

Defence **iQ**

# AI 2020: THE FUTURE OF DEFENCE & SECURITY

Exploring the intelligent enterprise investments, trends and challenges that will impact the defence landscape over the next two years

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Contributor logo

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## Contributors



**Andy Johnston**  
Head of Defence  
Programme  
techUK



**Daniel Fiott**  
Defence Analyst  
European Union Institute  
for Security Studies



**Dr Felix Hovsepien**  
CTO  
Technology Advisor



**Richard de Silva**  
Editor  
Defence IQ

## Author

**Richard de Silva (BA, MA) is the Editor of Defence IQ and quarterly publication 'Defence Industry Bulletin', for which he reports on matters of defence, security and intelligence.**

He is a regular face at leading trade show events, including Eurosatory, DSEi, Farnborough Air Show and the Counter Terror Expo, and has interviewed some of the world's most senior government and military leaders, including Gen. Sir Peter Wall (former CGS, British Army), Gen. Mike Hopton (former commander, USAF Air Combat Command), Lt. Gen. Michael Flynn (former Director, US DIA), VADM Rinaldo Veri (NATO; OUP Naval Commander) and Baroness Neville-Jones (former Chair of the British Joint Intelligence Committee).

He has previously worked for the British Broadcasting Corporation (BBC), IPC Media (now Time Inc. UK) and as an assistant lecturer at Kingston University.

For any questions about this report or the opportunity to collaborate on future Defence IQ content, you can email him on:

[richarddesilva@defenceiq.com](mailto:richarddesilva@defenceiq.com)



## Contributor foreword

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# Introduction

- **44 per cent of defence businesses are at the beginning /planning phase of their AI journey. The industry, however, is changing fast. Seventy one per cent expect intelligent enterprise technologies will have a “significant” impact on the industry by 2020.**
- **Operational decision-making is viewed as the area that is most likely to benefit from AI solutions, but more than half of the industry sees overcoming defence business culture as a major challenge.**

The 21st century, according to sci-fi luminaries such as Isaac Asimov, Arthur C. Clarke and Philip K. Dick, promised a world of humanoid robots, casual space travel and omniscient computers. While many sci-fi tropes have, of course, yet to be fully realised, there is a creeping sense that we are now on the cusp of a technological revolution... worthy of the most starry-eyed of futuristic visions.

Today, with the 2020s peering over the horizon, we are readying for Nasa’s Mars rover mission, commercial trips into orbit, universal translation apps, augmented reality entertainment and cities buzzing with autonomous vehicles. Meanwhile, artificial intelligence (AI), automation, predictive analytics and machine learning are already here – and beginning to up-end the way businesses operate.

For organisations in the defence industry, survival demands adaptation. Those who embrace AI and begin their plans for adoption can now build an advantage over competitors. Those that do not may be left behind altogether. Moreover,

pressure is growing for the defence and security sector to shed its traditional ‘closed-door’ attitude to outsider companies. Innovation can only take hold by removing these barriers and allowing tech companies to become creatively involved in new equipment solutions.

Operational decision-making is widely viewed as the area most likely to benefit from AI solutions, but more than half of the defence industry view overcoming conservative internal culture as a key challenge.

The biggest problem is that while we know change is afoot and exciting opportunities seem in reach, many are in the dark as to what this change looks like and how AI can and will impact the market on a practical level.

The speed of these technological changes is rapidly gathering pace. Our deep-dive research into the defence industry found that 44 per cent of businesses are at the beginning/planning phase of their AI journey. But 71 per cent expect AI and related technologies to be making a significant impact on the industry two years from now.

This report aims to provide a benchmark by probing the immediate challenges, opportunities and potential impact that intelligent enterprise technologies – including AI – will have on the industry.

We use the term intelligent enterprise (IE) to refer to the suite of new technologies that are revolutionising how companies operate, both internally and externally.

- **Artificial intelligence (AI)**
- **The ‘internet of things’ (IoT)**
- **Robotic process automation (RPA)**
- **Machine learning**
- **Data analysis procedures (such as predictive analytics and cognitive computing)**

Around 100 defence and security professionals from around the globe, including engineers and scientists, took part in our in-depth research which looked at:

- **The IE applications that will have the most impact on businesses by 2020**
- **What stage businesses are on their AI journey and where they want to be by 2020**
- **The biggest challenges for organisations to implementing IE in their business and what can be done to overcome them**
- **Business readiness for investment in AI**
- **Solution providers organisations are currently looking at to work with**
- **...And much more.**

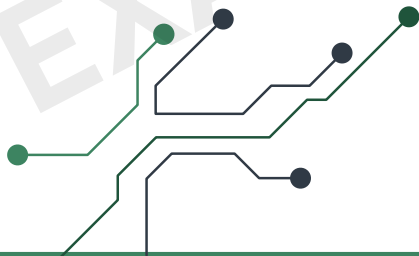
This report has been produced ahead of Defence AI Week, a five-day digital event taking place on 4-8 December, 2017, which will offer more insight from experts into the near-future impact of AI on the defence industry.

