Capgemini

DIGITAL CULTURE

CAPGEMINI'S VIEWS ON WHERE THE DEFENCE SECTOR WILL BE IN 2026

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CONTENTS

PURPOSE:

To explore the pressures and trends impacting the defence industry and how world class digital and IT capabilities can drive cost efficiency, delivery predictability, long term growth and sustained cultural adoption.

"OF COURSE THE 'GRAD' CAN DO IT."

I want to open this report with a challenge to the defence industry. I won't steal the thunder from the many experts who have authored it, but it's safe to say technology continues to leapfrog every challenge in its path. Most industries, from sport and retail to life sciences and board games, are finding a way to adjust to this change.

Marketing's request to put a new CD player onto the seven aircraft Concorde fleet heralded the beginning of my career as an British Airways Avionics Engineer. Simple in-flight entertainment, nothing safety related here, that's a job for the young lad - the grad, right? Fourteen trips on Concorde to New York and back, I was the envy of the team.

Many years later and I'm the last to volunteer to fix my mother's iPhone – that's what the grandkids are for – but my Concorde mission cemented my curiosity for getting creative with technology to make a long-lasting impact. A curiosity I've been free to explore with Capgemini across multiple sectors, but most recently in the defence industry.

Yes, one could argue the defence sector has the biggest technology challenge of all, due to its understandable complexity – security, speed-to-market, and the design, build and in-service costs – but it also has the greatest obligation. To provide the very best to those facing danger every day. And increasingly that 'very best' must include the most advanced technology the world can offer, and the most up-to-date digital capabilities available. The challenges presented by various state actors are clear and present.

To meet these challenges and our obligations, everyone involved in each stage of the defence supply chain must become committed partners in a new digital culture, a culture of curiosity where we explore the digital landscape, tirelessly searching for the best new digital tools and services. A culture too of responsibility, where we use these digital solutions to help improve the delivery of our own and others' products and services. A culture of boldness where we strive to overcome the constraints we love to hate. In essence, an overarching digital culture where each of us champions technology advances, interprets and applies them for ourselves and our organisations, and are embraced as leaders of change.

In this report, learn how changes across the digital landscape are impacting the defence sector and the opportunities they offer our use of traditional IT and more up-to-date operational and engineering equipment. Discover how best to deal with, and take advantage of, the wealth of data and information this equipment generates. Finally, understand the changes we, as custodians of this information, should make to accurately define the digital capabilities that support our customers and citizens, and how we can and should power towards a digital culture that will deliver a better service for us all.

But first, I will hand you over to Rob Bell – ultra-athlete, adventurer and engineering presenter – to share some insightful historical context and his unique perspective on the Fourth Industrial Revolution.

SIMON MACWHIRTER
Global Account Executive,
Vice President, Capgemini

IN *ANY* INDUSTRIAL REVOLUTION, IT'S THE PEOPLE THAT COUNT

ROB BELL

Ultra-athlete, adventurer and engineering presenter

In the heart of rural Shropshire there's an open-air living history museum called Blists Hill that gives you a flavour of life in an industrialised Victorian community at the turn of the 20th century. Its tranquil setting and surrounding greenery now mask the indelible heavy scars etched deep into the landscape borne from a period of unstoppable technological and societal change – and whose effects were felt the world over.

It was here about 300 years ago where Abraham Darby I, British ironmaster and foundryman, led the first industrial revolution with the lease of a blast furnace to develop cheaper methods for producing a higher quality iron. Coupled with other technological advancements at around the same time, such as the steam engine and the mechanisation of manufacturing processes – particularly within the textile industry, the industrial revolution sparked irreversible change for the economy and population of Britain.

This era of rapid progress was made possible by a number of visionary protagonists. And whilst some innovations may appear to have been created in isolation, it feels to me that many educated engineers and scientists throughout this period must have been conscious of a powerful wave of evolution and transformation that fuelled their work.

As a predominantly mechanically-minded engineer, the first and second industrial revolutions of the 18th and 19th centuries are of huge interest to me. And when reading this report, I couldn't help but make comparisons between the challenges and advantages of embracing change, as we enter what's become known as the Fourth Industrial Revolution – specifically for those individuals and organisations working in the defence industry and its supply chains.

MOVE FAST AND BE RIGHT EVERY TIME

Most notable for me is the difference in speed and versatility allowed by the adoption of data harnessing and digital technologies to generate new ideas and experiment with multiple options simultaneously, before bringing the right solutions to life in the physical world. In the analogue world, it took 60 years for James Watt to introduce world-changing efficiencies to Thomas Newcomen's steam engine.

Additionally, design enhancements won't rely on the flawed notion of learning from our mistakes. These benefits become increasingly attractive for the defence industry where traditionally the time and cost to bring new, state-of-the-art products and services to market have been infamously large, and where failure can cost lives.

Unsurprisingly, industry performance metrics were somewhat limited during the First Industrial Revolution, and progress often came about by accident rather than design. Impactful digitisation of defence supply chain and operations demands reliable and coordinated data gathering and processing.

And armed with the right tools, defence engineers and analysts can be much more reactive to live events, giving a competitive edge both in theatre and in the marketplace. Ideas and solutions can also be continuously refined – again increasing security and tactical advantage.

EMPOWERING VISIONARY CREATIVITY

But the potential benefits of digitisation do not come from technical capability alone. A fundamental shift in mindset and culture towards new ways of working is also required – at both the individual and organisational level. I'm reminded of the rebellious movement within the rapidly developing textile industry of the early 19th century, where a failure to adapt led to an unfortunate end for the Luddites.

Above, I mentioned the visionaries of engineering progress from centuries past and the likes of Brunel, Telford and Stephenson come to mind. One big difference in the modern defence industry is that through an empowered workforce – encouraged to experiment, with access to the right information and data, and armed with the right tools – visionary creativity can come from anywhere and at any time, not just from the Chief Engineers with the biggest hats. And whilst a change in culture will undeniably require senior leadership, there's a need for all players at all levels to fully understand and value their role in the continuous development of data gathering, data quality, data manipulation and solution implementation.

Success will come through coordinated planning of human resources and through detailed organisation of workstreams and data flows up and down the supply chain, working closely, in a joined-up way with internal and external partners.

Finally, what underpins all of the above is people. It's all too easy to assume that with the advancement of technology like AI, the role of individual talent and human intuition diminishes. This revolution will only work for the defence industry with the appropriate investment in skills and in the recruitment of talented people with diverse backgrounds and inventive ways of thinking to exploit the technological assets.

Digitisation is already happening at speed, in retail, automotive and entertainment industries. If the UK defence industry is to maintain an upper hand against the range of global threats, whose methods and means are becoming ever more complex and unpredictable, then from this report – researched and written by industry experts – it feels to me that it cannot afford to lose any time before implementing its recommendations.

In reading this report, I'm sure you too will find yourself making comparisons between this new age of digital defence engineering and your own areas of interest or experience. As an outsider, it looks like there's an enormous and complex task ahead. But the prospect of continuing the legacy of past industrial revolutions, stamping huge change on the world and fostering enhanced prosperity, sustainability and, crucially, security for humankind – well, that's an incredibly exciting challenge, isn't it?

CHAPTER 1 – WHAT ARE THE PRESSURES THAT DRIVE THE BUILD OF DEFENCE PRODUCTS?

MIKE DWYER

Head of Intelligent Industry, UK Centre of Excellence, Capgemini

Pressure and competitive advantage come full circle, strategic defence needs are changing rapidly, the defence supply network must adapt to deliver with pace, agility, and certainty in a digitally accelerated world, where new native talent is critical to success.

THE THREAT IS CHANGING

The Rt Hon Ben Wallace MP says that: "The first duty of Government is to defend our country and to keep our people safe."[1] The UK, USA and other allies across the Five Eyes and NATO must be constantly ready to counter current and future threats. These threats and pressures are emerging at an ever-increasing rate, whether due to the geopolitical climate, the need for a continuous at-sea deterrent (UK CASD), or ever-evolving terrorist capabilities and agendas. Keeping safe means being at the forefront of defence capability, to have a fundamental competitive advantage at home, and in theatre when necessary. Resources are becoming more scarce and costly, with associated supply chain volatility. To maintain the advantage, resilient and adaptive supply networks are required that can "prepare for unexpected events, respond to disruption and recover from them by maintaining the continuity of operations."[2]

The UK MOD is investing in nuclear submarines, tanks, naval fleets, aircraft, drones, satellites, and a digital transformation of defence. In 2021 and 2022, the UK MOD spent £45.9bn[2] on services and acquisitions (2.3% of UK GDP in 2022). The Dreadnought and SSNR programmes and FCAS/GCAP are major components of UK strategic spend, alongside cyber defence.

