonly used in businesses for such operations as cleaning, delivery, construction, inspection, and medical services such as dispensing or surgery.

Specialised equipment

Specialised equipment refers to equipment capable of automatically carrying out pre-specified task(s), excluding robotics. Specialised equipment includes, but is not limited to, computer numerically controlled (CNC) machinery, computer-aided manufacturing (CAM) systems, manufacturing cells, materials working lasers, automated guided vehicles systems, automated storage and retrieval systems, and automated materials handling systems. Excludes robotics equipment reported previously.

Specialised software

Specialised software is custom or packaged software dedicated to performing a particular business function, excluding artificial intelligence. Specialised software includes, but is not limited to, software applications for accounting, sales, marketing, customer service and billing, logistics, health care delivery, telemedicine, computer-aided design (CAD), computer-aided engineering (CAE), or inventory management. Specialised software excludes general purpose software such as word processing or spreadsheets. Excludes artificial intelligence software reported above.

Management practice score

The overall management practice score (management score for short) is an average of the scores along the four dimensions of management practices measured: continuous improvement, key performance indicators (KPIs), targets and employment practices.

Would-be adopters

Firms (reporting units) who had not adopted AI but reported that they were planning to.

12 . Data sources and quality

The Management and Expectations Survey (MES) primarily collects data about management practices in firms: how firms respond to problems, their employment practices, and how they use key performance indicators (KPIs) and targets.

Using the survey responses, we generate a management practice score for each responding firm. Management practice scores range from 0 to 1. Firms score 0 if they do not respond to ongoing problems, base promotion decisions on factors other than merit, and do not track performance or set targets. Conversely, to score 1, firms need to continuously review their processes with the aim to minimise future challenges, carry out regular performance reviews, train employees, and base hiring and promotion decisions on merit.

The latest wave of the MES, conducted across the UK from November 2023 to March 2024, introduced a new module which asked firms about their adoption of new technologies such as AI, cloud-based computing systems and applications, robotics, specialised software, robotics or specialised equipment. Full questionnaire is available in the Related downloads.

Strengths and limitations

Users should keep in mind that all estimates, by definition, are subject to statistical error. Standard errors, confidence intervals and statistical significance are included where necessary to measure uncertainty. The Office for National Statistics (ONS) has provided additional information on how we measure uncertainty in our surveys and further information on the strengths and limitations of the MES can be found in our Quality and methodology information report.

Full regression results are provided in the accompanying dataset and use robust standard errors. However, when analysing the results we tested the robustness of the findings to different assumptions about the variance of the estimates using robust standard errors and standard errors clustered by industry.

“Robust standard errors” are standard error estimates obtained using the Huber-White sandwich estimator of the variance and are robust to violations of homoskedasticity (constant variance). Robust standard errors assume observations are independent but not identically distributed.

Clustered standard errors are robust also to violations of independence. They allow for observations in a given industry, region, year (or other relevant dimension) to be correlated with one another. Violations of independence mean additional observations within a region or industry do not offer as much new information about the variable of interest as we thought. As a result, confidence intervals calculated based on clustered standard errors are wider, making it harder to identify significance.

All regression analysis in this article compares like-for-like firms as much as possible by including fixed industry and regional effects. By doing this, we can control for the average differences across industries or regions in both observable and unobservable explanatory variables. We can therefore compare observations that are much more alike.

Since technology adoption has only been included in the latest wave of the MES, the regressions use data on 2023 only. Therefore, the regression results should be interpreted as an association rather than a causal relationship. In future waves of the MES, we hope to have additional information of technology adoption to allow for a longitudinal analysis.

13 . Related links

Management practices in the UK: 2016 to 2023
Bulletin | Released 13 May 2024
Review of management practice scores for firms in the production and services industries across the UK in 2023 and Great Britain from 2016 to 2023.

Public Sector Management Practices Survey pilot, UK: 2023
Bulletin | Released 21 October 2024
Review of management scores of public sector organisations across the UK in 2023 based on findings from the pilot of our Public Sector Management Practices Survey (PSMPS).

Management practices, homeworking and productivity during the coronavirus (COVID-19) pandemic
Article | Released 17 May 2021
The companion article: using the Management and Expectations Survey 2020 to understand the determinants of good management in British businesses.

14 . Cite this article

Office for National Statistics (ONS), released 24 March 2025, ONS website, article, Management Practices and the Adoption of Technology and Artificial Intelligence in UK Firms: 2023