

AI AND YOUR JOB

A report by BCS, The Chartered Institute for IT

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Established in 1957, BCS, The Chartered Institute for IT, is the leading body for those working in IT. With a worldwide membership now of more than 55,000 members in over 100 countries, BCS is the qualifying body for Chartered IT Professionals (CITP).

BCS was incorporated by Royal Charter in 1984. Its objectives are to promote the study and practice of computing and to advance knowledge of and education in, IT for the benefit of the public. BCS is also a registered charity.

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FOREWORD

'MSN fires its human editors' was another in a long line of 'AI will take your job' scare stories. And, as night follows day, the AI made a high-profile error hours later, confusing mixed-race singers from a popular band.

In the MSN story, the processes are not journalists in a recognisable sense, but algorithms used to draw news from other sites. However, worries about job loss – and the subsequent bias in the image selection process – neatly encapsulates the issues facing people as they explore the world of work and tech companies as they try to deploy AI.

This research shows that the opportunity, at least for the present, is for businesses to train their people to work with AI – collaboratively – rather than AI being a source of job loss.

Brian Runciman MBCS
Head of Content and Insight, BCS

1 SUMMARY OF KEY FINDINGS

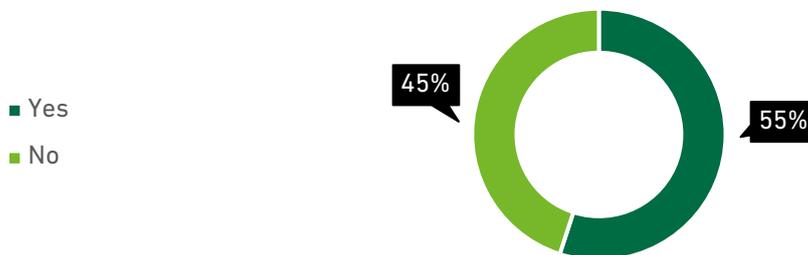
- > 55% of participants claimed that their organisation currently uses AI or machine learning applications.
- > Among those who don't currently use AI, 31% indicated that they have plans to do so. This represents 14% of all organisations represented.
- > Among organisations currently using AI applications, the top two uses are 'assisted or augmented decision-making' (55%) and 'predicting outcomes based on business data' (53%).
- > When adopting AI technologies, the skills that respondents consider to be most difficult to recruit for are data analysis skills (45%), technical skills (44%) and integration to business processes (37%).
- > 45% of respondents using AI indicated that their expectations of its usefulness have been met up to now. 20% felt it hasn't been met and 35% were neutral.

2 AI USAGE

In the free text answers in the survey, current uses made for interesting reading. They were broadly split into emerging disciplines such as driving support, situational awareness, security and AI applications with a longer history, such as computer vision, medical diagnostics, text analytics and scientific modelling.

When asked about the future requirements organisations may have for AI deployment, responses were similar to current usage, but with a lot more emphasis in specific areas. Chief among them were fraud detection and security applications. Also mentioned was user verification in different geographical territories and, in medicine, classification of patient results and automatic diagnosis.

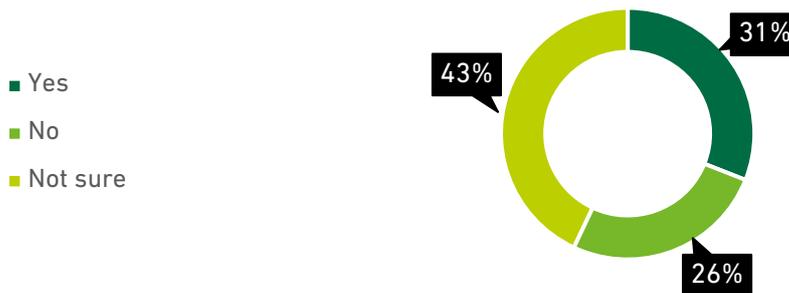
DOES YOUR ORGANISATION CURRENTLY USE ARTIFICIAL INTELLIGENCE (AI) OR MACHINE LEARNING?



Base: all respondents (n=364)

Source: BCS.

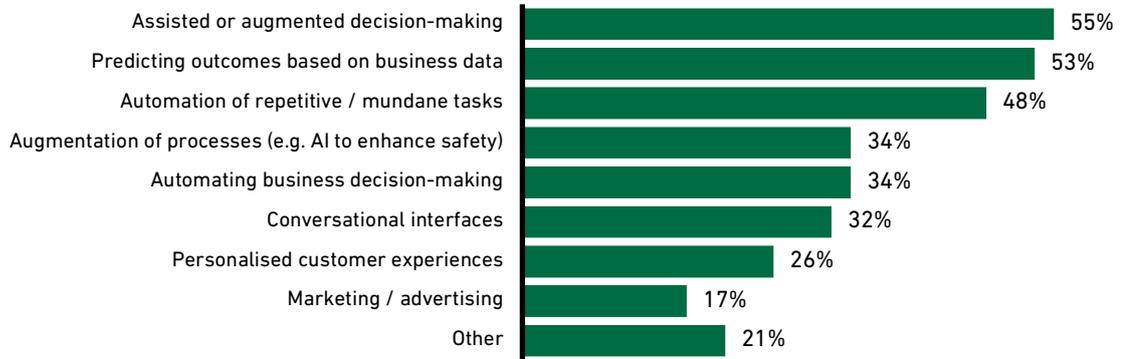
DO YOU HAVE ANY PLANS TO USE AI APPLICATIONS IN YOUR COMPANY?