CAPABILITIES	🇬🇧 UK	🇺🇸 US	🇦🇺 AUSTRALIA
DEFENCE BUDGET	• In 2023, UK Defence Secretary demands an increase in the defence budget of between £8bn and £11bn over five years	• US Department of Defense (DoD) estimated a USD816bn budget for the year 2023 and has maintained the edge in technology over its rivals	• Australia's defence budget was AUD48.6bn for 2022-23, a 7.4% YoY increase. Australia is increasing its defence ties with US due to Chinese military threat
SUBMARINES	• In May 2022, the UK Government announced £2bn investment in new nuclear submarines • Four UK built nuclear submarines will be introduced in the 2030s under Dreadnought programme • £10bn investment by MOD for the whole delivery	• By 2031, the US plans to build 12 submarines under submarine construction programme • Under this program, the US started building advanced Columbia-class SSBN. The programme will last until 2080s, cost USD110bn in complete nuclear submarine fleet renewal	• Planned to acquire nuclear-powered submarines under AUKUS deal with US and UK • Australia will get at lease eight submarines from either the US or the UK, at a cost of ~AUD17bn before 2040
NEXT-GEN AIRCRAFT	• Tempest is a sixth-generation combat aircraft being developed for Royal Air Force. The UK is expected to invest £2bn in the project by 2025 • In December 2022, UK merged Tempest programme with Italy and Japan for shared fighter jet, expected to be in service by 2035	• The NGAD is a United States Air Force (USAF) sixth-generation air superiority initiative, replacing Lockheed Martin F-22 Raptor by 2030s • In March 2022, USAF submitted USD1.7bn budget for FY 2023 for sixth-generation combat aircraft	• Australia still needs to commit to acquiring a sixth-generation crewed combat aircraft • Australia should consider investing in partnerships on the next generation of air combat systems
NAVAL FLEETS	• Planned to invest £38.1bn for naval fleet over the next 10 years under Defence Equipment Plan • In November 2022, UK ordered five anti-submarine warfare frigates for £4.2bn • Planning to bring in Type 83 destroyers in the late 2030s	• US planned to expand its naval fleet to over 500 ships by 2045 amid a strategic rivalry with China • US Navy planned for a fleet of 373 manned ships by 2045, supported by 150 unmanned surface and underwater vehicles	• In January 2023, Australia planned to purchase advanced sea mines and will invest AUD1bn on procuring high-tech underwater weapons • In January 2023, the Australian Government signed a contract with Kongsberg to deliver the Naval Strike Missile
BATTLE TANKS	• 148 Challenger 2 tanks will be upgraded by Rheinmetall BAE Systems Land (RBSL) to Challenger 3 tanks, at a cost of £1.3bn • Challenger 3 tanks equipped with the modern capability will be delivered to British Army by 2040	• General Dynamics is building the next-generation US military tanks, the AbramsX • AbramsX is light-weighted, 50% more fuel efficient with hybrid electridiesel engine and less costly with AI feature to identify targets	• In 2022, Australia signed a contract with US to replace the 59 M1A1 AIM Abrams with 75 M1A2 SEPv3, scheduled for delivery beginning in 2024
DIGITAL TRANSFORMATION	• In June 2022 the MOD published its new Defence Artifical Intelligence (AI) Strategy with aim of transforming UK defence into an AI-ready organisation • In 2022, the UK Government announced investment of £2.6bn in cyber and legacy IT over the next three years	• In March 2022, the US DOD asked for USD11.2bn in cyberspace activities funds for 2023 • In 2022, US national defense spending bill recommends boosting the DOD's spending of AI for cybersecurity	• In 2022-23 budget the Australian Government planned to invest AUD9.9bn over the next 10 years in new national cyber and intelligence capabilities through a REDSPICE programme

The US Department of Defense is investing similarly in nuclear submarines (SSBN ~USD110bn), next generation interceptor (~USD17.7bn), cyberspace (additional USD11.2bn for 2023) and cloud adoption (USD38.6bn) amongst other major programmes, such as the B-52 refit.

The Australian Defence Force (ADF) is planning to invest in nuclear submarines, with potential investment of AUD181bn. In parallel, in 2022-23, the Australian Government plans to invest AUD9.9bn over the next decade in new national cyber and intelligence capabilities through a REDSPICE programme. For many nations, huge investment in major defence products and services typically mandates international collaboration. Major multinational programmes, such as AUKUS and FCAS/GCAP, will be under significant conflicting pressures to be:

- technologically competitive
- cost-non-dilutive for large numbers of nations
- workshare respecting
- national political interest supportive
- supply network partner integrative
- secure and sustainable by default

THEY MUST BE FASTER, MORE COST COMPETITIVE AND DELIVER A STEP CHANGE IN PERFORMANCE THROUGHOUT THEIR LIVES, FOR BOTH CUSTOMERS AND END-USERS.

In theatre operations are changing rapidly, while the exploitation of information rich real-time technology delivers advantage and agility. Significant numbers of today's products and services are already potentially out of date.

At sea, traditional platforms such as submarines, aircraft carriers and frigates are still required, but their role is being challenged by new threats such as hypersonic missiles and nuclear armed torpedoes. In the air, aircraft, drones and other assets must be intelligently tasked and connected for greater mission effectiveness. Threats on the ground are more complex, with actors that we don't necessarily understand or have adequate intelligence to counter. Economic and material threats are emerging, as actors align in new ways to hamper or block supply chains and limit access to critical resources. Finally, the role of skilled forces personnel is changing as levels of integration and mission envelope increase, leading to enhanced training and operational readiness.

Thus, new and more complex innovation and delivery pressures exist that we, as the defence supply chain, must adapt to through new ways of thinking, intelligence gathering, information processing and digital and physical equipment provisioning.

DATA MUST BECOME INFORMATION – FASTER AND MORE EFFECTIVELY

It's not 'need to know' anymore, it's 'need to share'. Data is everywhere, in every conceivable format and state. Whilst security restrictions mandate segregation of data, we need to traverse these complex and disparate data sets to create understanding and actionable intelligence, to enable the best and most appropriate decisions during all phases of the product and service lifecycle.

The UK MOD's defence digital[3] and data[4] strategy papers acknowledge mistakes on previous large capital equipment programmes, where integrating data intensive products and services happens on a piecemeal basis. Now the MOD is expecting whole-lifecycle integration, so the sharing of system information will be transparent and cohesive, rather than restricted. This openness will inform a 'collaborative ecosystem' to serve a common customer, such as the MOD and Armed Forces.

Building on this idea, the concept of the 'Connected Theatre' is not new. For instance, Integrated Submarine Engagement relies on data fusion and intelligence across a mixed asset platform. However, the ability to hyper-connect assets and skilled operators to command and control and back into the supply chain is a real proposition, powered by data from theatre tasking, reconnaissance, maintenance, quality, supply chain and design records. The defence supply chain must get ready for this, or potentially be left behind, as interoperability, extensibility, cybersecure delivery and digital integration become driving forces of defence acquisition.

AGILITY IS YOUR ONLY COMPETITIVE ADVANTAGE

Dr. Will Roper famously said: "In today's era of volatility… The only sustainable advantage you can have over others is agility. Because nothing else is sustainable; everything else you create, somebody else will replicate."[6]

Defence products and systems are hugely complex and now intermeshed with other complex assets to form the Connected (or Integrated) Theatre. While the skilled personnel using them are highly competent and motivated, they need to know they're receiving accurate, trusted and secure information to make key decisions at the right time, in the right place.

Unfortunately, new defence products and systems take time to design, build and deploy – and are ordered in

relatively limited numbers. They require huge investment and come with complex supply chains and procurement needs. In some cases, a lack of investment in integrated digital capabilities and acceleration of delivery versus availability certainty has created cost overruns and operational underperformance.

Goals:
- Increased operational flexibility and response times
- Reduced through life cycle costs
- Increased asset utilisation

Challenges:
- Continuous service bulletins and engineering changes
- Constantly changing complex product and infrastructure asset configuration
- Complex large-scale datasets and performance analytics
- Planned and unplanned maintenance
- Synchronisation of the physical and digital supply chains
- Asset management through the lifecycle centring on the boat, systems and dockside infrastructure

However, digital expectation is accelerating. The daily experiences of the civilian consumer world are applying pressure to defence's approach to data science, information management, digital competencies and integrated delivery. Being leading edge means continuous improvement, investment and upskilling. Formula1[7] teams don't win by chance, they win by targeting the right hardware, software and information investment to maximise the team, drivers, and vehicle performance.

GREAT PRODUCTS AND SERVICES DELIVERED TO OUR CUSTOMERS AND END USERS

The defence supply chain network is under pressure to deliver national competitive advantage. We foresee the likelihood of shrink-wrapped or black-boxing products, resulting in the MOD buying outcome-driven services rather than products. The subsequent digital footprint of the product will therefore need to be transparent, and be the currency to transact, as opposed to hardware plus services - a potential natural evolution of 'mission-ready management services'.

We currently measure greatness through availability and performance (on time, on budget, and to the required quality standards). We must adapt that view to incorporate acceleration, upgradeability and adaptability. To do this, we must leverage our collective ability to engineer product and system capabilities that incrementally improve both physically and digitally throughout their lifecycle – including recycle or disposal. Digital improvement and mission readiness must be a continuous flow from the defence supply chain to the end-user, and back again.

