

# Management Practices and the Adoption of Technology and Artificial Intelligence in UK Firms: 2023

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# Background



Previous ESCoE co-research identified the importance of the measurement of management practices as an intangible capital into understanding productivity.



Research shows that management matters. Differences in management quality are important to understand, as they are significantly related to important firm outcomes such as firm-level productivity, profits, innovation, and survival.



Management and Expectations Survey (MES) measures the quality of management practices. Waves in 2016, 2019/2020 and 2023.



Understanding the role of management practices is important in informing economic growth.

# Research questions

There is a scarcity of comprehensive information on how AI adoption impacts productivity within UK firms, necessitating further research to fill this gap, including the relationship between management practices and AI and technology adoption.

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

# Four dimensions of management

Building on ONS (2018, 2021) and earlier work by Bloom, Sadun and Van Reenen (2013) we derive a management score based on:

- Continuous Improvement
- Key Performance Indicators
- Targets
- Employment Practices

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.
- Firms score 1 if they continuously review their processes with the aim to minimize future challenges, carry out regular performance reviews, train employees and base hiring and promotion decisions on merit.

# Survey coverage



~53,000 private sector organisations across the UK

Excluding:

- Agriculture
- Financial and insurance services
- Public sector organisations
- Firms with fewer than 10 employees



Including Northern Ireland for the first time



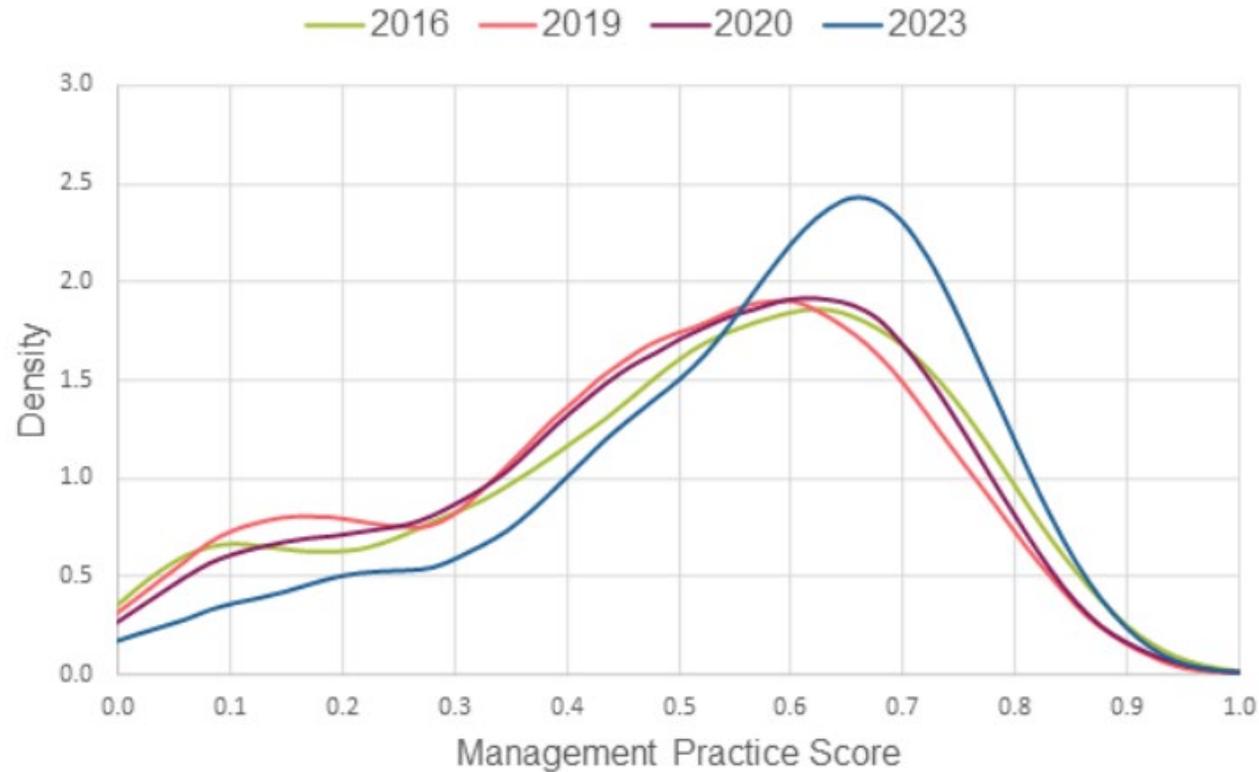
Drawing populations from Inter-Departmental Business Register (IDBR) and past respondents to Management and Expectations Survey (MES) and Annual Business Survey (ABS) 2022



Ask respondents about their business characteristics, management practices, expectations, learning & training, use of AI and technology