Base: all who do not currently use AI applications in their company (n=164)

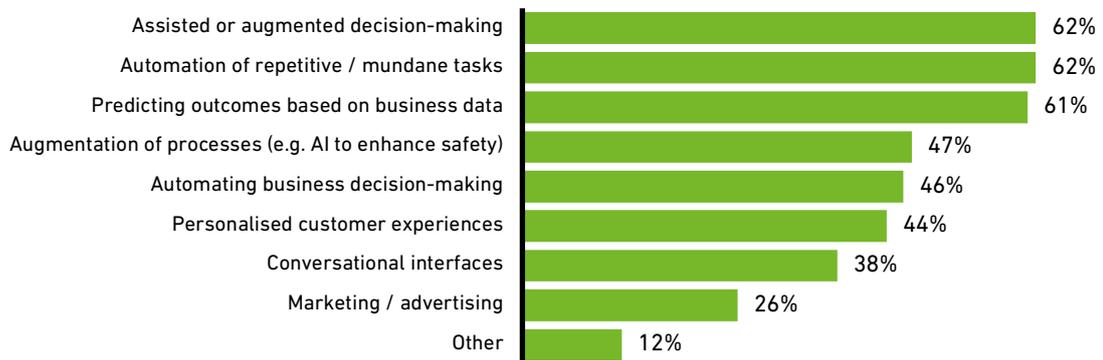
Source: BCS

FOR WHICH OF THE FOLLOWING DOES YOUR ORGANISATION CURRENTLY USE AI APPLICATIONS?
(PLEASE TICK ALL THAT APPLY)



Base: all whose organisation currently uses AI or machine learning applications (n=192)
Source: BCS

WHAT DO YOU THINK YOUR ORGANISATION'S FUTURE AREAS OF INTEREST WILL BE IN RELATION TO AI?



Base: all whose organisation currently uses AI applications or has plans to use it (n=237)
Source: BCS

WHICH OF THESE AREAS DO YOU CONSIDER HAS THE POTENTIAL TO BE MOST BENEFICIAL TO YOUR ORGANISATION? (PLEASE RANK YOUR TOP THREE)

Analysis % Respondents	Total	Not in top three	First choice	Second choice	Third choice
Automation of repetitive / mundane tasks	230	45%	25%	15%	15%
Augmentation of processes (e.g. AI to enhance safety)	230	62%	14%	12%	12%
Conversational interfaces	230	80%	3%	7%	10%
Automating business decision-making	230	75%	8%	9%	8%
Personalised customer experiences	230	77%	8%	8%	8%
Predicting outcomes based on business data	230	52%	16%	17%	15%
Marketing / advertising	230	92%	1%	3%	5%
Assisted or augmented decision-making	230	43%	20%	23%	15%
Other	230	92%	5%	1%	2%

Source: BCS

3 TECHNOLOGIES IN CURRENT USE

We asked respondents what technologies they currently used to create AI services. Some of the answers focused on techniques: multi-agent systems, machine learning, GANs, neural networks, deep learning, robot process automation, Markov chains and so on. The brand-specific answers were:

- > IBM Watson.
- > Microsoft Azure.
- > Tensorflow.
- > Amazon Web Services.
- > Python.

Some also specified that they are developing their own tools, citing some open source alternatives such as AI Algorithms Suite, Red Hat Linux and Spark; programming languages including Java Script, C++ and Scala; as well as standard libraries such as Sci-kit-Learn and Keras. A whole host of other services were namechecked, including Matlab, OS library Pytorch, Seldon Core, Google Coral, Nokia AVA, Kibana Machine Learning and Databricks.