Therefore, organisations must be as digitally enabled, if not more so, than the products and services they put into field. The digital culture necessary for this is powered by new skills and energised around a common purpose.
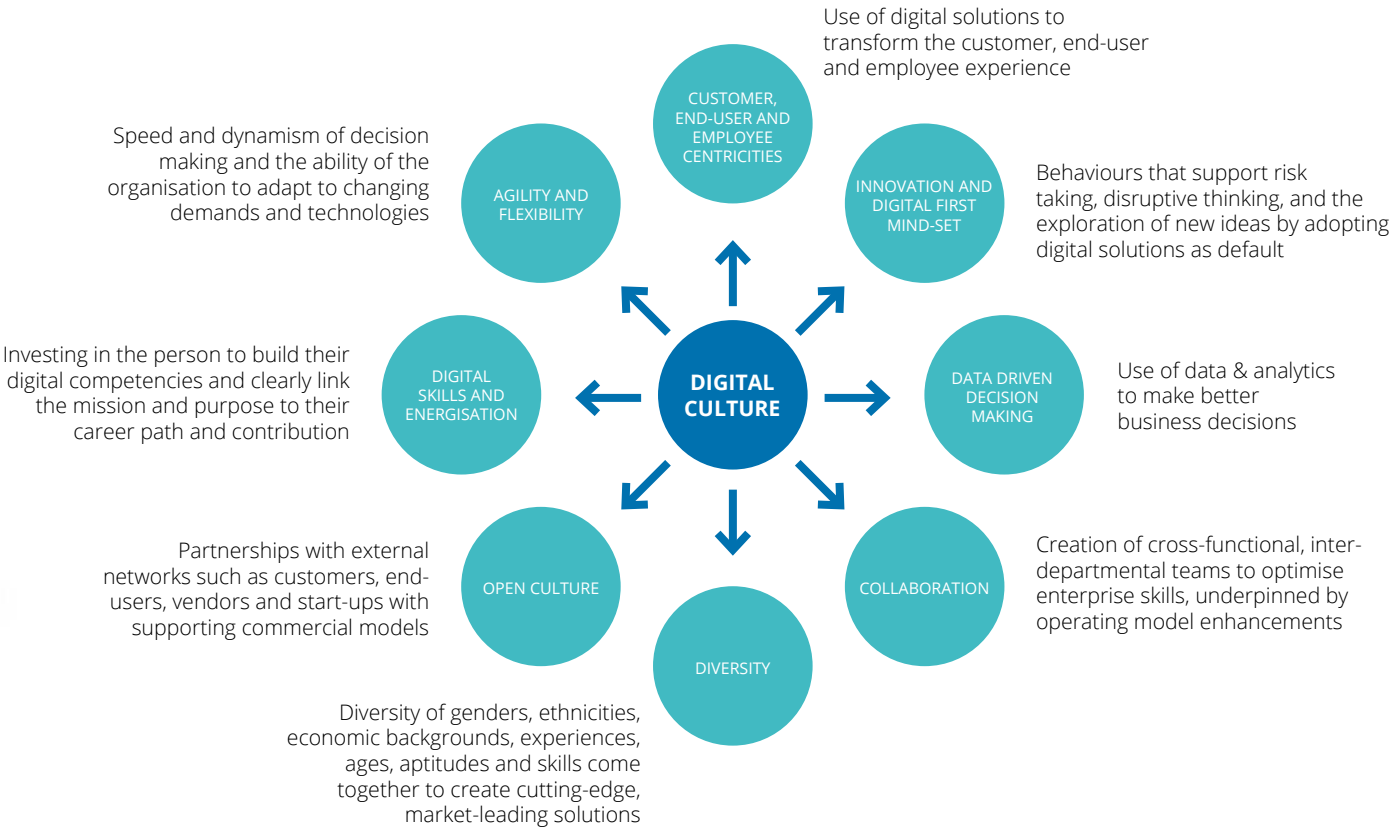
YOUR WORKFORCE MUST BE SKILLED AND ENERGISED TO DELIVER

We foresee programmes such as the FCAS/GCAP[8] platform and the tripartite AUKUS will become part of a multinational 'information first' system-of-systems, i.e. the realisation of cross-asset, end-to-end supply chain and forces information sharing. Therefore, it will be mandatory to digitally augment the supply chain, to enable better decisions, use less resources, reduce errors and increase product and system competitive advantage. We must energise our current and future workforces to embrace digital culture and be native in emerging technologies and ways of working, thereby maximising gains from shopfloor to end user.

DIGITAL CULTURE IS THE KEY

Digital culture is founded on eight principles, as shown in this diagram.

To be leading edge and create national competitive advantage, we must accelerate our collective investments in new skills[9] and foster a digital culture that delivers our strategic interests. We must embrace new ways of working, outcome-based commercial models, and corresponding organisational structures – all supported by value-driving core functions and digital IT services.

Use of digital solutions to transform the customer, end-user and employee experience

Speed and dynamism of decision making and the ability of the organisation to adapt to changing demands and technologies

Behaviours that support risk taking, disruptive thinking, and the exploration of new ideas by adopting digital solutions as default

Investing in the person to build their digital competencies and clearly link the mission and purpose to their career path and contribution

Use of data & analytics to make better business decisions

Partnerships with external networks such as customers, end-users, vendors and start-ups with supporting commercial models

Creation of cross-functional, inter-departmental teams to optimise enterprise skills, underpinned by operating model enhancements

Diversity of genders, ethnicities, economic backgrounds, experiences, ages, aptitudes and skills come together to create cutting-edge, market-leading solutions

CUSTOMER, END-USER AND EMPLOYEE CENTRICITIES

AGILITY AND FLEXIBILITY

INNOVATION AND DIGITAL FIRST MIND-SET

DIGITAL SKILLS AND ENERGISATION

DIGITAL CULTURE

DATA DRIVEN DECISION MAKING

OPEN CULTURE

DIVERSITY

COLLABORATION

We see this as an integral part of our competitive advantage and corporate culture. We deliver world-class engineering services[14] and business transformations that are fundamentally powered by digital and data excellence. This mandates that a diversity of genders, ethnicities, economic backgrounds, experiences, aptitudes and skills come together to create cutting-edge capabilities that solve existing problems and find solutions to new business and engineering challenges.

DIGITAL CULTURE – IT'S UP TO US

As leaders and experts, we must add to our own skill sets and adapt the organisational culture around us. If you are a CIO, should you be the Chief Digital Officer? If you are a Chief Engineer or Operations Director, how much digital innovation, experimentation and development have you built into your delivery plans?

How are you providing opportunities for your digital stars to use new connected methods, tools and data to push the envelope on better-faster-cheaper insight, planning and delivery? Collectively, we must change our approach to reward and recognition to compete in an aggressive talent market[15]. More expensive talent means what? An opportunity for better retention, investment in skills and business capabilities? Or greater motivation to perform, move faster and digitally deliver the excellence needed in the Connected Theatre? Having the talent pool accessible is great, but not investing in and sustaining careers means we'll continue to lose skills to those organisations offering more attractive packages and career paths.

The bottom line is this: To meet the changing threats and needs in our industry, we must have a workforce that's suitably skilled, energised and agility-enabled – which can only be achieved by investing in our digital cultures. We must create a digital culture that embraces changes in both engineering technology and information technology, and integrates them both.

THE GENERATION GAP MUST BE CLOSED

We must collectively mitigate the generational gap and talent war running in all sectors of the UK economy[12]. The UK Institute of Engineering and Technology wrote to the UK Government to highlight that there are 173,000[11] engineering places open, with no concerted plan to address this. This is a national issue not just a defence industry problem, creating significant pressure on our ability to research, design, supply, build, operate and maintain our critical defence platforms and products. Availability of talent is directly affecting the availability of capability. To mitigate this, the UK's largest defence supplier, BAE Systems, has made a commitment to take on more than 3,000 apprentices, with a focus on the person not just the CV to develop the critical skills needed to fulfil their order book and growth ambitions[12].