# Key takeaways

## Journey



Not only is there keen interest in artificial intelligence and associated technologies, but many businesses involved in defence are undertaking internal transformation to glean the benefits. However, time is short. While the majority [71 per cent] of the industry believes intelligent enterprise will be playing a significant role in defence by 2020, only 3 per cent claim to have so far established their programmes, with two thirds still at the starting line. This suggests a wave of businesses will be left behind the curve within the next three years unless action is taken to speed up adoption.



## Trends



Artificial intelligence topped the list of IE technologies expected to have the biggest impact on the defence industry by 2020, with over half of respondents buying into the hype. AI is not a 'new' technology but word of the benefits of recent, advanced developments are reaching an audience.

Cognitive analytics also ranked highly, under which AI (and sometimes machine learning) is applied to traditional data analysis. Businesses are keen to exploit massive advances in High Performance Computing, primarily when it comes to simplifying conventional processes.

Notably cost-cutting is not the main driver. Instead, an overall effort to modernise businesses is the primary goal, with organisations expecting to build a competitive edge by streamlining activities and getting products or services to the market more quickly than ever.

## Challenges



The defence industry boasts some of the most advanced technology in the world – supported by Big budget government- and military R&D projects. However, it is also notorious for having some of the longest lead-times for delivery to the end-user, with military equipment frequently becoming entangled in competition, bureaucracy, lawsuits and rapidly evolving requirements. Likewise, traditional defence companies are often resistant to changes in process or partnering with non-conventional defence parties. All in all, this culture is deemed to be the biggest danger to advancing intelligent enterprise. Many businesses will need to re-evaluate how they operate and begin committing to new ways of thinking.



## Investments



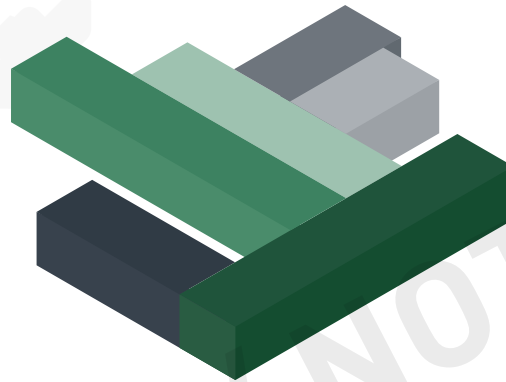
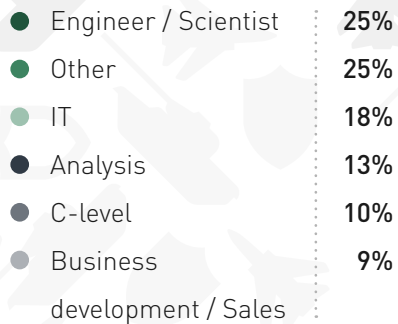
Most of the industry is aware of the business rationale behind IE and AI implementation but about 16 per cent have begun to actively invest in the technology. Meanwhile, around one third of the industry is now shortlisting options and requesting supplier proposals, while another third have a desire to move forward but see their plans stymied by "other priorities". Integration with existing infrastructure and legacy systems is the biggest barrier to investment for more than a third of organisations at the present time. Therefore, despite an appetite for advancement, the slow rate of change and adaptation across the industry as a whole may prove to be an even bigger hindrance than cost or ROI analysis in the long-term.



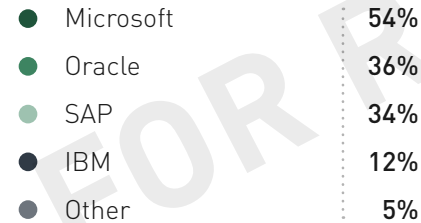
# About the research

Around 100 global defence professionals, from business leaders to engineers, took part in our in-depth research into the intelligent enterprise landscape and the impact of AI as the next driver of change within the defence industry. Here is a brief breakdown of the participants.