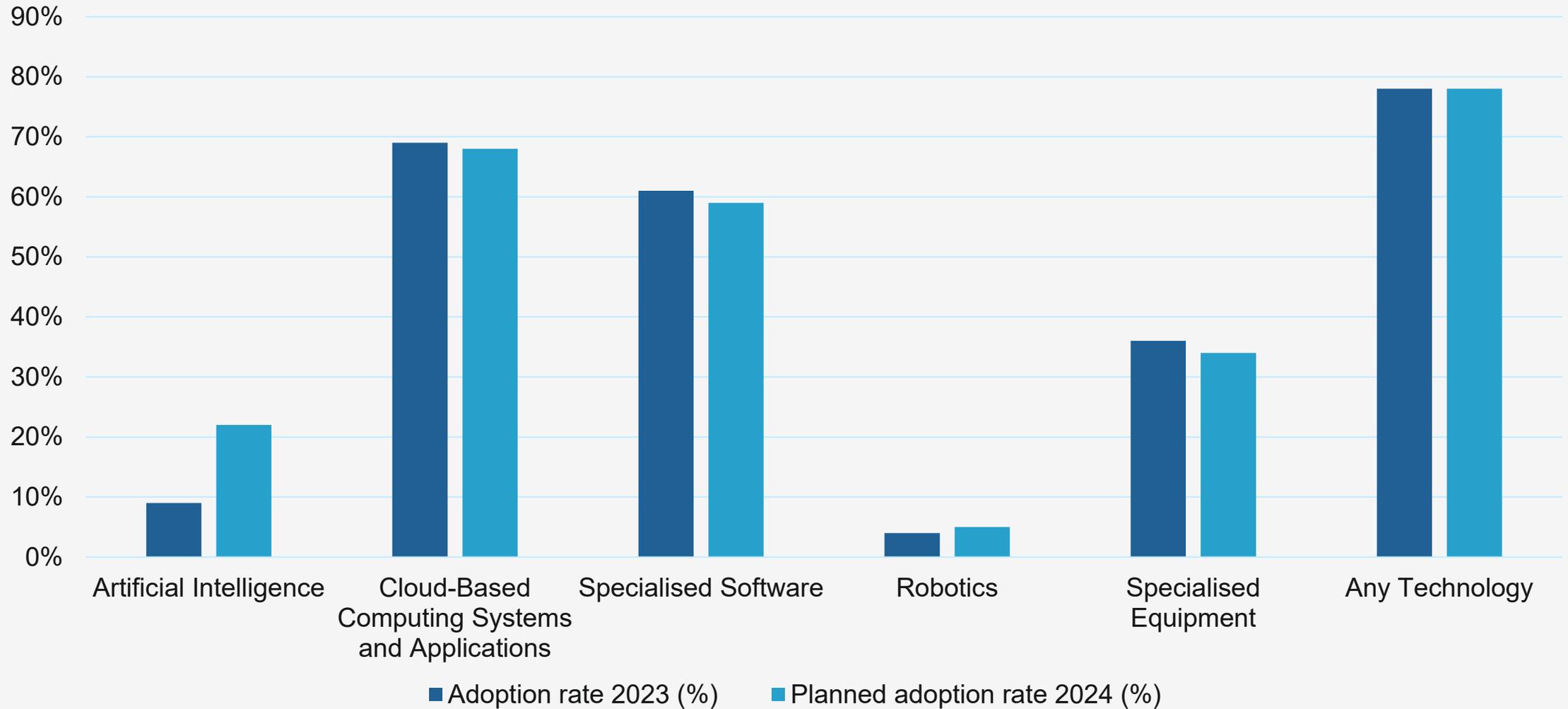
# Overall management practices have improved since 2016

Distribution of overall management practice scores, whole sample, Great Britain and UK, 2016 to 2023



# AI was used by 9% of firms in 2023 and is projected to be adopted by 22% of firms in 2024

Technology adoption rates, UK, 2023



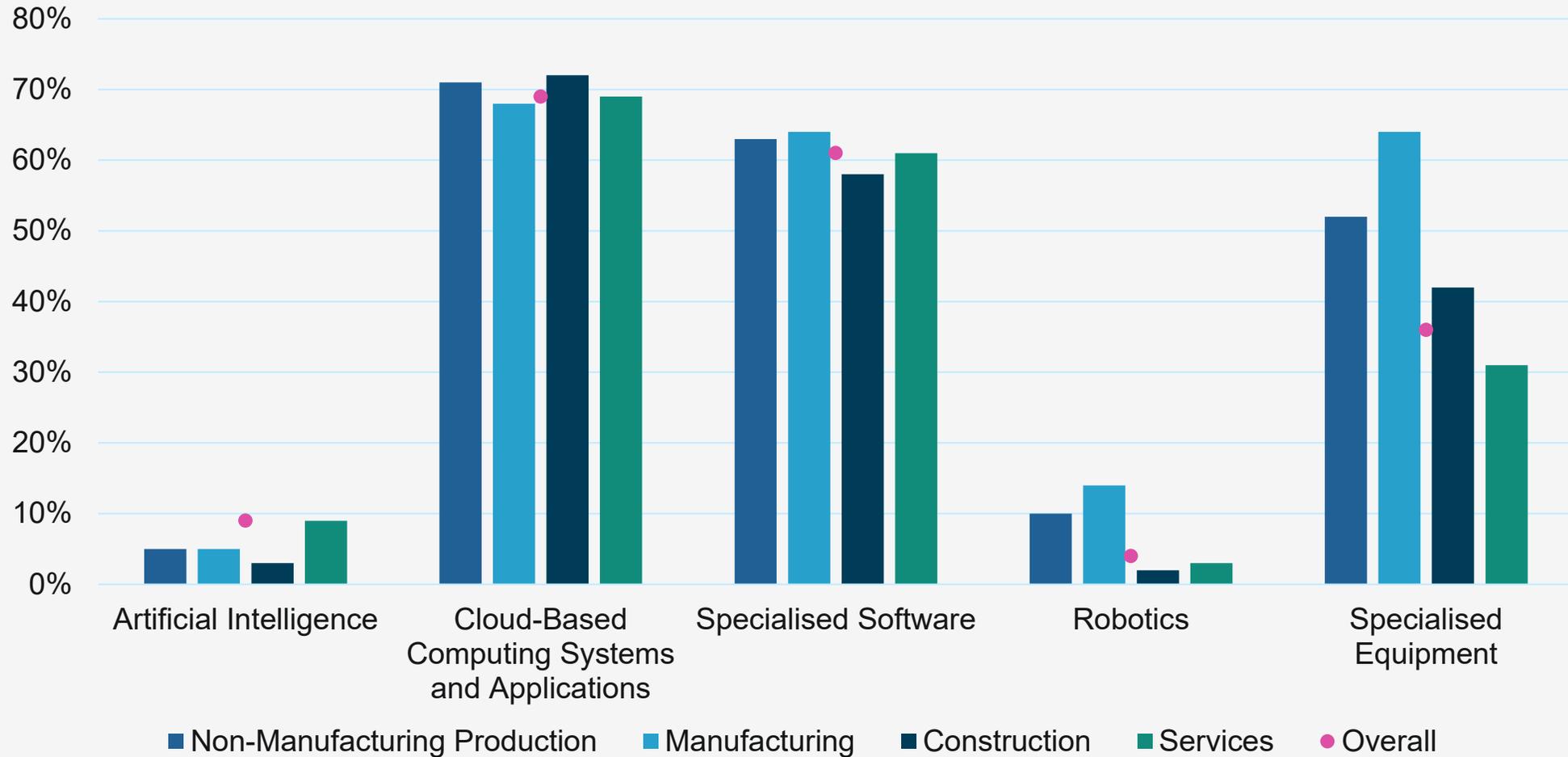
# Firms adopt multiple technologies at the same time, pointing to complementarities between technologies