At Capgemini we hire, on average, 800 to 1,000 digital new starts and returners every year. We have fulfilled our 2021 promise, following COVID-19, to create 1,500 new digital roles in the UK[13].
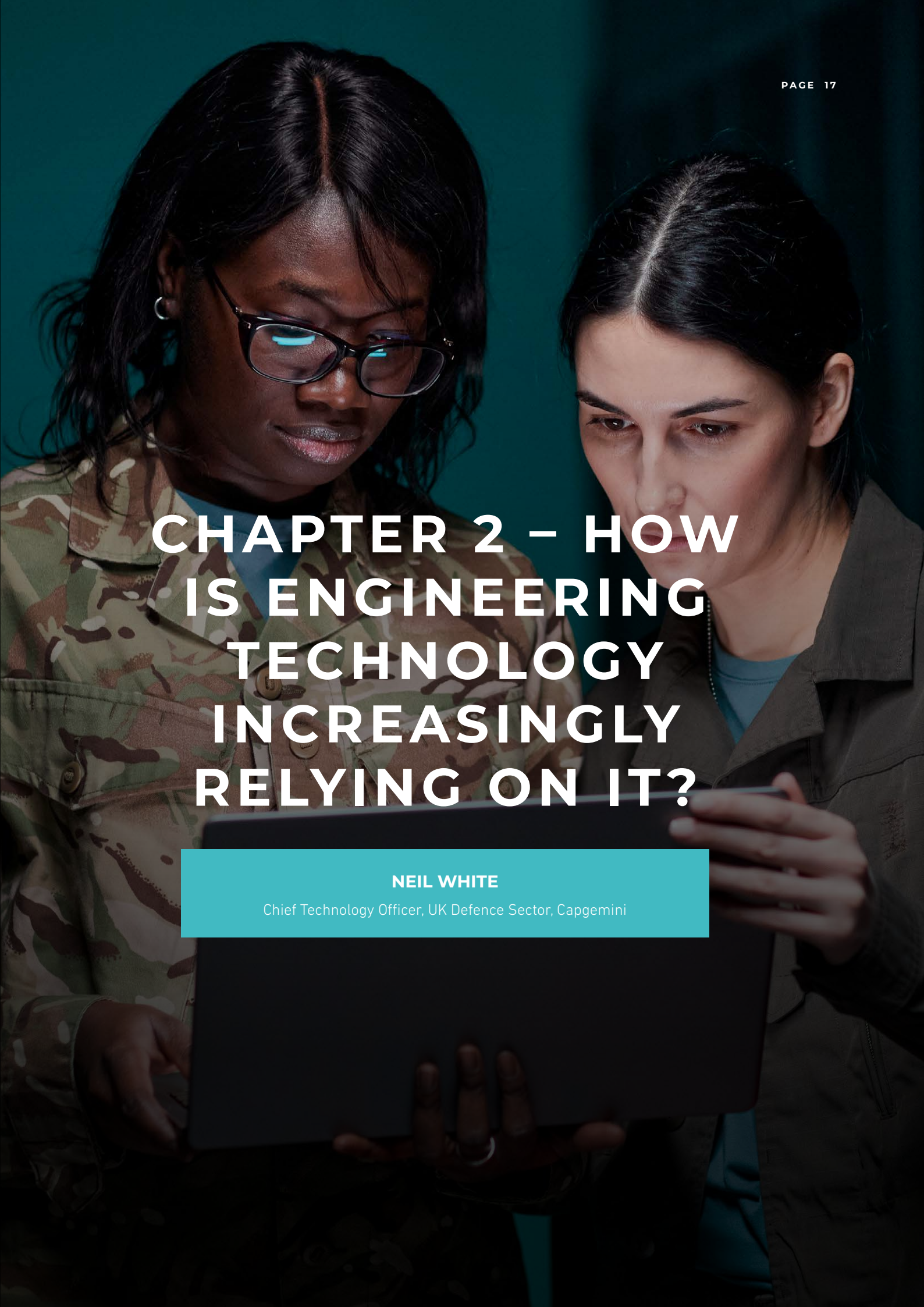
CHAPTER 2 – HOW IS ENGINEERING TECHNOLOGY INCREASINGLY RELYING ON IT?

NEIL WHITE

Chief Technology Officer, UK Defence Sector, Capgemini

THE WORLDS OF ENGINEERING AND IT ARE COLLIDING. IT'S AN UNSTOPPABLE FORCE THAT'S CREATING NEW CHALLENGES – AND OPENING UP EXCITING POSSIBILITIES FOR ENHANCED CAPABILITY.

UNLOCKING GAME-CHANGING VALUE

Historically, large, high-value defence assets (such as planes, ships, submarines and armored vehicles) were relatively self-contained systems in the battlespace. Over the last 50 years, real-time data flows in and out of these systems have been limited to radio signals, with maybe – in the comparatively recent past – some degree of information logging. Now these assets are communicating in real-time with IT systems in base locations. With these developments come challenges, for example, ensuring that communication can't be used as a tracking mechanism, or become an easy target for a cyber attack. But once robust security provisions are in place, the opportunities to deliver enhanced capabilities are enormous. The game changer is data, the value of which, when captured, processed and shared, accelerates exponentially, especially when combined with continuous upgrades. Maximising the value of data requires new skills and agile ways of working throughout the defence ecosystem.

CAPABILITY ENHANCEMENT THROUGH DATA SHARING

An individual tank operating independently can only rely on its own sensor suite. But a connected tank can additionally rely on the sensors of a real and virtual army of allies, from other tanks in the locality, to surveillance drones and more. The additional data from these surrounding assets provides a live, and substantially more detailed, three-dimensional picture on which to base operational decisions. Add in the strategic overlay from real-time back-office analysis, and the information and insights within it become even more powerful.

Integration between back-office IT systems and operational technology (OT) is therefore essential. Only back-office IT systems can collate all the data, process it, and then distribute the priceless analysis back to assets in the theatre, although an on-asset – edge – capability is clearly also necessary for resilience and graceful degradation. Put simply, fully connected back-office IT can deliver a huge advantage to in-theatre assets.

Once data sharing is fully in place, assets can be withdrawn and replaced as needed, without any operational impact, as all incoming assets immediately inherit all the relevant data from its predecessor – as well as all previous on-station assets.

For example, a submarine moving on patrol comes into position pre-loaded with all the threat and maintenance information collected by every previous patrol. And as more data is gathered, analysed and shared, its cumulative power grows, for example by identifying patterns of movement or tactical repetition.

We can further subdivide the IT/OT connectivity by time, thereby further informing operational decision making and resource allocation. Tactical updates for immediate use need to be in real time, while equipment and resupply status updates need to be regular, but are not as time- critical, enabling flexibility about where to position spares or replenishment stores.

Meanwhile, information releases can be tightly controlled - for example, maintenance schedules to be actioned weeks in the future can be kept secure locally and disseminated to restricted groups of recipients.

CONTINUOUS ASSET UPGRADES

To best use the data available, and ensure capability is maximised, we again look to IT/OT integration.

The pace of technological change is accelerating faster than ever, with functionality increasingly implemented in software. We cannot now consider stand-alone upgrade programmes or refresh activities. Continuous, rolling upgrades to assets must become business-as-usual.

By building software-intensive assets, we can move to a continuous software deployment model. Every asset that leaves its base to go into theatre should do so equipped with the very latest version of software compatible with its existing hardware. And the software needs to be hardware agnostic, allowing evergreen hardware approaches to be deployed, decoupled from software.

This continuous update of hardware and software ensures that the asset's capability is in a state of continuous optimisation. At the same time, we don't want to 'move fast and break things' in the style of Facebook's approach to development – our goal must be to move fast and be right every time.
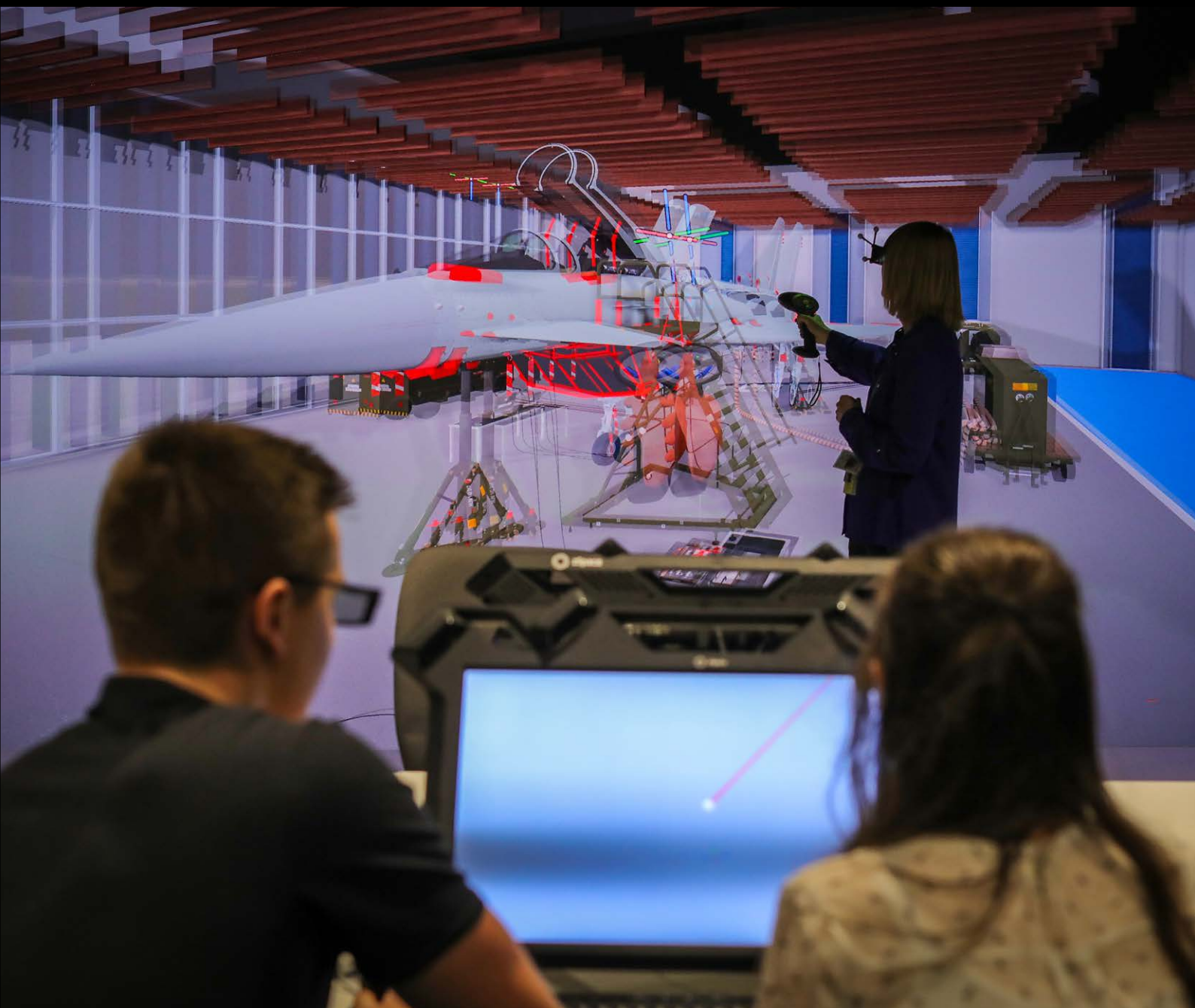
Hardware-agnostic software also allows us to run assets of the same class with diverse hardware and different software versions. This means we reduce the potential severity of a cyber attack. If hostile actors manage to carry out a denial-of-service attack on an asset, only the subset with a susceptible software/hardware combination is impacted. Other assets remain operational. We have known for over 5,000 years that the most efficient victory is one where there is no fight. If you can disable the entire opposition fleet in one cyber attack, they have no ability to engage.