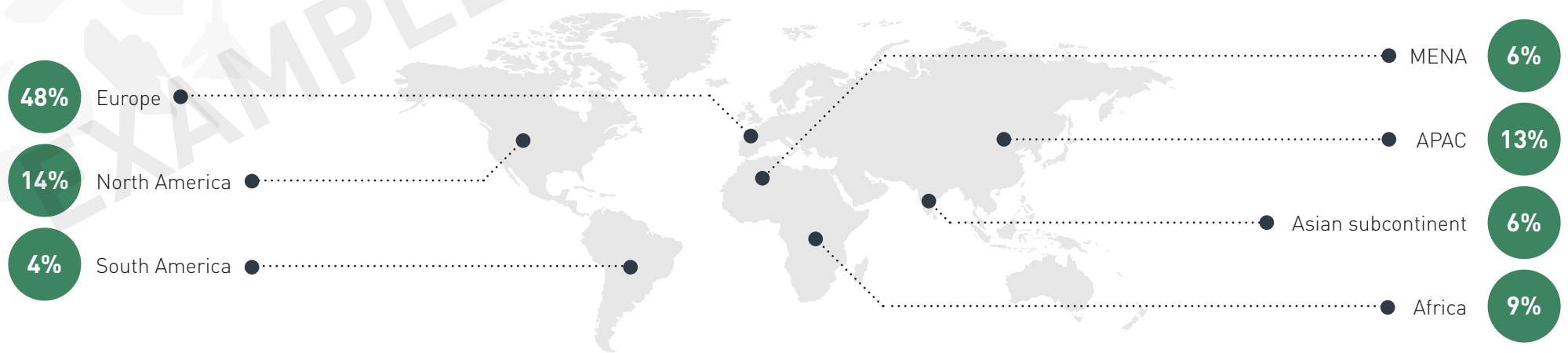
Which title best describes your current role?



What legacy ERP system do you currently operate?



In which region are you based?

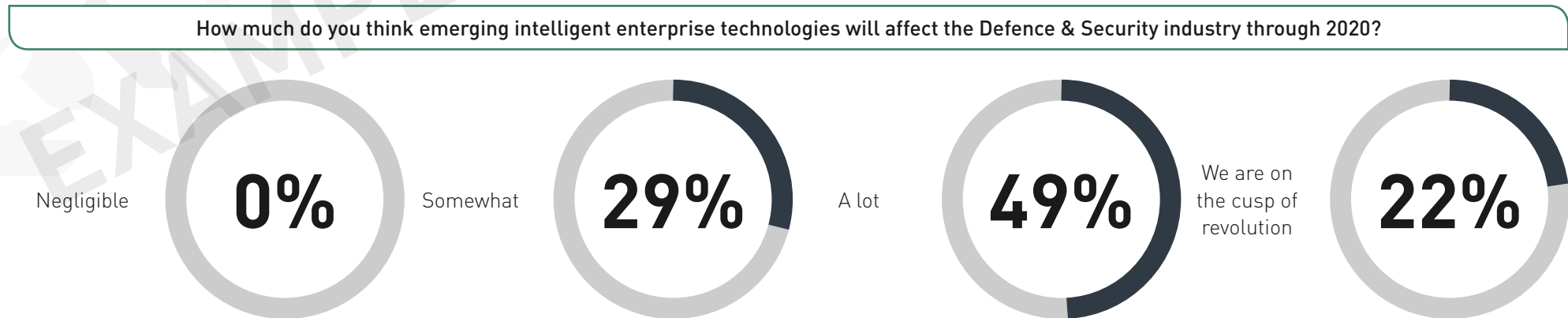
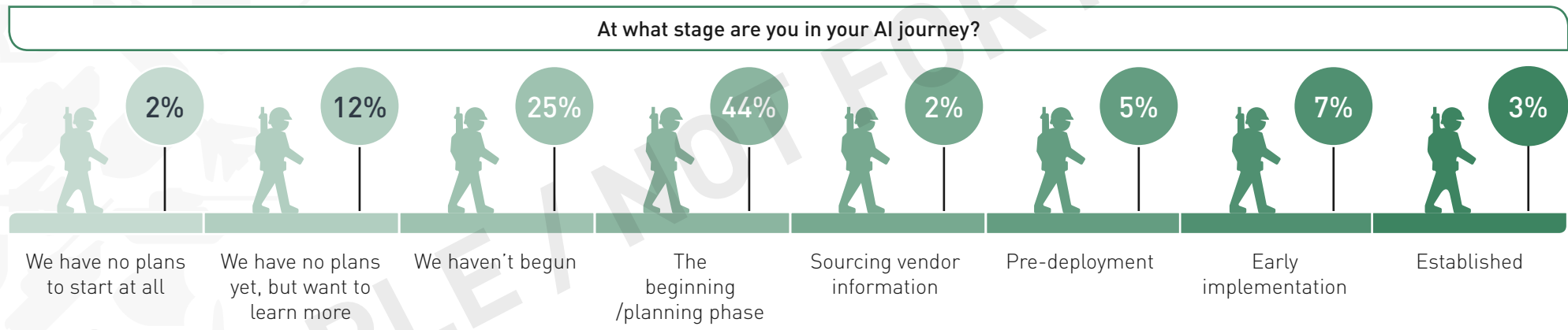