Percentage of firms adopting technology Y (column) conditional on having adopted technology X (row), MES, UK, 2023

Technology	Y = Artificial Intelligence	Y = Cloud-Based Computing Systems and Applications	Y = Specialised Software	Y = Robotics	Y = Specialised Equipment	Only one technology
X = Artificial Intelligence	-	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

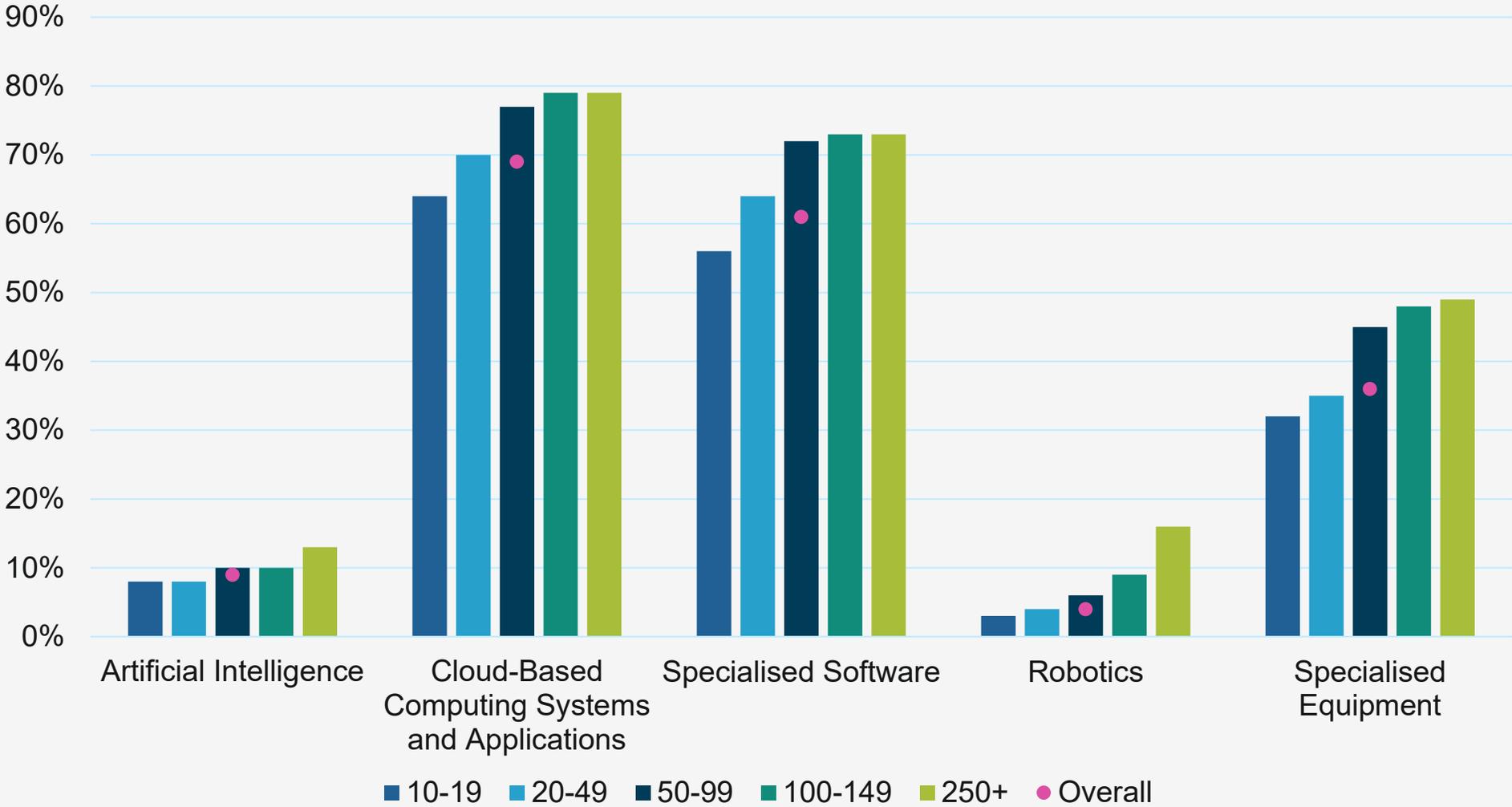
# Adoption of cloud-based computing systems and applications is highest in all sectors, but artificial intelligence and robotics are lagging