HAVE YOUR EXPECTATIONS OF THE USEFULNESS OF AI BEEN MET UP TO NOW?
 (PLEASE ANSWER ON A 1 TO 5 SCALE, WHERE 1 IS NOT AT ALL AND 5 IS FULLY)

Base % Respondents	
Base	100%
Mean	3.3
Not at all (1) / Fully (5)	
Not at all (1)	4%
2	16%
3	35%
4	34%
Fully (5)	11%

Base: all whose organisation currently uses AI or machine learning applications (n=180)
 Source: BCS

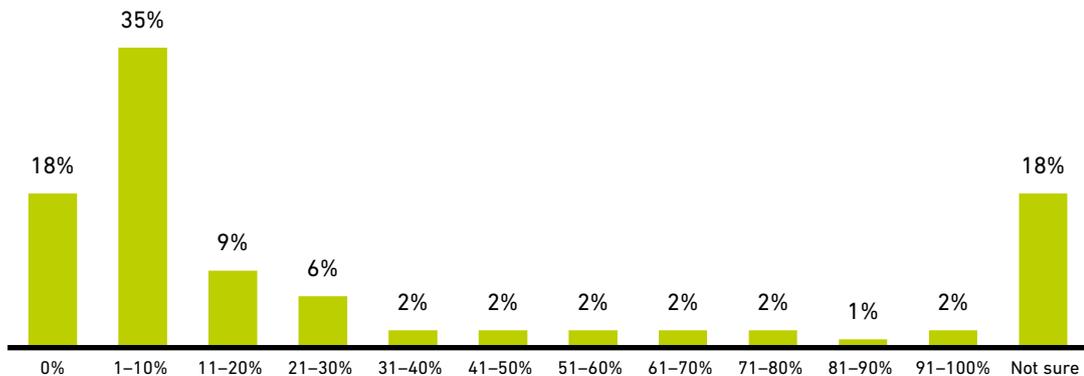
HOW IMPORTANT DO YOU BELIEVE AI WILL BE IN ENABLING YOUR ORGANISATION'S LONG-TERM GOALS?
 (PLEASE RATE ON A 1 TO 5 SCALE, WHERE 1 IS NOT AT ALL IMPORTANT AND 5 IS VERY IMPORTANT)

Base % Respondents	
Base	100%
Mean	3.84
Not at all important (1) / Very important (5)	
Not at all important (1)	4%
2	9%
3	21%
4	33%
Very important (5)	34%

Base: all respondents who answered this question (n=299)

Source: BCS

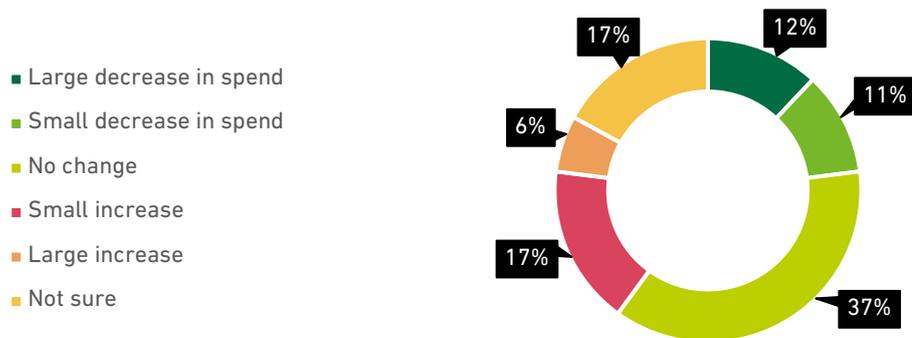
APPROXIMATELY WHAT PERCENTAGE OF YOUR INVESTMENT DOES YOUR ORGANISATION USE TODAY ON AI INNOVATION AND RESEARCH?



Base: all respondents who answered this question (n=266)

Source: BCS

GIVEN COVID-19 MAY IMPACT ORGANISATIONAL REVENUES, HOW DO YOU FORESEE YOUR ORGANISATION'S SPEND ON AI CHANGING OVER THE NEXT 12 MONTHS?



Base: all respondents who answered this question (n=285)

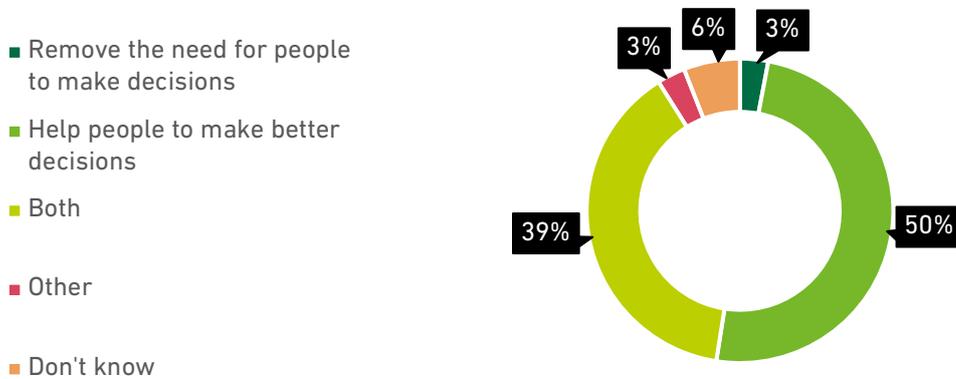
Source: BCS

4 AI AND PEOPLE

Only 3% said they were looking at removing the need for people in the process. 50% cited their motivation being 'to help people to make better decisions,' while 39% went for a combination of the two. These are very top line results, of course, but perhaps indicate that the job panic is still premature.