# AI 2020: The journey

Not only is there keen interest in artificial intelligence and associated technologies, but many businesses involved in defence are undertaking internal transformation to glean the benefits. However, time is short. While the majority [71 per cent] of the industry believes intelligent enterprise will play a significant role in defence by 2020, only 3 per cent claim to have so far established their programmes, with two thirds still at the starting line. This suggests a wave of businesses will be left behind the curve within the next three years unless action is taken to speed up adoption.

More than two thirds [69 per cent] of defence organisations with plans to undertake development in IE are now in the beginning/planning phase of their AI rollout or have yet to begin. Only 2 per cent of organisations have no plans or interest in beginning this journey.

Our starting point was finding out exactly where organisations are on their AI journey today.

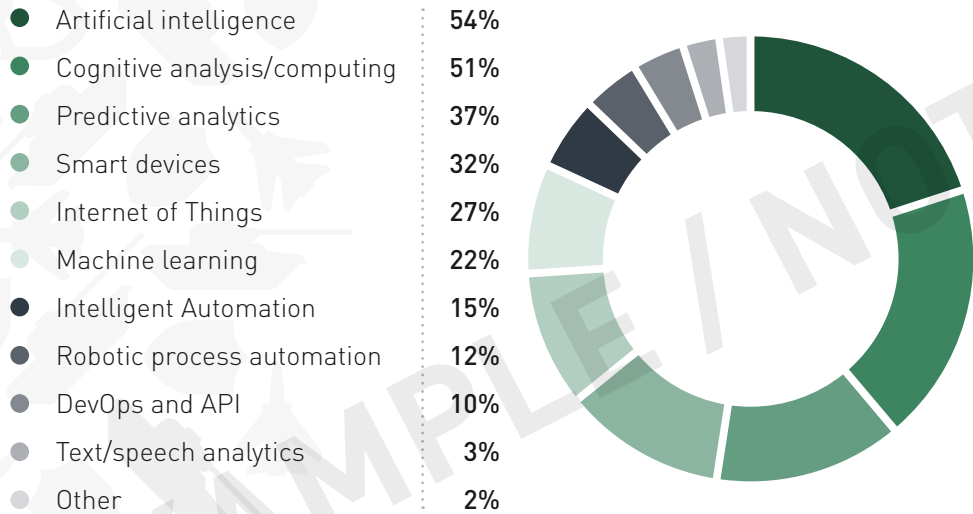


# AI 2020: The trends

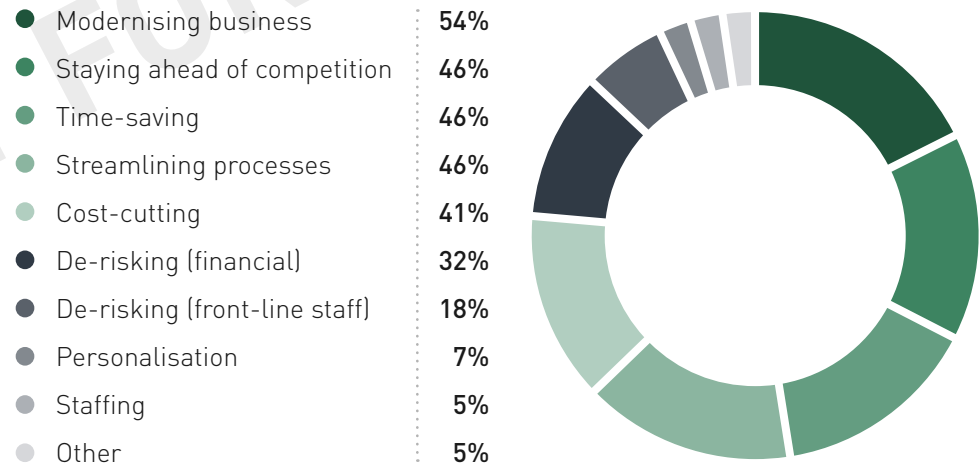
Intelligent enterprise spans a range of technologies that is upending how companies operate internally and externally. But which of these fast-developing technologies will have the most significant impact on the defence industry in the next few years. Which one will cause the most change and disruption to the way organisations operate? We asked our community for their predictions.

Artificial intelligence, cognitive analysis and predictive analytics are the IE applications that will have the biggest impact on defence organisations by 2020

What intelligent enterprise areas do you think will have the most significant impact on your business?