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



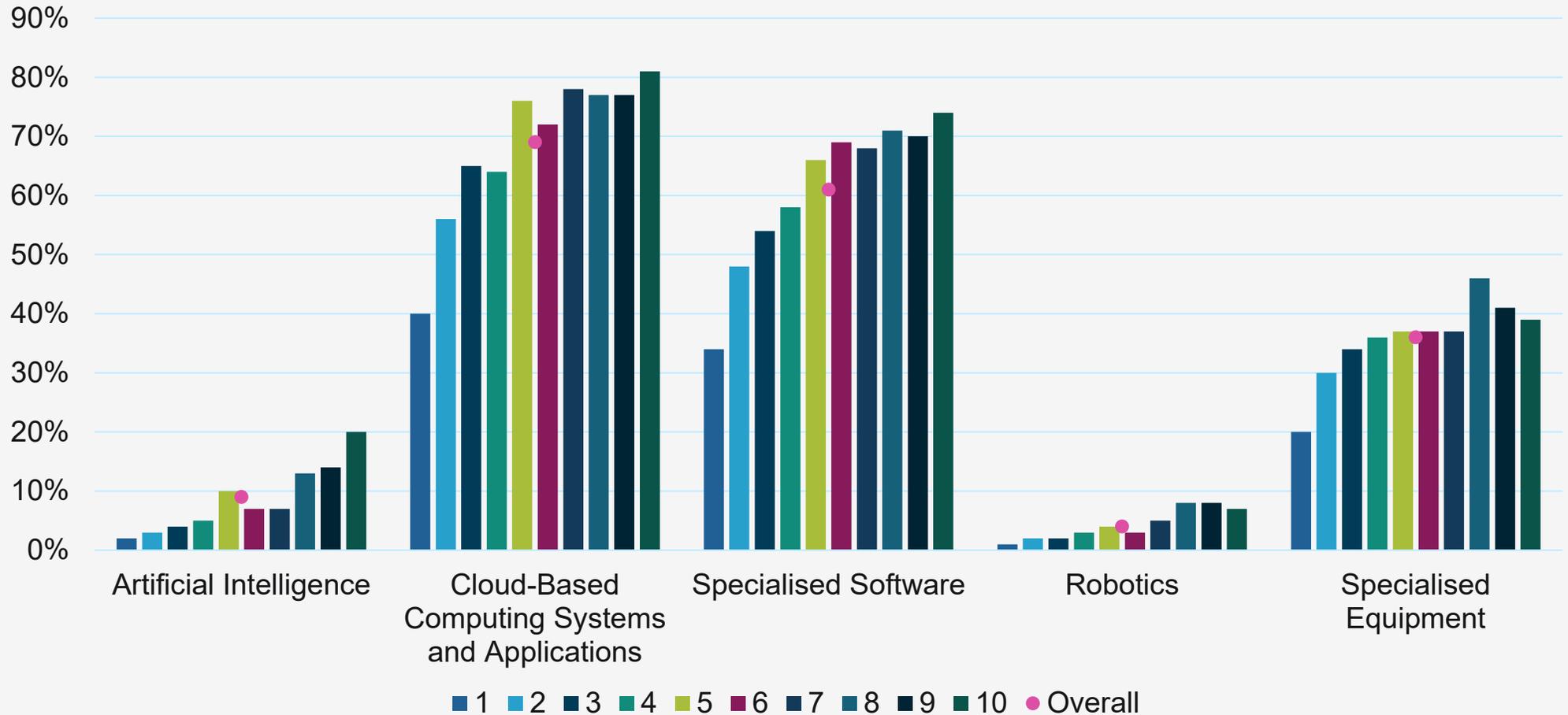
# Adoption of all technologies surveyed increases with firm size

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



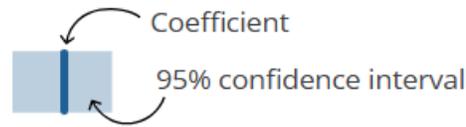
# On average, firms with higher management scores adopted more of each advanced technology in 2023

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

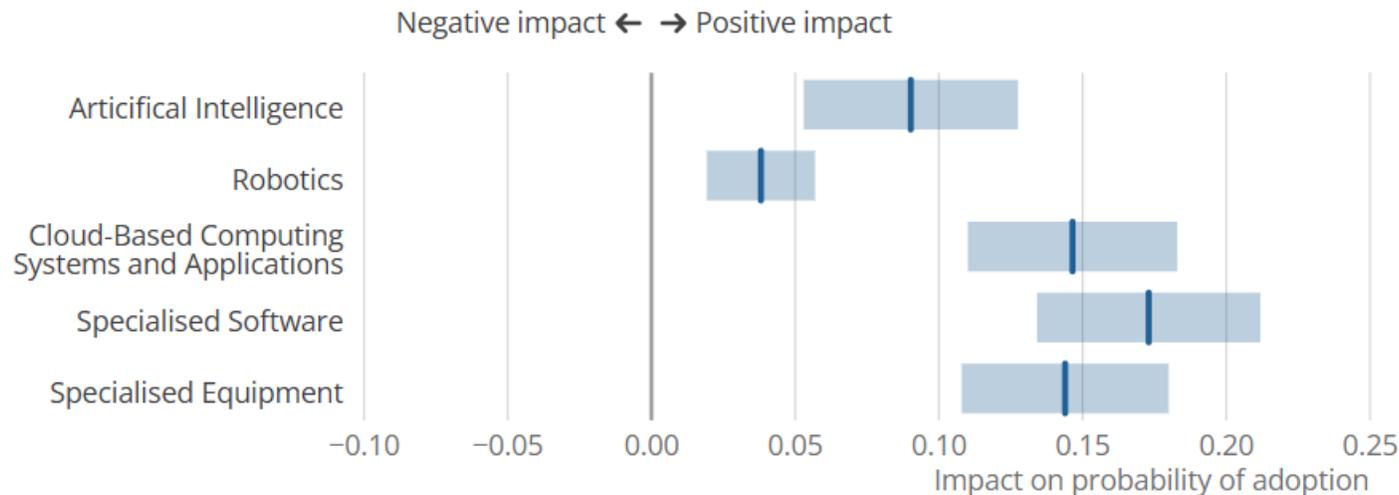


# Management score predicts higher adoption rates even when controlling for firm characteristics

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



ln(Management practice score)