Those being more specific in their answers seemed to follow the idea that assisting decision-making, or, as one answerer wrote: 'helping people make sufficiently accurate assessments and decisions significantly more efficiently and with less effort,' seemed to be the balance. This was also reflected in the 80% who felt that the more desirable approach to decision-making was augmenting it for people, rather than removing people from that process.

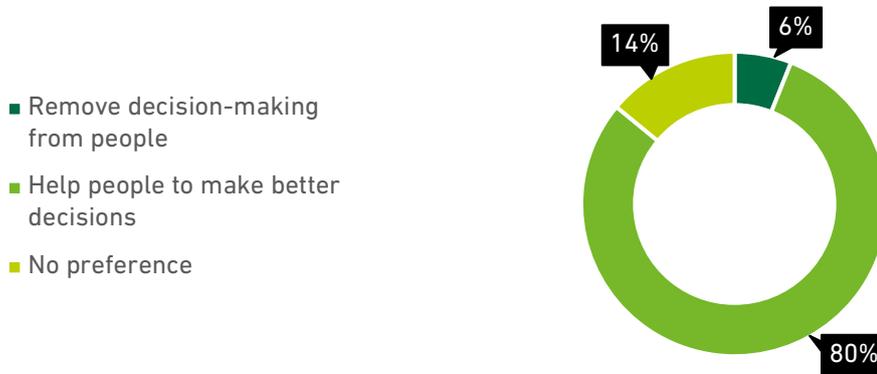
ARE YOU (OR WILL YOU BE) DEVELOPING AI SYSTEMS THAT WILL REMOVE THE NEED FOR PEOPLE TO MAKE DECISIONS OR HELP PEOPLE TO MAKE BETTER ONES?



Base: all whose organisation currently uses AI applications or has plans to use it (n=238)

Source: BCS

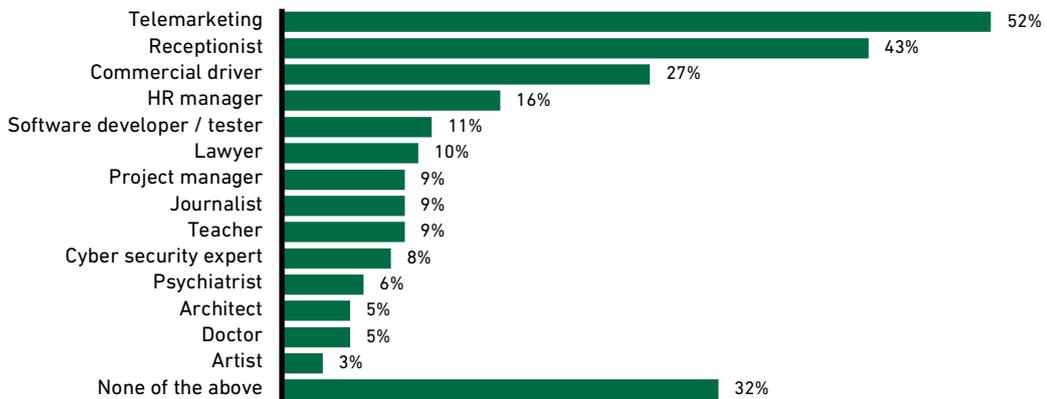
WHICH DO YOU THINK IS MORE DESIRABLE – AI SYSTEMS THAT REMOVE DECISION-MAKING FROM PEOPLE OR SYSTEMS THAT HELP PEOPLE MAKE BETTER DECISIONS?



Base: all whose organisation currently uses AI applications or has plans to use it (n=238)

Source: BCS

WHICH OF THESE PROFESSIONS, IF ANY, DO YOU THINK WILL BECOME OBSOLETE WITHIN THE NEXT 10 YEARS AS A RESULT OF AI? (PLEASE TICK ALL THAT APPLY)



Base: all respondents who answered this question (n=286)

Source: BCS

The above question endeavours to get a feel for changes 10 years out – a big ask. We also asked members which roles they expected to see replaced by AI within five years. Some answerers were adamant that there would be none, with reasons varying from ‘reliable systems need clear architectural decisions,’ to the (perhaps justifiable and very specific) contextual fears of ‘working in nuclear engineering systems.’

However, most respondents expected a shift in working. Said one commenter: ‘I expect people will think that testing can be automated by AI.’ Another remarked that the replacement of roles would consist of ‘almost everything, except where human emotions are involved – caring, sales, cooking.’