Where do you think it could have the most significant impact on your business?



Artificial intelligence topped the list of IE technologies expected to have the biggest impact on the defence industry by 2020, with over half of respondents buying into the hype. AI is not a 'new' technology but word of the benefits of recent, advanced developments is reaching an audience.

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\*Respondees could choose up to three options.



# AI 2020: The challenges

While it is encouraging to see that many are anticipating a raft of benefits from AI adoption, there remain significant barriers for the defence and security sector. Our research delves into the biggest obstacles – and the possible routes to overcoming them.

The biggest barriers to AI progression are building an accommodating internal culture, keeping up with the rapid changes in technology, and upgrading/working with legacy systems.

## What are the biggest challenges in implementing AI in your organisation?

- Culture 59%
- Rapid changes in technology 39%
- Upgrading/working with legacy systems 37%
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- Linking initiatives to ROI 34%
- Competing priorities 34%
- Recruiting the right people 29%
- Gaining senior management buy-in 27%
- Getting maximum value from investment 19%
- Assigning internal responsibility 15%
- Other 5%
- Lack of suitable vendors 2%



## What could help you to overcome these challenges?

- Industry research 24%
- Case studies 22%
- More budget 18%
- A clearer view of the vendor market 17%
- Training 12%
- Other 7%



The defence industry often boasts the most advanced technology in the world, sometimes backed by government- and military-funded R&D projects. However, it is also notorious for having some of the longest lead-times for delivery to the end-user, with military equipment frequently becoming entangled in competition, bureaucracy and rapidly evolving requirements. Likewise, traditional defence companies are often resistant to

changes in process or partnering with non-conventional defence parties. All in all, this culture is deemed to be the biggest danger to advancing intelligent enterprise. Many businesses will need to re-evaluate how they operate and begin committing to new ways of thinking.

# AI 2020: The investments

We have looked at the top trends across IE and AI ahead of 2020 as practitioners predict the biggest changes that will impact their organisations and the wider defence industry. But what is their actual business readiness when it comes to staying ahead of their competitors and industry disrupters? And what barriers to investment are hampering their efforts to move onto the next stage on their journey?

Integration with existing infrastructure and legacy systems is the biggest barrier to investment for over a third of organisations.

## How would you define your business readiness for investing in AI/IE?

- Aware of the business rationale and inactive – interested but other priorities taking precedence 35%
- Aware of the business rationale and actively starting to shortlist – aware of the main themes and starting to desktop research 27%
- Unaware of the business rationale and inactive – not interested at this time 12%
- Aware of the business rationale and actively sending out RFP to a range of vendors 10%
- Already investing and will be looking to invest further in the 12 – 24 months 9%
- Already investing and will be looking to invest further in the next 12 months 7%



## What do you see as the biggest barrier to investment in AI/IE?

- Integration with existing infrastructure/ legacy systems 37%
- How quickly it can demonstrate an ROI 20%
- Lack of understanding of which solution area to focus on 17%
- Stakeholder buy-in 12%
- Price 10%
- Other 4%



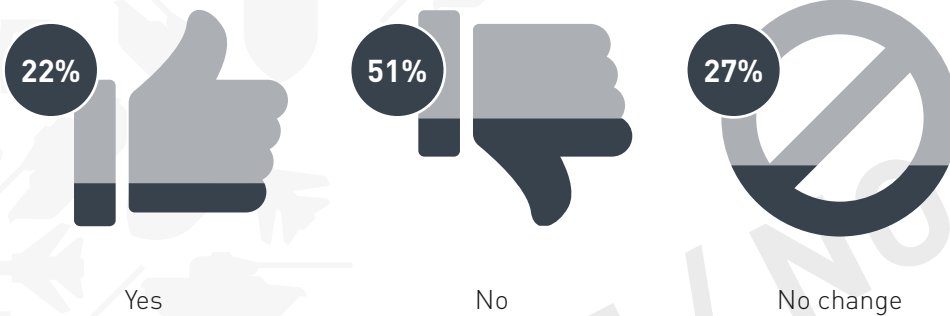
Most of the industry is aware of the business rationale behind IE and AI implementation but only around 16 per cent have begun to actively invest in the technology. Meanwhile, around one third of the industry is now shortlisting options and requesting supplier proposals, while another third have a desire to move forward but are seeing their plans stymied by “other priorities”. Integration with existing infrastructure and legacy systems is the biggest barrier

to investment for more than a third of organisations at the present time. Therefore, despite an appetite for advancement, the slow rate of change and adaptation across the industry as a whole may prove to be an even bigger hindrance than cost or ROI analysis in the long-term.