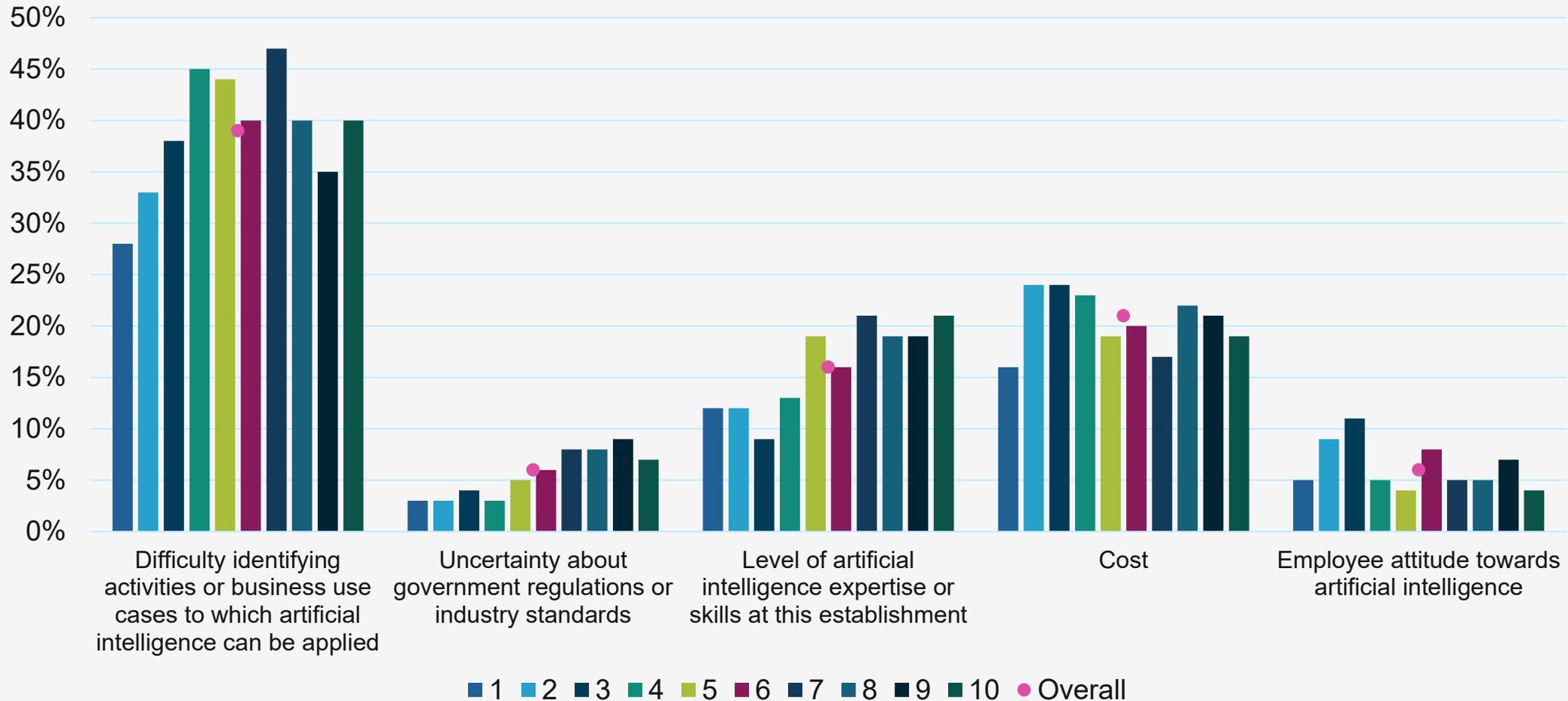


A 10% increase in management score is associated with a:

- 0.9 percentage point higher probability of adopting AI
- 0.4 percentage point higher probability of adopting robotics
- 1.5 percentage point higher probability of adopting cloud
- 1.7 percentage point higher probability of adopting specialised software
- 1.4 percentage point higher probability of adopting specialised equipment

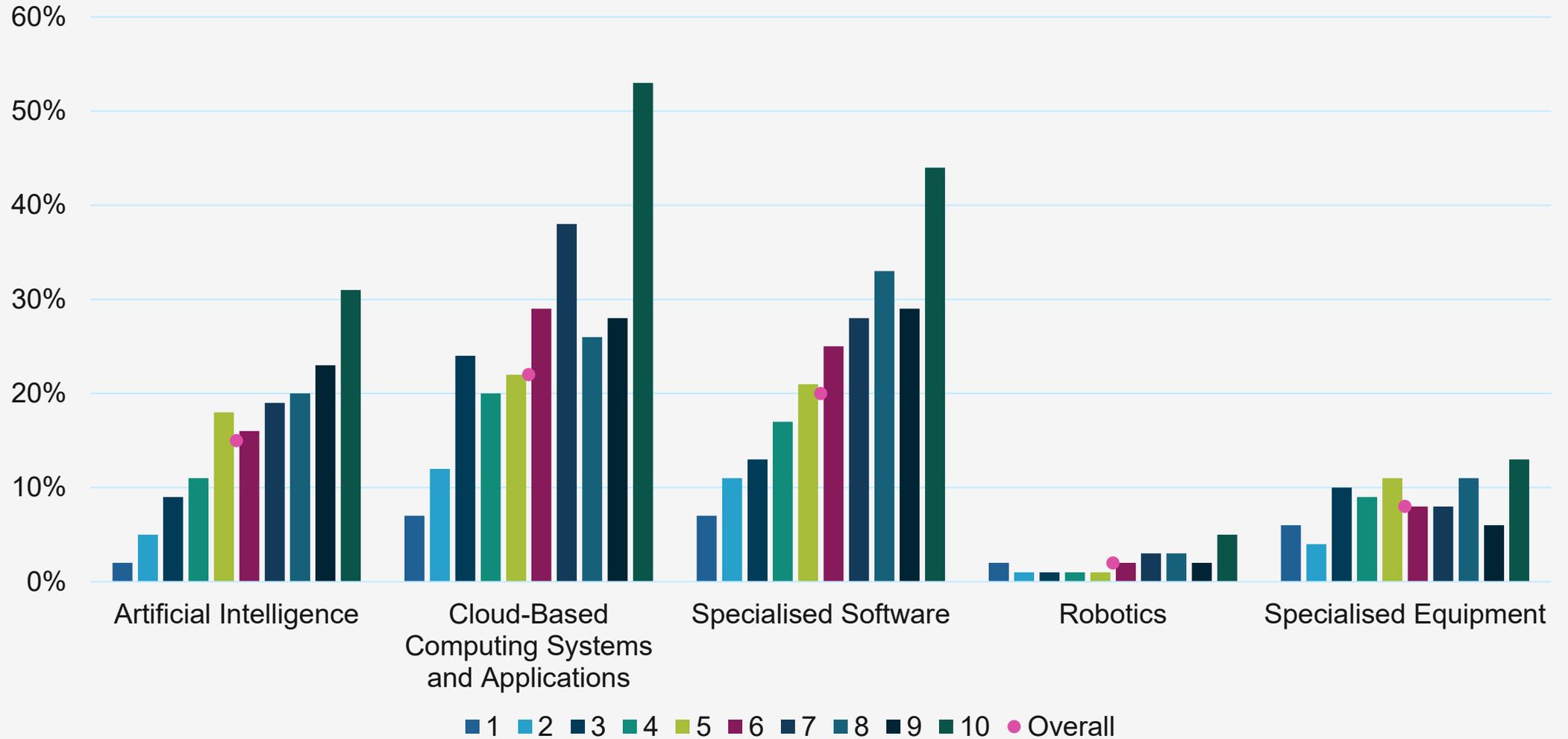
# Firms with higher management scores were more likely to report uncertainty about regulations and the level of AI skills as a barrier to AI adoption