4.1 What other roles are in danger?

Some specifics mentioned in the comments included:

- > Call centre staff. Said one commenter: ‘there is a massive opportunity to revolutionise the customer-facing activities in our organisation. From being the first point of contact to contextually sign-posting relevant materials, through to full automation of certain requests, we could both improve user experience and extend support hours without incurring massive additional costs.’
- > Middle management and its attendant roles – planning, survey analysis (irony?).
- > Traditional administrative and clerical roles: claim handling, credit approval, underwriting, stock ordering, receptionists.
- > Junior professional functions such as those in law, accountancy, finance, risk management, trading and book-keeping.
- > Advice services (as one commenter summarised: ‘anything rule-based’): legal, translation checking, finance and HR, data entry.
- > Medical diagnostics, radiology.
- > Crime reporting.

4.2 What about new roles?

Although a long view, we asked commenters to theorise which jobs may be created over the next ten years. In AI itself, as a discipline, there were a number of recurrent themes:

- > AI Auditors.
- > AI specialist developers.
- > AI testing roles.
- > AI detectives (to discover error sources in systems).
- > Application of AI frameworks in industry.
- > AI explainers – for lay audiences.
- > AI ethics auditor.
- > AI model builder.
- > AI algorithm tuner.
- > RPA business analyst.
- > AI standards certification.
- > AI legal specialists.
- > AI body of knowledge curator.
- > Decision interpreter / referee.

4.3 Other roles commenters felt would have a wider remit or see increased demand

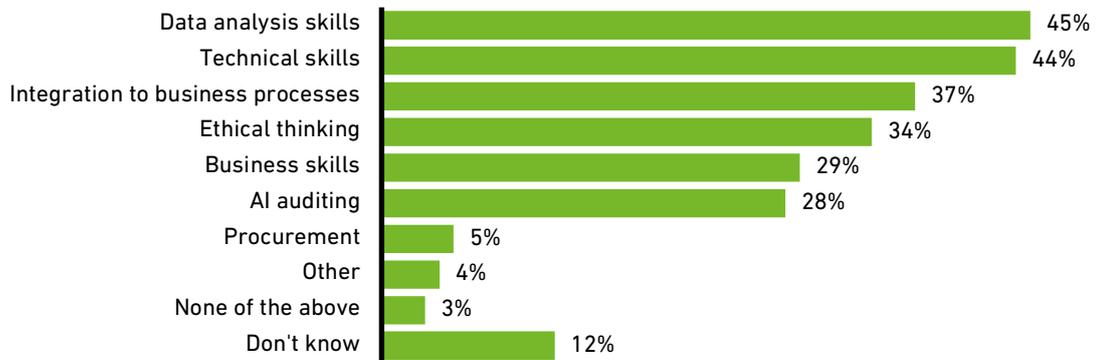
- > Data analysis.
- > Data scientist.
- > Healthcare analysts.
- > Behavioural interaction specialists.
- > Ethicists.

The free text also held some interesting nuggets that reflected the need for creative human thinking in the system, such as: 'conceptual understanding of the art of the possible'; 'understanding the cognitive psychology of decision-making'; 'deep philosophical expertise'; 'identifying which parts of complex systems will benefit from AI automation'.

And, of course, some jobs will come out of AI directly, or see an increase in existing demand, including AI application development, data cleansing experts, bias consultation, resilience analysis in the security context and legacy data expertise.

5 AI AND SKILLS

WHEN ADOPTING AI TECHNOLOGIES, WHICH SKILLS DO YOU CONSIDER ARE MOST DIFFICULT TO RECRUIT FOR? (TICK ALL THAT APPLY)



Base: all respondents who answered this question (n=308)

Source: BCS

This question also garnered some brief verbatim responses. Other skills considered difficult to recruit for today included:

- > Conceptual understanding of the art of the possible.
- > Bioscience backgrounds.
- > An understanding of the cognitive psychology of decision-making.
- > Financial impact awareness.
- > Infrastructure skills (comment: 'there are a lot of coders, but few to build it.').
- > Machine learning model designs.
- > Philosophical expertise.
- > The ability to identify which parts of complex systems will benefit from AI automation.
- > Clinical AI computer science.

We asked participants to comment on the new job functions they envisage will be needed as AI is incorporated into their business practice.

The answers ranged from AI engineers with the ability to integrate machine learning models into production, through to experts in large scale data gathering. The need for abstract thinkers came up again here. Data scientists, although acknowledged as an existing discipline, were again mentioned – clearly being seen as a scarce resource.

Some skills that marry technical expertise with business requirements were also listed, such as business analysts with an understanding of the principles of AI and knowledge of data governance. Hybrid skills were also commonly mentioned: those with security knowledge, autonomous networking knowledge, a general overview of AI, data cleansing expertise and bias consultants.

Some interesting neologisms were suggested. One commenter talked about 'data ingestors' – people to organise, sort and ingest the data. They would feed this to 'data story tellers' who, in turn, are protected by 'data guardians' – they keep the storyteller honest by pointing out flawed conclusions or reasoning.