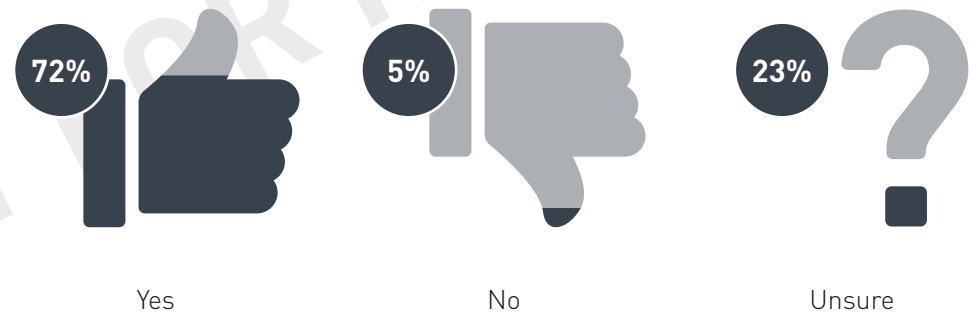
# AI 2020: The investments

AI is commonly seen as a threat to jobs given the widespread possibilities for automation. However, in opening up new areas of business, the advent of this technology may also create new job opportunities. The defence industry lies more on the optimistic side, while the vast majority are confident IE will save their organisations money over the next five years.

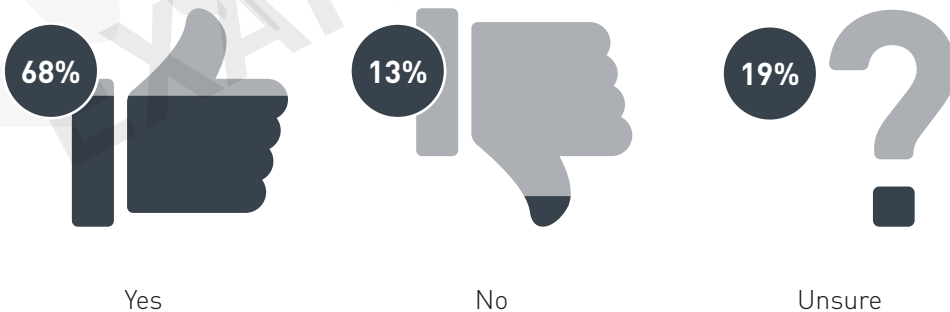
Do you expect intelligent enterprise to significantly cut jobs in the Defence & Security industry through 2020?



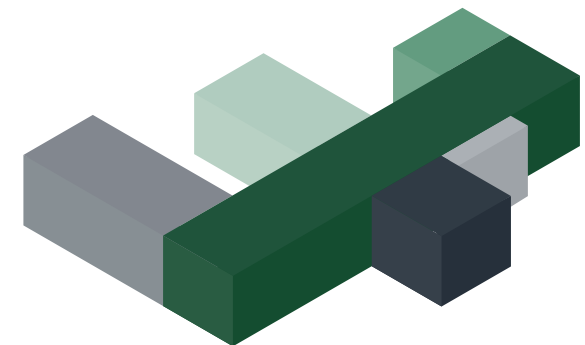
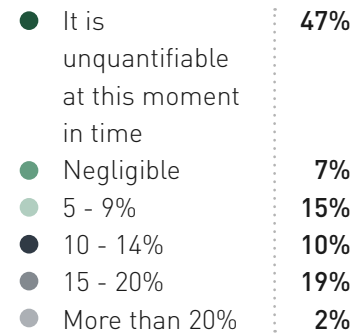
Do you think intelligent enterprise will create more jobs in new areas of this industry by 2020?



Can intelligent enterprise applications save your company money in the next five years?



...If yes, how much could it save?



## Contributor article

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## What this tells us: A European perspective

The survey results reveal a gap between the rhetoric and reality around the role AI could play in the security and defence sector. Rhetorically, most survey respondents believe that the so-called AI revolution will save them time and money in the future. Industry is also clearly excited about the potential of AI and how it may positively affect the security and defence sector. A majority feel that AI could help reduce costs, streamline business and help with business modernisation.

The real issue to focus on, however, is the reality of how far industry is prepared to capitalise on the AI revolution. Most respondents explain that they are only at the beginning phases of understanding what benefits AI could bring, and, to the extent that they are, the main focus is on using AI as a tool to help with decision making and analysis. I was quite surprised to learn that most respondents did not feel that AI could play a role in manufacturing and logistical processes. My expectation was that businesses would use AI for data and analysis and production, but that does not appear to be the case at present.