BENEFITS STRETCH DEEP INTO THE SUPPLY CHAIN

Whilst linking IT and OT as close to operations as possible is clearly important, realising the benefits of applying IT discipline to engineering analysis across the supply chain is increasingly achievable, thereby opening up exciting possibilities. In other industries, using IoT technology allows operational equipment to 'talk' to manufacturing teams, who can then promptly review and amend design and build instructions. Factories now have real-time visibility and monitoring of equipment, with a preventative maintenance and fix regime – moving away from the traditional wait for a small company down the road to fix it when it breaks, when they have time.

Automation to streamline workflows and optimise production enables improved collaboration, reduces waste, and provides more accurate manufacturing outcomes. Tracking and tracing products (and the expensive equipment that builds them) produces enhanced compliance and quality assurance. And these benefits can extend across the supply chain – improving operations for larger organisations and changing the price point for smaller/local organisations to participate. All of this happens with improved use of the vast amount of data produced and analysed. As an example, Capgemini recently completed a piece of work on welding pre-heaters. The resulting data ensures that excessive pre-heating – causing 100% waste of used electricity – is avoided.

NEW SKILLS AND WAYS OF WORKING

In human terms, the integration of IT and OT means we need systems thinking teams that combine the skills and experience of multiple specialist domains. To build the best assets for armed forces – from bullets to submarines – we need the best and brightest engineering teams. The defence industry is competing with many private sector employers for these skills, for example, the finance, manufacturing and automotive industries. We need to build a compelling case for working in the defence sector. This means looking beyond salary – whether that's an attractive and attainable career trajectory, a technology-enabled workplace, and/or a collaborative and mutually supportive culture. These are attributes that the defence sector has not historically been associated with.

IT and OT integration will transform in-theatre asset capability, by sharing data and bringing back-office computational power firmly into the mainstream, combined with continuous upgrades of assets to take the best advantage of the new information. This is a transformation to a new, interconnected digital culture, with engineering and IT indistinguishable – not a digital wrap, papering over the cracks of legacy assets.

And once connected in a new, all-embracing digital culture, we will never disconnect.

CHAPTER 3 – WHERE WILL INFORMATION TECHNOLOGY BE IN FIVE YEARS' TIME?

ROB KERNAHAN

Vice President, Chief Architect, Capgemini

The last five years have seen pivotal technological developments that are supercharging organisations and unlocking competitive advantage. Diverse industries are dramatically changing the way they think about business – with defence and its supply chain in the vanguard of these seismic shifts.

Technology can now be deployed at immense scale and has been democratised through new commercial models. New operating methodologies enable us to be faster, more efficient, and more productive. AI and data are changing the way we think about value, new skill sets are emerging, while traditional crafts are falling away. In this chapter we expand on what the next five years is likely to hold in IT – and what it means for the defence sector.

**LASER FOCUS ON DELIVERING VALUE**

IT and business have fused. IT is no longer a cost centre, now it's a turbocharged enabler and growth engine. Technology is the catalyst for new business models that are propelling companies forward with pace and purpose. In defence, we see this in numerous ways, not least in the merger of the digital and the physical:

Complex digital twins are generating huge value and reducing risk and time-to-market in development cycles.

Augmented reality is making the right data available, at the right time, for those who need it most – accelerating engineering activities and improving quality and efficiency.
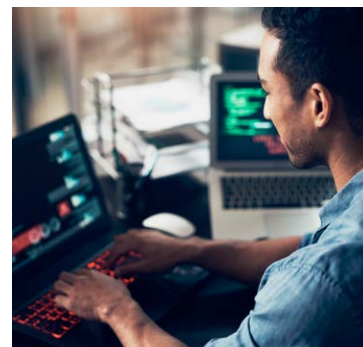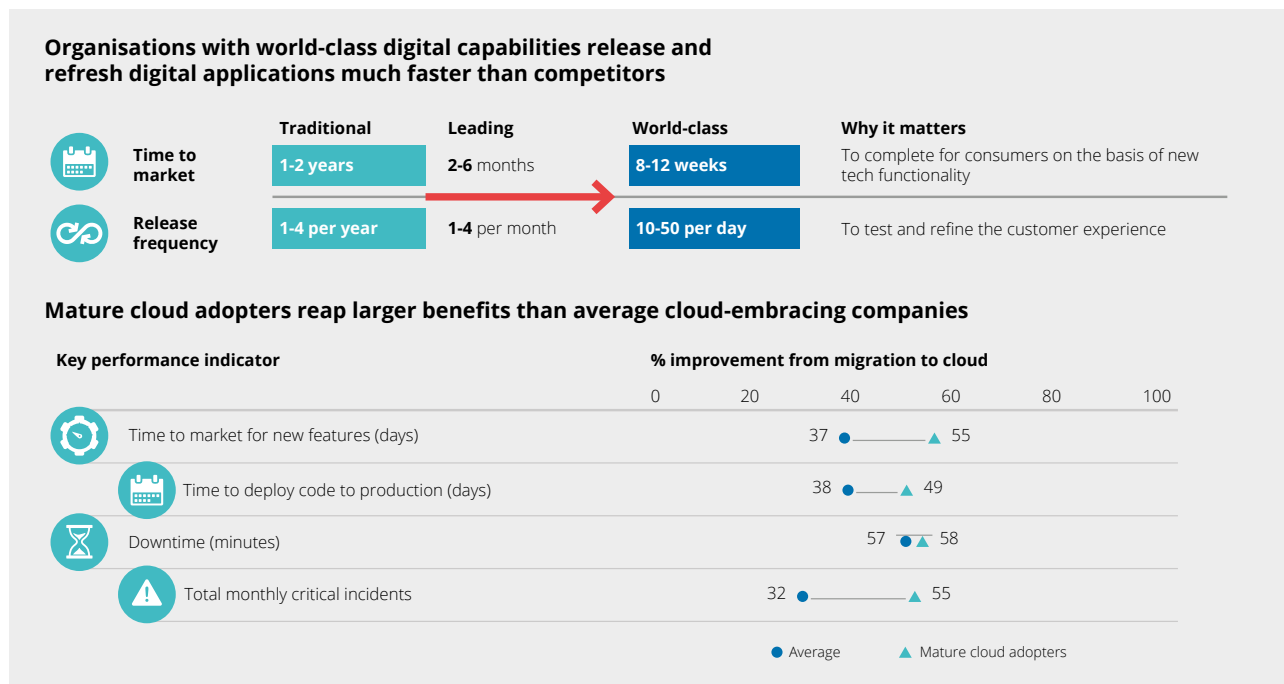

Convergence of IT and OT systems is creating new ways of managing value. The complete ecosystem is now visible, creating more opportunity for operational excellence.

FOR THE FUSION OF IT AND BUSINESS TO BE SUCCESSFUL, NEW OPERATING MODELS ARE REQUIRED THAT MINIMISE FRICTION AND MAXIMISE EFFICIENCY.