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



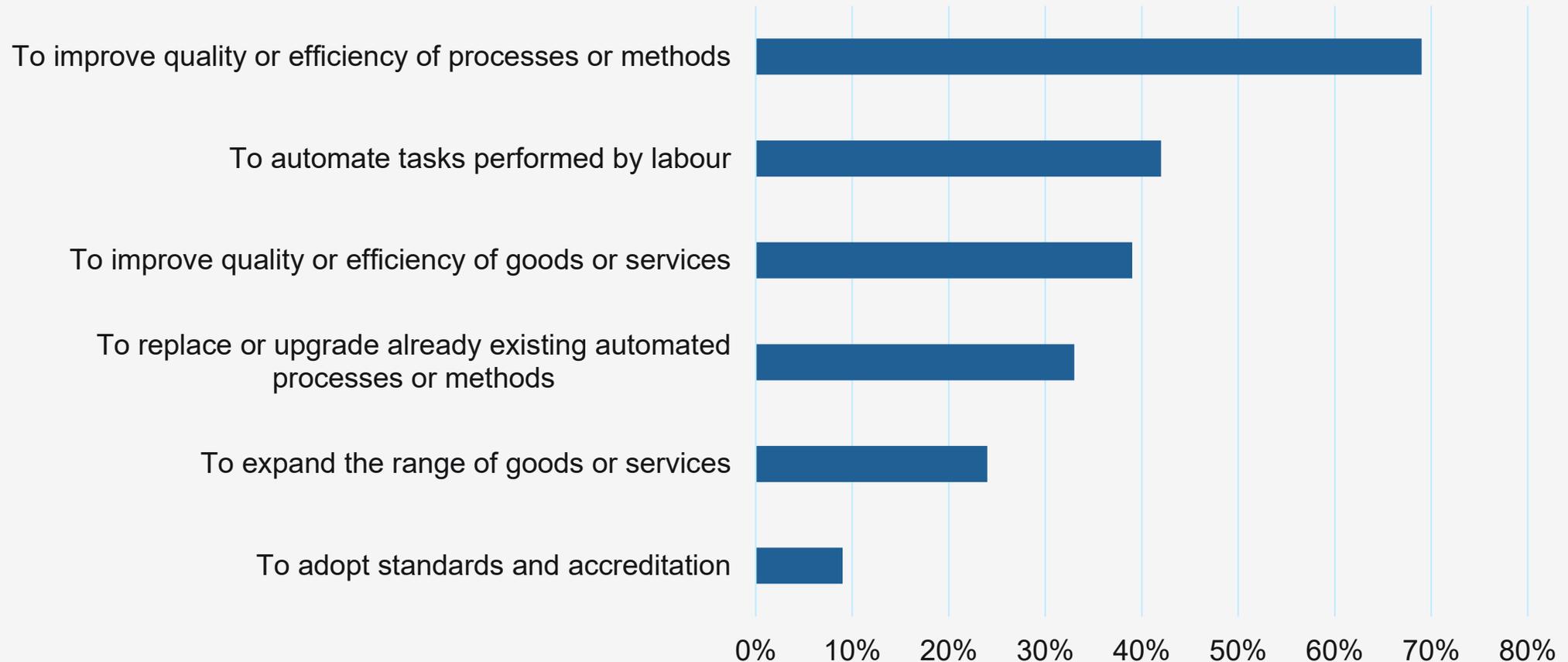
# Firms with higher management practice scores are more likely to plan to adopt AI