Many of these skills are already in existence of course. One commenter acknowledged this whilst also saying: 'we really need to see significantly more well-rounded and experienced software engineers – to specialise in AI, modelling and analytics.' Another cited the need for 'tech-savvy middle and senior managers.'

The importance of keeping social and emotional intelligence capabilities in AI teams was also mentioned. Where people with knowledge of sociology, conversation specialists, human / tech interaction designers – all underpinned by a cognitively diverse team – would be important.

5.1 Inter-disciplinary teams

IT has seen the demand for inter-disciplinary teams become more important than ever – and the emergence of AI methods only adds weight to that. So, we asked participants the extent to which they use two or more teams together, including strategic business units, the difficulties that can entail and how they envisage that developing.

TO WHAT EXTENT HAVE YOU USED AN INTER-DISCIPLINARY TEAM APPROACH (I.E. INVOLVING TWO OR MORE TEAMS, INCLUDING STRATEGIC BUSINESS UNITS) IN YOUR ADOPTION OF AI?
(PLEASE RATE ON A 5-POINT SCALE, WHERE 1 IS NOT AT ALL AND 5 IS FULLY)

Base% Respondents	
Base	100%
Mean	3.41

To what extent have you used an inter-disciplinary team approach (i.e. involving two or more teams, including strategic business units) in your adoption of AI?
(Please rate on a 5-point scale, where 1 is not at all and 5 is fully)

Not at all (1)	12%
2	14%
3	16%
4	20%
Fully (5)	27%
Don't know	11%

Base: all whose organisation currently uses AI applications or has plans to use it (n=214)

Source: BCS

A lot of the issues raised in the verbatims on difficulties faced when trying to create an inter-disciplinary team to develop AI applications – unsurprisingly – cross over with the skills gap and general issues that face business. This respondent's comments set the scene:

'There is a 'huge difference between PhD level data scientists and commercial objectives / other team members. Switching to research focused teams / outcome focused teams has helped. Working with teams close to the data and involving them along the way; trying to get rid of the myth elements of what we currently can/cannot do – making sure all teams understand the baseline of the capability. All of these things are really difficult.'

A holistic view came up several times in the comments – the importance of understanding the business as a whole – in terms of business requirements and risk management. This comment is useful here:

'WE HAVE A LOT OF EXPERIENCE IN COLLABORATION AND INTERDISCIPLINARY WORK AND THERE ARE MANY POTENTIAL DIFFICULTIES. MOSTLY, THEY ARE PROBLEMS OF COMMUNICATION, TRAINING, EXPECTATION MANAGEMENT, PERCEPTION OR PERSONAL PREJUDICE.'

These, again, are general business issues rather than AI specific.

A common tech complaint is that high technical enthusiasm competes with low business engagement. One commenter put it this way:

'This leads to over-engineering solutions or establishing requirements not really linked to business objectives. Business wants to 'do AI' so it is seen as 'doing AI' rather than because it considers that it has a requirement to contribute towards achieving business value. This gives engineers the control and can lead to blue-sky approaches with little business return.

'Whilst we track innovation in AI and have a good technical understanding of where it could help us, we are careful that all uses of AI must link back to justified business improvements vs the investment to be made and the risks to be inherited.

'There is little understanding of how to quantify or qualify the risks (especially security risks) of using AI and little work done on certifying or accrediting the use of AI in terms of autonomous systems operating in high risk areas where such assurance is required.'

'It is generally not difficult to find technical engineers, but harder to find people that can incorporate AI use / management into risk management, governance and certification processes.'

Other business-related issues that came up were the prevalence of traditional thinking and the difficulties in overcoming silo working attitudes. Alongside that, it was mentioned that technical people need to 'understand the risk appetite of the organisation.'

When looking at problems with inter-disciplinary teams faced with the tech itself, the most frequent issue was a common understanding what AI is. Many consider it to be misused as a catch-all term and not considered in relation to how it can be applied to business problems. This has led to engagement issues, with some teams 'not being sure of what value this [AI] could add.'

Also mentioned was the 'transition from experimental software to fully engineered production' and an interesting comment on methodology was that 'programmers want to use Agile and Agile doesn't work for data science.'

Finally, soft skills reared their head – with one commenter saying there is a 'lack of non-technical disciplines in the tech business.'