THE LAYER CAKE IS GONE

There's a consensus that modern IT operating models must be product and platform-based to unlock value – with the product providing IT business alignment and intimacy, whilst the platform delivers consistency and fundamental acceleration. A recent Gartner survey found that 85% of organisations favour a product-centric application delivery model. The benefits of this approach are clear, obvious, and measured:

Organisations with world-class digital capabilities release and refresh digital applications much faster than competitors

	Traditional	Leading	World-class	Why it matters
Time to market	1-2 years	2-6 months	8-12 weeks	To complete for consumers on the basis of new tech functionality
Release frequency	1-4 per year	1-4 per month	10-50 per day	To test and refine the customer experience

Mature cloud adopters reap larger benefits than average cloud-embracing companies

Key performance indicator	% improvement from migration to cloud
	0 20 40 60 80 100
Time to market for new features (days)	37 ● — ▲ 55
Time to deploy code to production (days)	38 ● — ▲ 49
Downtime (minutes)	57 ●▲ 58
Total monthly critical incidents	32 ● — ▲ 55

● Average   ▲ Mature cloud adopters

Source: McKinsey & Company

However, there are several challenges, especially in defence:

CLOUD IS THE ENABLER, BUT CAN IT MEET THE DEFENCE SECURITY AND REGULATION CHALLENGE?

To enable modern, product-based operating models to work, cloud is a key enabler as it allows us to decouple architectures at a cost point that is acceptable. Industries with simpler security models have rushed to cloud to gain these advantages.

Overcoming security complexity has been a challenge for defence, and only now can cloud meet the combined imperatives of security, sovereignty and regulation.

New patterns are emerging that will be embraced over the next five years, allowing high-security domains to use public cloud. These range from low-high development patterns to full sovereign cloud deployments. Many are already making the move to get access to the same advantages others have enjoyed for years.

COMMERCIALLY AVAILABLE OFF-THE-SHELF (COTS) MAKES IT HARDER; DEFENCE IS COMPLEX

IT works best when it is loosely coupled and highly cohesive. We all want the joy of microservice architectures, but things like product lifecycle management and associated requirements and use of complex COTS requires compromise.

COTS creates complexity around the things that microservices free up, such as release and deployment. Organisations that have embraced this have moved from two releases a year to 20 small releases a day, fundamentally reducing risk and increasing business value.

Many in manufacturing have begun to tackle this and are designing new operating models and deployment approaches to compensate for the issues of tightly coupled COTS systems.

LEGACY DATA MODELS CAN BE A BARRIER TO PROGRESS

Data is often described as an organisation's most valuable asset after its people, with the data residing within defence and security organisations having immense value.

Patterns are emerging to drive integration through data, enabling new, innovative systems to be created and activated quickly. However, ensuring visibility and control of data is essential to maximise value and impact.

The first step is to achieve ownership of data, the second is to curate it and the third is to exploit it. Technology is providing a growing toolkit to help organisations to do just that.

Data is the key to significant acceleration and enhanced collaboration in major programmes carried out by defence organisations.

THE FUSING OF TECHNOLOGY AND BUSINESS

The digital and the physical converge – a tale of twins.

OT and IT convergence has matured, with technology now bringing physical and digital worlds together. This has produced a sharp rise in digital twins spanning complex systems, operational environments, even mapping whole cities.

The business case for twins is obvious. Correctly deployed, it de-risks and speeds up product development and decision making. The art of the twin is to give it enough fidelity to make it useful and extensible so that scenarios can be tested and understood.

The skills required for this are niche and need a blend of hybrid technology and engineering to be effective. Building this capability in an organisation now is essential as it takes time to mature.

It's estimated that, in 2021, 13% of companies were using digital twins in their lifecycle. By the end of 2023 it is expected that this will be 50%, illustrating the maturity of and trust in the technology.

Everything is connected and distributed – however, you've got to get the loops working.

While systems are converging, and the physical and digital worlds are becoming one, at the same time distributed compute is becoming commonplace.

Deployed edge on the device in theatre is now a minimum requirement. This network-based distributed compute and its interoperation will dominate the next cycle of innovation and technology. It's the key to unlocking Multi-Domain Integration (MDI) in the defence space and the critical success factor in allowing Multi-Domain Operations (MDO) to operate effectively. And it's being powered by global connectivity – nation states are connecting everything to gain real-time insights into operational situations. The value in all of this is realised by the curation of feedback loops.

Operational data, generated at the deployed edge, can be used to understand real-world performance, to inform the supply chain, and to affect the value chains that build their products. This can be directly linked to the digital twins, where the real world can be modelled to solve highly complex issues. This has value in many ways, for example, logistics can be automated and optimised, and product design and manufacturing can learn quickly and improve quality rapidly.

The building blocks for these loops are already in place, with the next five years seeing a huge improvement in the available bandwidth for these loops to thrive. However, organisations must first understand these loops and flows, and work with their ecosystems and customers to curate them.

Avengers Assemble: let's build it fast... and right.

Technology abstraction has been regarded as the future for a long time. The next five years will see a continued drive for abstraction in Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) technology services and the rise of as-a-service business models. This is essential for complex organisations to embrace as it removes a huge amount of toil from daily tasks, and avoids the minutiae of technology that adds no direct value.

In this world, system assembly is easy and rapid, value release becomes simple, and businesses can focus on what matters. PaaS and SaaS have come of age, with mature security models.

If AI is the future, what haven't we thought of?

AI has reached a threshold. ChatGPT has deployed a highly accessible version of what some would consider to be simpler AI, yet it's changed so many things and we're already seeing designers using AI to create amazing outcomes.

Many industries are now tuning into this potential, and with AI replacing many human tasks over the next five years, defence organisations will need to pay close attention to the optimum skills mix required to power its AI and data journey. AI is the next battleground, and autonomy through AI will be key for not only support systems for design, build and care, but also in the systems that original equipment manufacturers build for the MOD.

Security is always important, but all this tech will make it easier, honest!

Imagine a day when your favourite voice assistant tells you about risks you need to manage as you start work. It may sound farfetched, but the technology is emerging to make this a reality. The dashboard is dying, and the analytics are now doing the heavy lifting for us.

New patterns and approaches to security are maturing, with the algorithm having access to operational data and hunting out the threats before they become an issue. Automation in security will be essential to cope with human cognitive overload in this space.

From a security perspective, OT will need to work using the same disciplines as IT. Continuous threat analysis will be vital too, with analytics and AI required to remove complexity and identify priorities. Education and training will be paramount, with everyone and everything a potential threat vector.

People with a purpose are the pivotal factor.

Skills are changing fast. People are being outperformed by AI in domains we thought safe from automation. And this, at a time of geopolitical unrest, creates a multi-dimensional problem for the defence industry.

People with a purpose make the difference. Delivering within a highly motivated and supportive model in an energetic and compelling environment will allow your people to cope with uncertainly and change. This is the single most important thing required to drive success.

ACADEMIES AND CONTINUOUS LEARNING

The talent war is fierce. The task is to empower people to meet new technology challenges head on – and exploit the opportunities they present, enabling them to deliver against high expectations.

To enable this, defence organisations should seek to create technology talent academies, to equip new and existing staff with the skills they need to play their part in the achievement of the organisation's goals. Academies can deliver value in five key areas:

1. **Skills development:** Technology is changing fast, and a clear focus on continuous learning is required, allowing people the time to develop to rise to the challenge.

2. **Increasing retention:** Providing employees with opportunities for growth and development can help improve retention rates.

3. **Enhanced collaboration:** Academies can bring together employees from different departments and teams, promoting collaboration and knowledge sharing.

4. **Greater diversity:** Academies can identify and develop talent from a range of backgrounds and experiences, increasing diversity in the workplace. This can lead to more creative and innovative solutions and help promote a more inclusive and supportive work environment.

5. **Improved productivity:** With new skills developed and new experiences formed, a natural side effect is a significant increase in productivity that can be measured in double-digit percentage improvement.
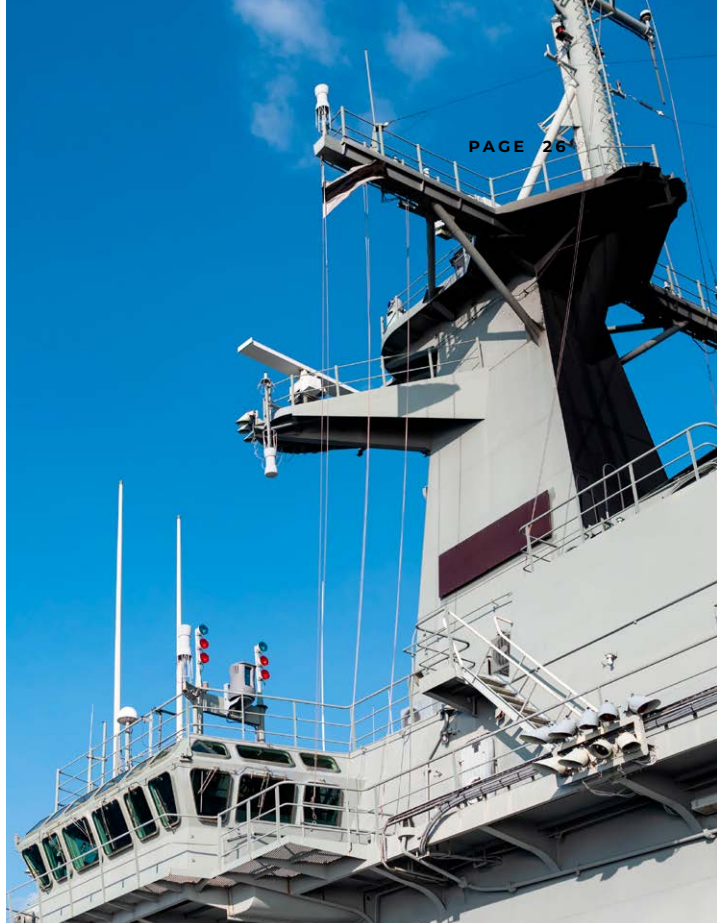
Investing in employees' development is proven to deliver significant results:

- Capgemini's Digital Transformation Institute conducted a survey of 1,700 executives and found that 62% of respondents believe that employee upskilling is a key driver of digital transformation success.