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



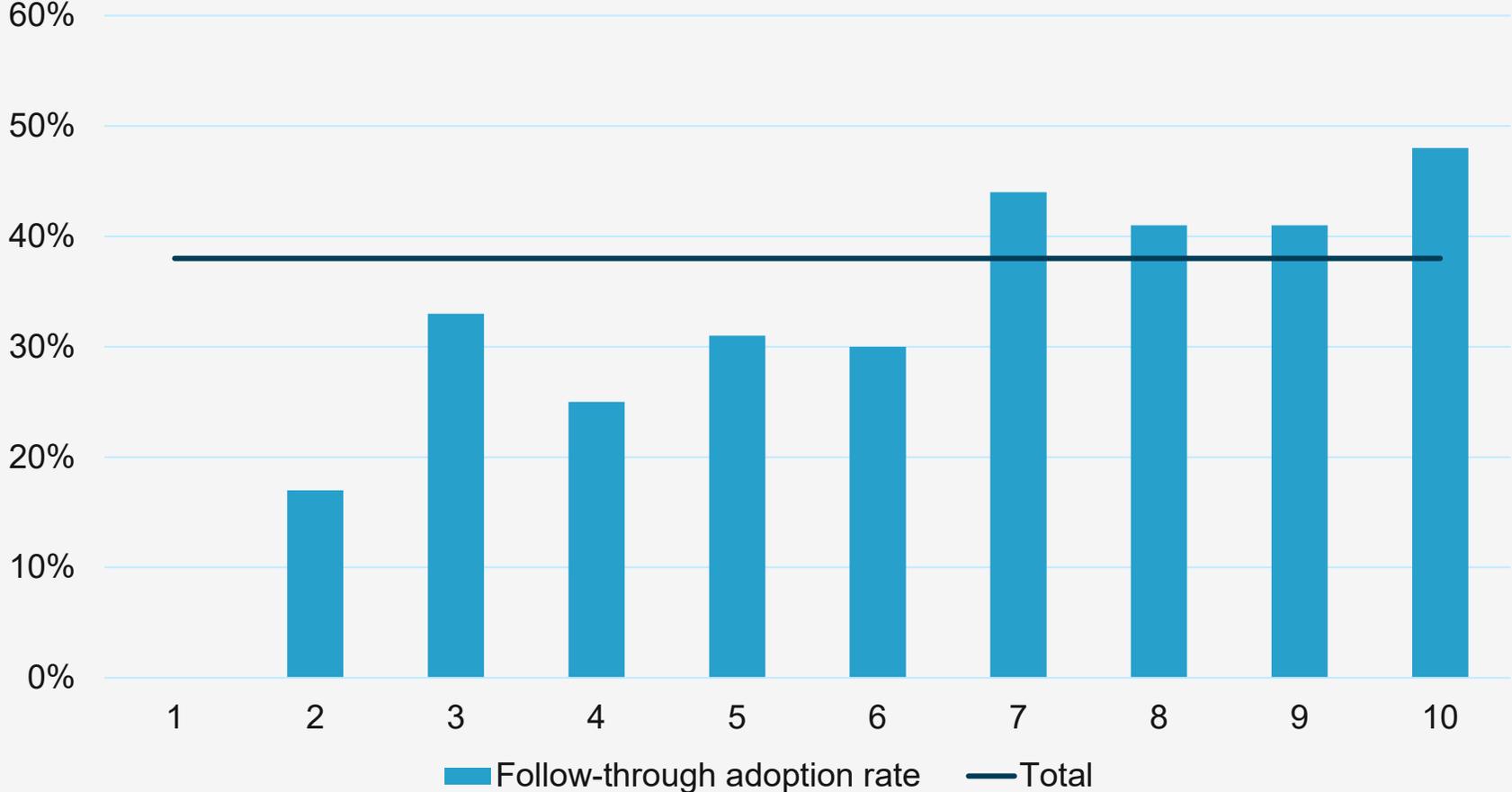
# The most important reason for would-be AI adopters is to upgrade processes and methods

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



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

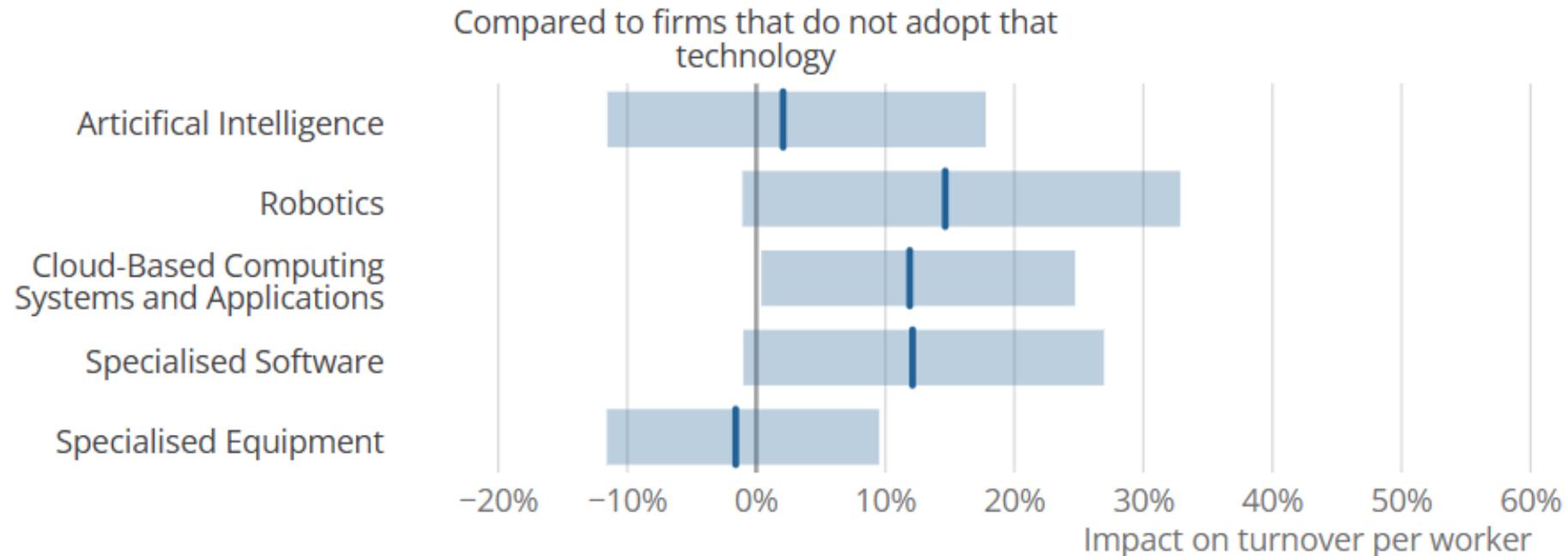
Percentage of firms that adopted various types of AI as part of their methods or processes, UK, Management and Expectations Survey 2023 and Business Insights and Conditions Survey 2024



# 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 coefficients and confidence intervals

## Technology



# Conclusion

- 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.