What I was not surprised to learn, however, relates to the major inhibitors behind a lack of uptake on AI. The need to change business culture, rapid changes in technology and competing priorities are obvious reasons behind a delayed response to AI. I think that the survey also reveals some interesting concerns about AI. First, industry – much like military planners – is unclear about how AI could be integrated into existing infrastructure and legacy systems. Second, it is still unclear how AI will affect employment

in the security and defence sector. Indeed, while respondents feel that AI will create more jobs across the whole of the economy there is less confidence in AI's ability to create jobs in the security and defence sector.

“**Business culture in the security and defence sector needs to take stock of the potential of AI in a more practical sense... dedicated financing of and commitment to research is clearly required.**”

For European industry, therefore, it is clear that the business culture in the security and defence sector needs to take stock of the potential of AI in a more practical rather than general sense. This change in culture will not come about alone. Not only does AI represent a clear need for civilian and military sectors to learn more closely from one another, but dedicated financing of and commitment to research is clearly required. New financial instruments at the European level may well assist firms in looking at the potential of AI, but such instruments mean little without national governments and defence planners also investing time, energy and resources into understanding and investing in the potential afforded by AI. I expect European firms to first start using AI (such big data modelling, robotics, IoTs) to help with production and marketing processes. However, whether AI will be used to improve Europe's military effectiveness is a debate that is still in its infancy.

### Author



Daniel Fiott joined the European Union Institute for Security Studies (EUISS) in late 2016, where he analyses European defence policy and defence industrial issues. Prior to this, he worked for four years as a researcher at the Institute for European Studies at the Free University of Brussels (VUB) (2012 -2016). At the VUB he analysed and lectured on various aspects of European security, including defence industrial issues more specifically.

From 2014-2016 he served as a fellow of the Research Foundation – Flanders (FWO). He was awarded this prestigious scholarship for his research on European defence industrial cooperation. In 2016 he was awarded the IISS' 'Palliser Prize' for his work on EU-NATO cooperation. Daniel was educated at the University of Cambridge and the Free University of Brussels (VUB).

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## Industry impact: The UK perspective

It is clear that 'intelligent enterprise' and the associated technologies offer both industry and the defence customer a wealth of new opportunities in terms of military capability. However, it can be argued that although they may eventually offer significant operational advantage in the coming decades, the most effective use of such technologies in the short term may be that of regular enterprise management.

The UK Defence industry and the Ministry of Defence deal with huge amounts of data on the performance of equipment, provision of services, performance of contracting mechanisms, and commercial processes. It is here, within the mountains of under-utilised data, insufficient skills, time, resources, and siloed working that intelligent enterprise could make an immediate effect. The benefits that have been brought to private sector enterprises through utilisation in logistics, business management and even human resources could be equally as effective in Abbey Wood, Whitehall, and across the front line commands.

A cultural shift to integrate new ways of working and to utilise technologies are complex processes that require strong leadership and a demonstrable benefit to the end-user within good time. Defence procurement in the UK has a unique culture that is not instantly compatible with intelligent enterprise or some technologies that operate efficiently at pace and scale. However, integrating process automation and

intelligent data analysis into the daily lives of those tasked with managing existing programmes and projects could yield big results. Here UK industry can pull from experiences in other markets and use that experience to guide civil servants towards a more efficient way of working.

“  
Defence procurement in the UK has a unique culture that is not instantly compatible with intelligent enterprise.  
”

Changes in this part of the Defence ICT estate would result in two major changes in the workforce. Firstly, civil servants would have increased scope in their roles to conduct more analytical activities, looking to improve the service that is provided rather than just delivering what is set. Secondly, integration of new technologies would bring in new companies and their associated skills base into Defence. A fresh injection of outsider influence at a time of pressures on Defence spending and increasingly frequent technology challenges such as cyber-attack would be a great addition to the industry.

### Author



Andy Johnston is responsible for leading the Defence Programme at techUK, the UK's technology trade association representing companies and technologies that are defining today the world that we will live in tomorrow'. On behalf of industry members he works to form strategically valuable relationships with areas of the Ministry of Defence (MOD) responsible for and reliant on ICT and emerging technologies.

Andy holds an MA in Intelligence and International Security from King's College London and a BA in International Relations and Strategic Studies from Lancaster University. His studies included UK defence procurement policy, security and political risk analysis and research into security approaches to the global narcotics trade. Before joining techUK Andy worked in Higher Education as a Student Adviser and Development Officer.

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# AI definitions: A timeline

What actually is 'artificial intelligence'? Are we all speaking the same language? Felix Hovsepian, PhD, explains the history of the term – and why it matters...