- Companies that invest in employee development and training enjoy 37% higher productivity[16].

- LinkedIn found that 94% of employees would stay with a company longer if it invested in their career development.

- The Society for Human Resource Management found that companies with a strong culture of learning have higher employee engagement and retention rates.

- Diversity and inclusion programmes can improve innovation by up to 15%[17].

ONE THING IS CLEAR: NOTHING IS CLEAR. SO KEEP YOUR CRYSTAL BALL CLOSE.

Acceleration continues, innovation is relentless, and the creativity being demonstrated through technology is boundless. The systems and approaches needed to cope with this are often outdated and need refreshing or replacing. While there are many uncertainties, especially in defence and security, there are also some things beyond doubt:

1 TECHNOLOGY AND BUSINESS INTEGRATION IS MORE IMPORTANT THAN EVER, AND IT WILL BE TECHNOLOGY THAT POWERS THE FUTURE OF ORGANISATIONS.

2 THE LASER FOCUS MUST BE ON VALUE, AND ORGANISATIONS MUST BE RELENTLESS IN REMOVING BARRIERS, ENABLING AUTONOMY, AND MAKING THE RIGHT THING EASY TO DO, AND THE WRONG THING HARD TO DO.

3 A STRONG EMPHASIS SHOULD BE PLACED ON THE SKILLS REQUIRED TO MAKE THIS FUSION A PRACTICAL REALITY. CONTINUOUS SKILLS ASSESSMENT MUST BE BUSINESS AS USUAL.

4 THE PRODUCTS THAT THE DEFENCE INDUSTRY BUILDS MUST BE DIGITALLY ENABLED, WITH THE ENTIRE END-TO-END LIFECYCLE OPERATING IN LOCKSTEP WITH INTEGRATED DATA MODELS.

Future success is rooted in technology, data and people, to propel defence organisations forward and to deliver the multi-dimensional shield that protects us. The use of consistent, accurate and timely information and insights, based on robust data, is a critical element of this – and forms the focus of the next chapter.

CHAPTER 4 – CONTROLLING, MANAGING AND SHARING SECURE DATA – AND THE PRICELESS INSIGHTS WITHIN IT

PHILIP HARKER

Vice President, Insights and Data, Capgemini

The MOD, international alliances such as NATO and AUKUS, and the defence sector as a whole, are wrestling with a constantly evolving set of challenges, as nations respond to the impacts and rippling effects of global and regional events. When considering their response, there is one common denominator – the need to transform digital and data capabilities to enhance our collective ability to serve and defend the realm.

Recently published white papers from the MOD exploring the digital and data revolution clearly articulate the opportunity for efficiency in back-line operations and, perhaps more importantly, the need to embrace digital technology and the power of data as the key differentiator in multi-modal front-line theatres.

This new imperative is reflected in the procurement and service of equipment, and the technological and competitive market developments driving the defence industry. This is most apparent in the consortia-led approach at the heart of major initiatives such as the Global Combat Air Programme (GCAP) and Dreadnought submarine initiatives.

THE OPPORTUNITY

How can defence contractors best support the MOD in treating data as of vital importance, second only in value to people? By evolving in parallel and having data ecosystems that support equipment, CADMID and effective monetisation.

A recent study by Capgemini Research for Data Ecosystems found that the necessity to share data provides a significant opportunity for large organisations. Those participating in data ecosystems have the potential to gain enormous financial benefits over the next five years.

TO MAXIMISE THE VALUE AND IMPACT OF THESE MARKET SHIFTS, DEFENCE ORGANISATIONS MUST EFFECTIVELY SUPPORT THE DEMANDS AND EXPECTATIONS THAT DIGITAL TECHNOLOGY AND DATA WILL DRIVE, INCLUDING INNOVATION WITHIN THE CADMID PROCUREMENT PROCESS.

COLLABORATIVE DATA-SUPPLY CHAIN

Data → Insights → Value (improved quality, effective promotion, improved customer experience etc.)
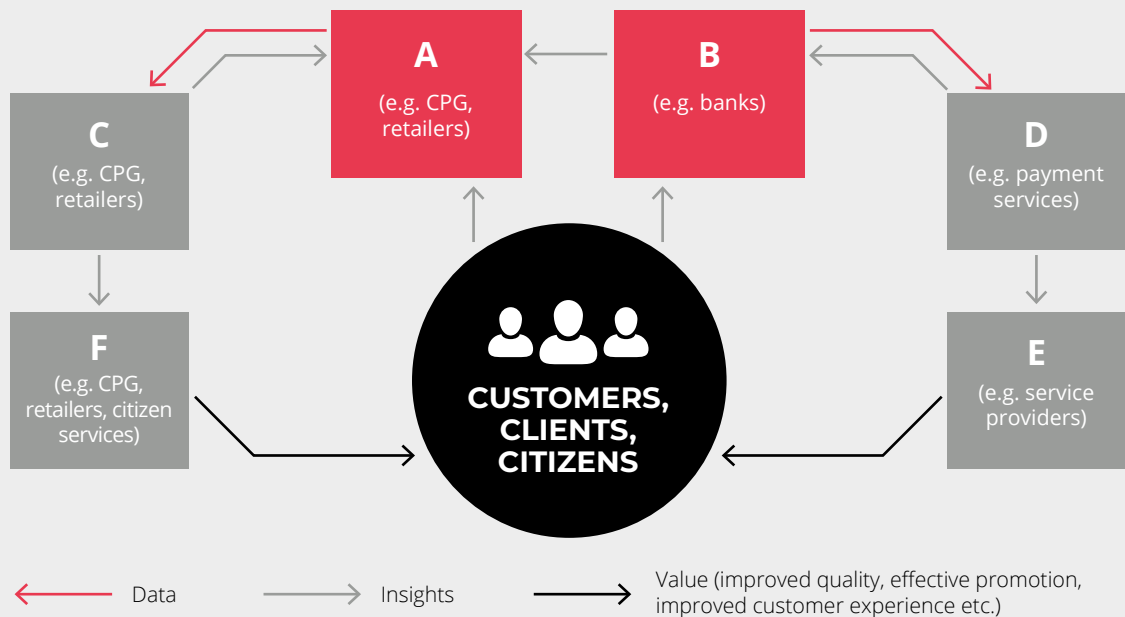
CPG = Consumer product goods

Source: Capgemini Research Institute Analysis.

The ambition is clear and imminent. Delivering a digital system of record, encompassing all assets and equipment, will enable both substantial cost efficiencies and increased revenue opportunities, adopting the commercial model pioneered by Rolls-Royce's ground-breaking 'power-by-the-hour' approach. This principle of turning a product into a service is now well established and commonplace in the provision of IT hardware and software to the business community.

Full lifecycle analysis of critical components will yield unique insights and a template approach that will enable defence organisations to monetise both in-service and preventative maintenance – another well-established concept. The Capgemini study mentioned above highlights how Airbus partnered with a number of aerospace, technology and academic organisations to improve and accelerate the design of aircraft wings, while at the same time reducing development costs.

THE PLATFORM ECOSYSTEM – ENABLING SEAMLESS DATA FLOWS

The major technology organisations recognise the emergence of data ecosystems as a collaborative business need for the defence sector, with many parties serving a common objective for one customer, in this instance the UK MOD. Defence contractors each have valuable data sets, yet when merged and integrated, the complete picture will be revealed. With it, the uniformity and consistency of the data will be set and governed through policy and standards, as will the sovereign status of the data for the most precious and secure artefacts.

So, for example, BAE Systems, as the whole-boat integrator for the submarine, will take the primary role in ensuring the uniformity of the data, delivering the data assets alongside the physical assets, and to follow its in-service life and on to end-of-life.

As in the natural world, platform ecosystems, if nurtured correctly, will live, evolve, and thrive, and conversely, suffer if under-nourished or poorly maintained. The challenges facing it are immense, with complex, structured and unstructured data needing to be consumed instantly from an array of devices, equipment and services, from in-theatre, shop floor, dockside and more.

TOP CHALLENGES FACED BY A MAJORITY OF ORGANISATIONS – BY CATEGORY

		Share of organisations citing it as a top challenge
Governance, risk, and compliance	Cybersecurity threats	62%
	Intellectual property and sensitivity of data	57%
Financial	Lack of investment in talent and skills	56%
	Unclear return on investments in a data ecosystem	29%
Trust	Consumer resistance towards sharing data	56%
	Lack of trust in external data	46%
Technological	Lack of data sharing platforms to control access rights	56%
	Poor data quality (including lack of data availability)	53%

Source: Capgemini Data Ecosystem Survey; N=750 organizations, April-May 2021

Technology is also empowering and democratising the exploitation of data at the sharp end, a pivotal step in the evolution of the foundational ecosystem. Building on this robust foundation, further change is needed to organise both process and data around the future consumers of data – vehicles, surface ships, submarines and aircraft.