# Future plans

- Planning for Wave 4 of the Management and Expectations Survey
- Exploring the funding options and scope for this survey
- We are conducting a longitudinal analysis of management practices to support with our future sampling strategy

# Questions and discussion

- [Management practices and the adoption of technology and artificial intelligence in UK firms: 2023](#)
- [Management practices in the UK QMI](#)
- The MES dataset is available to accredited researchers in the SRS.
- For feedback or any enquiries, please email: [mes@ons.gov.uk](mailto:mes@ons.gov.uk)

# Annex

# Annex A: MES 2023 Scoring Schedule

## Section B - Continuous improvement

12. In 2023, in general what is the most common response to problems faced within this business?	
a. We resolve the problems but do not take further action	1/3
b. We resolve the problems and take action to try to ensure they do not happen again	2/3
c. We resolve the problems and have a continuous improvement process to anticipate similar problems in advance	1
d. No action is taken	0

## Section C - Key performance indicators

14a. In 2023, how many key performance indicators (KPIs) does this business monitor?	
a. 1-2 key performance indicators	1/3
b. 3-9 key performance indicators	2/3
c. 10 or more key performance indicators	1
d. No key performance indicators	0
14b. In 2023, how frequently is progress against the key performance indicators (KPIs) reviewed by managers?	
a. Annually	1/6
b. Quarterly	1/3
c. Monthly	1/2
d. Weekly	2/3
e. Daily	5/6
f. Hourly or more frequently	1
g. Never	0
14c. In 2023, how frequently is progress against the key performance indicators (KPIs) reviewed by non-managers?	
a. Annually	1/6
b. Quarterly	1/3
c. Monthly	1/2
d. Weekly	2/3
e. Daily	5/6
f. Hourly or more frequently	1
g. Never	0

## Section D - Targets

16a. In 2023, which of the following best describes the main timeframes for achieving targets within this business?	
a. Main time frame is less than one year	1/3
b. Main time frame is one year or more	2/3
c. Combination of time frames of less than and more than one year	1
d. There are no <u>targets</u>	0
16b. In 2023, how easy or difficult is it to achieve these targets?	
a. Very easy - Possible to achieve without much effort	0
b. Quite easy - Possible to achieve with some effort	1/2
c. Neither easy nor difficult - Possible to achieve with normal effort	3/4
d. Quite difficult - Possible to achieve with more than normal effort	1
e. Very difficult - Possible to achieve with extraordinary <u>effort</u>	1/4
16c. In 2023, approximately what proportion of managers are aware of these targets?	
a. All	1
b. Most	2/3
c. Some	1/3
d. None	0
16d. In 2023, approximately what proportion of non-managers are aware of these targets?	
a. All	1
b. Most	2/3
c. Some	1/3
d. None	0
17. In 2023, what are performance bonuses for managers usually based on within this business?	
a. Their own performance as measured by targets	1
b. Their team's or shift's performance as measured by targets	4/5
c. Their site's performance as measured by targets	3/5
d. The business' performance as measured by targets	2/5
e. Performance bonuses are not related to targets	1/5
f. No performance bonuses	0
19. In 2023, what are performance bonuses for non-managers usually based on within this business?	
a. Their own performance as measured by targets	1
b. Their team's or shift's performance as measured by targets	4/5
c. Their site's performance as measured by targets	3/5
d. The business' performance as measured by targets	2/5
e. Performance bonuses are not related to targets	1/5

## Section E - Employment practices

21. In 2023, how are managers usually promoted within this business?	
a. Based solely on performance or ability	1
b. Based partly on performance or ability, and partly on other <u>factors</u> For example, partly based on length of service or business restructuring	2/3
c. Based mainly on factors other than performance or <u>ability</u> For example, length of service or business restructuring	1/3
d. No managers are <u>promoted</u>	0
22. In 2023, how are non-managers usually promoted?	
a. Based solely on performance or ability	1
b. Based partly on performance or ability, and partly on other <u>factors</u> For example, partly based on length of service or business restructuring	2/3
c. Based mainly on factors other than performance or <u>ability</u> For example, length of service or business restructuring	1/3
d. No managers are <u>promoted</u>	0
25. In 2023, on average how many days training and development do managers undertake in a year?	
a. Less than a day	0
b. 1 day	1/4
c. 2 - 4 days	1/2
d. 5 - 10 days	3/4
e. More than 10 days	1
26. In 2023, on average how many days training and development do non-managers undertake in a year?	
a. Less than a day	0
b. 1 day	1/4
c. 2 - 4 days	1/2
d. 5 - 10 days	3/4
e. More than 10 days	1
27. In 2023, which of the following best describes the timeframe that action is taken to address under-performance among managers within this business?	
a. Within 6 months of identifying under-performance	1
b. After 6 months of identifying under-performance	1/2
c. No action is taken to address under-performance	0
d. There are no <u>under-performance</u>	0
28. In 2023, which of the following best describes the timeframe that action is taken to address under-performance among non-managers within this business?	
a. Within 6 months of identifying under-performance	1
b. After 6 months of identifying under-performance	1/2
c. No action is taken to address under-performance	0
d. There is no under-performance	0

# Annex B: Industry aggregations

- **Non-manufacturing production:** B (Mining and quarrying), D (Electricity, gas, steam and air conditioning supply) and E (Water supply; sewerage, waste management and remediation activities)
- **Manufacturing:** C (Manufacturing)
- **Construction:** Section F (Construction)
- **Distribution, hotels and restaurants:** G (Wholesale and retail trade; repair of motor vehicles and motorcycles) and I (Accommodation and food service activities).
- **Transport, storage, and communication:** H (Transportation and storage) and J (Information and communication).
- **Business services:** M (Professional, scientific and technical activities) and Section N (Administrative and support service activities)
- **Real estate:** equals Section L (Real estate)
- **Other services:** P (Education), Q (Human health and social work activities), R (Arts, entertainment and recreation) and S (Other service activities).

# Annex C: Technologies surveyed

- **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.
- **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.