1688

The history of AI dates back to Gottfried W. Leibniz (as in the man who invented calculus). In 1673 Leibniz designed and built the world's first 4-function numerical calculator. This inspired him to have a vision of a universal language 'Characteristica Universalis' and a machine that would automate reasoning 'Calculus Ratiocinator', much like a numerical calculator automates arithmetical operations.

1929

The famous logician Kurt Gödel enters the picture. Gödel spent many years studying the research papers left behind by Leibniz, and he is convinced that the vision Leibniz had for creating a universal language and a reasoning machine was a viable project.

Kurt Gödel was a friend of Albert Einstein at the Institute of Advanced Study in Princeton. Einstein once mentioned to a friend that his own work no longer meant much, and that he only travelled to the Institute so that he would have "the privilege of being able to walk home with Gödel". This quotation exposes the intellectual calibre of this quiet reclusive man.

1936

Alan Turing enters the scene and according to this biographer, Andrew Hodges, Turing began thinking about AI during the period that he was working on his famous paper on 'On Computable Numbers, with an application to the Entscheidungsproblem'. Turing introduces the concept of a "Turing Machine" in this paper.

The earliest evidence we have of Turing's involvement in AI are the recollections from those who worked with Turing Bletchley Park. For example, Donald Michie recalls:

"Arriving at Bletchley Park in 1942 I formed a friendship with Alan Turing, and in April 1943 with Jack Good. The three of us formed a sort of discussion club focused around Turing's astonishing "child machine" concept. His proposal was to use our knowledge of how the brain acquires its intelligence as a model for designing a teachable intelligent machine." [1]

1950

Turing publishes his seminal paper entitled 'Computing Machinery and Intelligence' [2]. In this paper Turing states:

"Most of the programmes which we can put into the machine will result in its doing something that we cannot make sense (if at all, or which we regard as completely random behaviour. Intelligent behaviour presumably consists in a departure from the completely

## Author



Felix Hovsepian is a consulting CTO with a focus on R&D and AI. He holds degrees in mathematics and a PhD in Computer Science (Artificial Intelligence). He spent four years as a Research Fellow undertaking research in AI and Automated Reasoning, and more than a decade as a professor of Informatics at Western International University. He has designed and built enterprise-level document imaging systems for multi-national companies, x-ray imaging systems for dentists for a global dental products company where he served as the CTO, and a biometric system that won an award for innovation from the British Government.

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disciplined behaviour involved in computation."

Further:

"It can also be maintained that it is best to provide the machine with the best sense organs that money can buy, and then teach it to understand and speak English.

## AI definitions: A timeline

This process could follow the normal teaching of a child.”

This last paragraph is significant, because it indicates that Turing was not thinking in terms of intelligent algorithms, or intelligent software, but intelligent machines that at the very least possessed ‘sensors’, which it could use to ‘observe’ its environment.

1956

John McCarthy together with Marvin Minsky, Claude Shannon and Nathan Rochester organize the infamous ‘Dartmouth Conference’, during which McCarthy coins the term “Artificial Intelligence”. Here is the summary for the proposal that was submitted for this conference:

“The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.”

1973

During the ‘Lighthill Debate’ [3] John McCarthy provides the following definition for the term ‘Artificial Intelligence’: “Artificial Intelligence [AI] is a science; it is the study of problem solving and goal achieving processes in complex situations.”

“

**We are not attempting to emulate the human mind, but rather build a system that we, as human beings, would recognize as ‘intelligent’.**

”

McCarthy further states:

“It [AI] is a basic science, like mathematics or physics, and has problems distinct from applications and distinct from the study of how human and animal brains work.”

2017

The current managing director of Microsoft Research’s main Redmond Lab, Eric Horvitz, provides a more modern definition of AI, as:

**“... the scientific study of the computational principles behind thought and intelligent behaviour”** [4]

Moreover, Horvitz states the four main pillars of AI as:

- Perception
- Learning
- Natural Language Processing
- Reasoning

While it is very common to find articles and papers that mention the first three of these pillars, it is quite rare to find popular articles that mention reasoning, despite the fact that it is now considered to be the next big challenge.

These are by no means the only people who have played a key role in the development and evolution of this fascinating field. For example, I did not mention Warren McCulloch, the leading pioneer of neural networks. But my intention here was to introduce a few of the key figures of the field, and distinguish this field from the evolution of ‘computers’ that has its own history and timelines. I also wished to introduce the definition for the term ‘artificial intelligence’ that John McCarthy presented in 1973, because the phrase “distinct from the study of how human and animal brains work” is significant – we are not attempting to emulate the human mind, but rather build a system that we, as human beings, would recognize as ‘intelligent’.

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