5.2 Some solutions?

What can be done to address some of these issues? The following suggestions are based on comments:

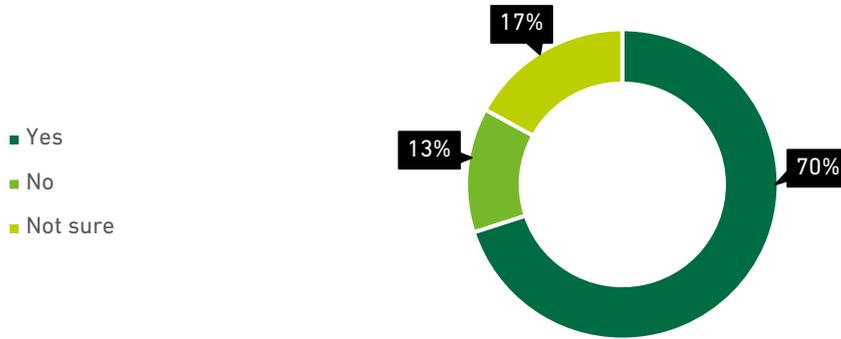
Communication issues:

- > Agree your terminology. A general lexicon of shared terms will, hopefully, lead to a common understanding.
- > Agree your terms. A common organisational strategy is vital to have a joined-up approach to development.
- > Be realistic. Even in technical teams, separate the hype from the reality.
- > Help your leaders. Comment: 'more experienced business leadership does not understand the possibilities and limitations of AI.'
- > Clearly communicate the potential benefits AI can bring in both product and process terms.

The business issues

- > Get the skills balance. Comment: 'a healthy balance between tactical specialists and system-thinkers / soft-system thinkers is all-important.'
- > Define project scopes clearly. Comment: 'teams are excited about using AI/ML and tend to be over-optimistic as to what can be delivered.' The reverse can also be an issue – scepticism).
- > Overcome the fear. Comment: 'starting 25 years ago, I ran projects which involved computer scientists, mathematicians and domain experts for several applications in industry and commerce. The main difficulty was that most managers were unaware of (and even unwilling to consider) the shortcomings and fallibilities of unaided human information processing. Until that problem is overcome, progress has been and will continue to be slow. We are not scared of trucks that carry many more tons over longer distances than we can manage, or of aircraft that can take us further than we travel unaided... Indeed, we accept them and welcome them. However, as soon as an invention outperforms us intellectually or socially, we appear to become fearful and resistant to it. Until most people are educated to an appropriate level in STEM subjects, progress will be slow. Naturally, humans must control that progress, but must do so on the basis of research and reason, not of gut instinct.'
- > Make mental space. Comment: there is a 'lack of bandwidth to be freed from the day job to focus on new initiatives and experiments.'
- > Foster trust. Comment: There is a 'lack of understanding about technology by executive levels. This creates insufficient funding, support and often creates unreasonable expectations and timeframes. Executives need to trust their professionals.'

DO YOU THINK GENERAL STAFF SHOULD BE TRAINED TO WORK COLLABORATIVELY WITH AI?



Base: all respondents who answered this question (n=289)

Source: BCS

AS AN EMPLOYER, HOW IMPORTANT IS IT TO YOUR ORGANISATION FOR YOUR STAFF TO BE ABLE TO EVIDENCE STAFF CAPABILITY THROUGH STANDARDS?

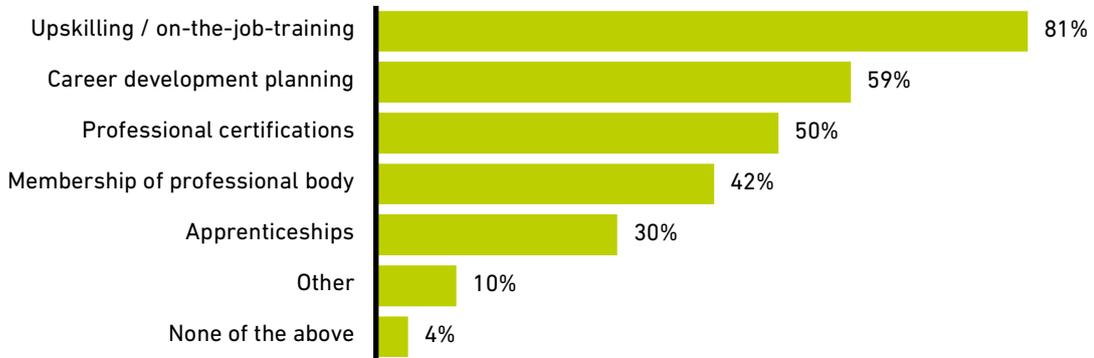
(PLEASE RATE ON A 1 TO 5 SCALE, WHERE 1 IS NOT AT ALL IMPORTANT AND 5 IS VERY IMPORTANT)

Base % Respondents	
Base	100%
Mean	3.37
Not at all important (1) / Very important (5)	
Not at all important (1)	5%
2	9%
3	23%
4	35%
Very important (5)	29%

Base: all whose organisation currently uses AI applications or has plans to use it (n=217)

Source: BCS

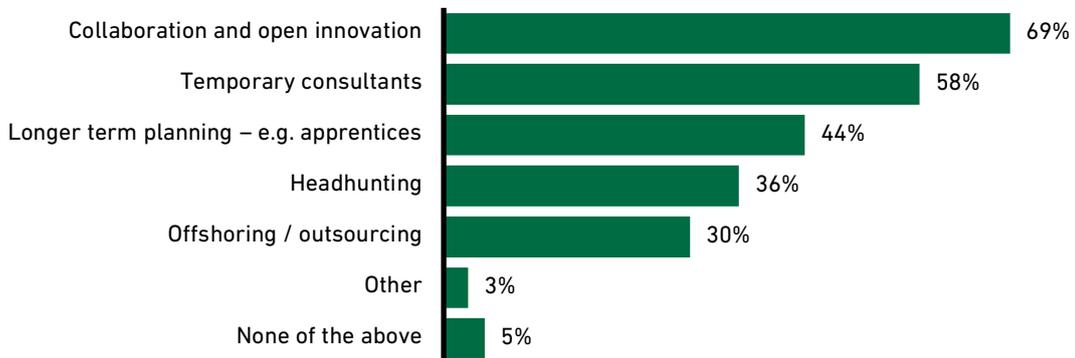
WHICH OF THE FOLLOWING METHODS WOULD YOU USE TO HELP DEVELOP YOUR INTERNAL AI TALENT?
(PLEASE TICK ALL THAT APPLY)



Base: all whose organisation currently uses AI applications or has plans to use it (n=216)

Source: BCS

WHICH OF THESE APPROACHES MIGHT YOU TAKE, IF YOU CONSIDER USING EXTERNAL SUPPORT TO
ENHANCE YOUR AI CAPABILITY? (PLEASE TICK ALL THAT APPLY)



Base: all whose organisation currently uses AI applications or has plans to use it (n=215)

Source: BCS

6 THE ROLE OF GOVERNMENT

As in many countries, the UK government has declared that it wants to make the country a leader in AI. We know the UK has a lot of technology expertise, so we asked commenters what more they expected from government to foster the UK's AI capability. The following are some of those ideas:

6.1 Funding and employment

- > Better funding for training and apprenticeships.
- > Grants, tax relief and hubs in the Midlands and the North.
- > Abolish bodies that don't work such as the Research Councils and target funding directly to universities and researchers.
- > Make coding and associated mathematics a requirement for entering the labour market. Abolish student fees and replace them with grants for studying subjects of national importance. That would include AI.

6.2 Legal and oversight

- > OGC¹ should work with BCS to formulate, publish and evangelise AI best practice.
- > Clarify the legal frameworks.
- > We need AI standards, education and control, perhaps setting up an Ethical Trust codex for AI application.
- > How about a UK version of DARPA²?
- > A strong stance is required on ethical and explainable AI.
- > The government should demonstrate value and trust by using services and embedding them in existing processes e.g. HMRC³, DWP⁴, DEFRA⁵.
- > In order to build up the confidence and trust of the public, AI systems need to be rigorously tested by independent bodies, in realistic scenarios, to gather independent evidence that the technology is safe and predictable. In addition, a regulatory framework should be put in place to provide the robust and formal codes of practice to ensure effective oversight and safeguarding.

¹ Office of Government Commerce

² Defense Advanced Research Projects Agency

³ HM Revenue and Customs

⁴ Department for Work and Pensions

⁵ Department for Environment, Food and Rural Affairs

6.3 Technical and skill issues

- > Encourage open data platforms.
- > Encourage more honest marketing of AI (many things are currently being mis-sold as AI!).
- > Allow more skilled worker visas, especially since the European talent is moving to Berlin.
- > Provide more support for regulatory sandboxes for fintech AI innovation, etc.

6.4 Education

- > We need a greater emphasis on school subjects that provide a good foundation for AI understanding, e.g. computer science, maths, philosophy, biology and psychology.
- > We need to build a common framework to get normal people involved. For example, Hadoop / Spark / Jupyter notebooks require a lot of expertise and understanding. Some of the cloud tools / Elastic have a much lower entry point, they're arguably less powerful but they're actually good enough for a lot of problems. If the government backed a framework that looked across the ingest, store and analyse segments, you could then align roles to that; people could understand the part of it they're interested in and then people could work together to get better value.
- > Make data science more interesting and widely taught. Fund colleges and universities to achieve this.

7 TECHNICAL NOTES

This survey was conducted online by BCS. A total of 364 respondents completed or partially completed this questionnaire during the period 21 May to 9 June 2020. The survey was aimed at both decision-makers and those working in AI tech.

The survey was promoted via a number of means, including direct email invitations to c10,000 members plus an invitation to the BCS Artificial Intelligence Specialist Group.

Percentages quoted are based on the number of respondents who answered each question. This number is indicated on each chart or table, usually as a footer. This will vary from question to question because some questions were put to a subset of respondents, based on their answers to earlier questions in this survey. Also, non-respondents to specific questions are excluded from the base.