When it's in service, defence equipment is constantly communicating, consuming and digesting data for its existence and operation in theatre. And when at rest, it's offloading the data from the theatre, the oceans and the skies. This requires the platform, data architectures and models to seamlessly flow to deliver service, care, insight, analysis and analytics. All the while, the vast volume of data needs to be protected, trusted, processed and exploited, whilst maintaining its integrity, security and original purpose.

THE DATA ECOSYSTEM – ENABLING COLLABORATION THROUGH CATALOGUING

Acknowledging the opportunity for data exploitation, many organisations have embarked on the long process of mapping and evaluating their data. Cataloguing data in this way helps them better understand the importance of the systems-of-record for both back-office and front-office operations. The resulting data catalogues will be empowered from shared services, through a factory operation model, for consistency and operational efficiency. Most significantly, the data will be owned, governed, maintained and exploited by the business, for the business.

Cataloguing allows all data to be appropriately secured and trusted, its lineage protected, and subsequently for it to be safely deleted when obsolete. Best practice in these areas can drive significant operational savings when locked in with resolute policies, governance, and automation.

Cataloguing is even more important when supporting the emerging demands for greater collaboration amongst consortia partners, where systems-of-systems thinking is required. In these scenarios, where original equipment manufacturers are increasingly the integrator, operating on behalf of the MOD, it's essential to have integrated platforms and accurate, unfettered data flows between the various systems that are accessible and consistent for all parties.

There are considerable challenges and opportunities in a flowing data ecosystem for large consortia programmes like GCAP, Dreadnought and SSNR, where data flows can be designed to deliver maximum value for the operator, the MOD.

DATA GOVERNANCE – UNLOCKING EFFICIENCY AND SUSTAINABILITY BENEFITS

Data governance is an essential counterpart to data cataloguing and should be seen as a liberator not a constraint. It's vital to have policies applicable to business models – and adherence to these policies can be automated and deployed with great effect, with far greater control than previously possible. For example, in a recent project, Capgemini helped Shell implement a full information lifecycle policy for its use and maintenance of email, resulting in 3.3bn files deemed aged or redundant being securely deleted – saving 8,000 tonnes of CO_2e. By applying automation, the policy will now trigger the removal of around one billion redundant and obsolete records each year.

Many organisations have ambitious aspirations around the latest innovations, without fully appreciating the in-depth foundational work required to secure the projected return on the technology investment. AI, and in particular, generative AI, is an example of where the foundation of strong governance and comprehensively catalogued data assets are essential. A package of real-world, ethical and sustainable policies and procedures, delivering trust in the underlying data, is a prerequisite if the opportunities are to be fully exploited.

BUILDING CAPABILITY – THE RISE OF THE KNOWLEDGE WORKER

The ability to engineer, manipulate and exploit data will surpass the evolving technology labyrinth and enable it to be industrialised through liberating methods like agile, resulting in Dev-Ops/Data-Ops as a core data capability and delivered as a shared service.

The well-established function of management information and business intelligence (MI/BI) will evolve further, into more commoditised reporting for more generic requirements. A new breed of knowledge worker will emerge, armed with an analytical mindset, empowered by a digital backbone and motivated by curiosity, becoming a key resource for business and functional scenarios and simulation. Hence, the MI/BI function will evolve into a key capability, embedded in the business, and a core enabler throughout the value chain throughout the value chain and in effect supporting the digital workforce.

CHAPTER 5 – NEW TECHNOLOGY TRENDS ARE DRIVING NEW DIGITAL CAPABILITIES

GUY RIDEAL	**ROB KERNAHAN**
Vice President, Delivery Partner, Capgemini	Vice President, Chief Architect, Capgemini

The first part of this report has explored the changing face of the defence industry and the impact digital technology is increasingly having across the Connected Theatre. The rise of cloud, AI and other technologies are presenting opportunities to transform IT and enable businesses. The defence industry expects increasingly integrated and data-rich products, with the goal of accelerating and improving the value chain for design, manufacturing and aftercare. To meet these objectives, organisations will need to embed new operating models and ways of working, built around services and solutions that change outcomes. Integrated IT and business operations, i.e. 'technology-fused businesses', will be one of the biggest enablers of this positive future.

In these final two chapters, we'll look at where organisations must focus to extract the most value from these digital capabilities. We'll examine potential structural changes to organisations' operating models that will help identify innovative new digital capabilities and embed them into business-as-usual, thereby realising consistent, long-term benefits.

The case for new operating models that consist of products and centralised platforms that enable enterprise-wide technology solutions, systems and applications has never been stronger. A recent Gartner study showed >85% of organisations have started to move to this style of operating model.

A quick explanation of product-centric models (PCM) are required here. A PCM refers to an approach where the development and delivery of software/ technology solutions is organised around specific products or applications. The focus of a PCM is on creating and maintaining individual products or services, with dedicated teams for each product. So, each product typically has a team responsible for its design, development, testing, deployment and ongoing maintenance. These teams work independently, focusing on optimising their specific product's features, functionality and user experience. (Note: this only works if the drive for standardisation via platforms allows the room and flexibility for valid deviations to be delivered to local markets and differing sectors.)

This is especially important in the defence industry, where differing environments, risks and requirements are stark. Here are three key levers that can help achieve the best of both worlds.

THE BENEFITS OF MOVING TO NEW OPERATING MODELS INCLUDE:

- transforming IT services to enable businesses to adapt easily to customer demands

- improving service through best-of-breed suppliers for applications and products

- reducing duplication and improves centralisation, resulting in cost reduction and quicker service

- introducing automation to improve issue resolution and change adoption, and enhance user experience

- providing visibility across the application portfolio for improved compliance, cost containment and common service implementationservice implementation.

1. CREATE PRODUCTS AND PLATFORMS TO DELIVER HARMONISATION, INTIMACY AND ACCELERATION

A digital core and its associated platforms are a purposefully designed layer which provides the capability for short and long-term business solutions. To exploit the efficiencies and maximise the value of a shared service in large organisations, it's first essential to standardise not only repeatable activities but also the way that the technical layer supports them. Importantly, these services need to be low friction, easy to customise where required, and promote advocacy through a great experience.

A truly optimised shared service will enable an organisation to become more agile and exploit opportunities, fuelling business growth. For example, standardised project processes and delivery methods provide rapid mobilisation – and this mobilisation can leverage shared products and services that are preconfigured for the environment to supercharge initiatives aligned to business needs.

Creating teams aligned to product and platform, who understand the value they provide, produces an environment in which delivering value is always the primary objective. Product teams foster business intimacy, while platform teams deliver harmonisations and fundamental acceleration.

A product and platform operating model, powered by a standardised digital core, will enable the creation of a truly digital culture, where technology becomes the business enabler, with tools that promote seamless, effective and efficient collaboration within the client organisation and its partners.

How do we achieve this advanced level of shared capability performance?

1. The starting point is to understand the end-to-end value chain of business need.

2. Analysis of this drives understanding of what's common and what's not.

3. then explore the different technology solutions that enable all shared service tasks.

4. Work towards a single, optimised and future-proofed solution.

5. Simultaneously connect it to parts of the organisation that need to remain bespoke.

2. CREATE STRONG OWNERSHIP OF TECHNOLOGY ASSETS AND FOCUS ON A LOOSELY COUPLED BUT HIGHLY COHESIVE ARCHITECTURE

For the operating model to work, it's essential to assign all technology assets to a product or platform. These should be connected and integrated by flexible APIs and via data lake architectures, providing an 'as a service' approach to delivering value outcomes.

Using this approach, each product or platform is responsible for their assets and development roadmaps. This allows for the decoupling of complexity and enables much better flexibility to deliver true transformation. Large-scale 'tech refresh' and 'business transformation' initiatives rarely deliver on time and to budget, and many simply fail. This new model deals with these issues, allowing each discrete part of the organisation to tackle their challenges. It also allows innovation to thrive, provides the freedom to change and reduces the organisational complexity that can prevent change from delivering success.

Critical success factors include:

1. Enterprise architecture and security need to change their roles to become enablers. This group must set the 'rules of the road', providing enough guidance to control risk while enabling the freedom to deliver.

2. The service needs to adapt, passing ownership to the products and platforms, and moving to a 'trust and verify' model. Importantly, impact is the responsibility of the product/platform with their technology assets, and they have the responsibility to deliver great solutions and experiences.

3. Funding models need to change. When moving to this model, we need to think about delivery having consistent and constant capacity. This makes commissioning of work much easier and drives better ways of working. Without this change, we continue the stop-start nature of old waterfall systems, and waste precious time, money and effort on things that aren't valuable.

The true value of this model is that asset ownership drives a more caring enterprise that values what it does, everyone understands their role (and how it supports the wider delivery of products) and has the freedom to deliver. This creates a passion for change and the maintenance of assets, which in turn delivers improved technology management.
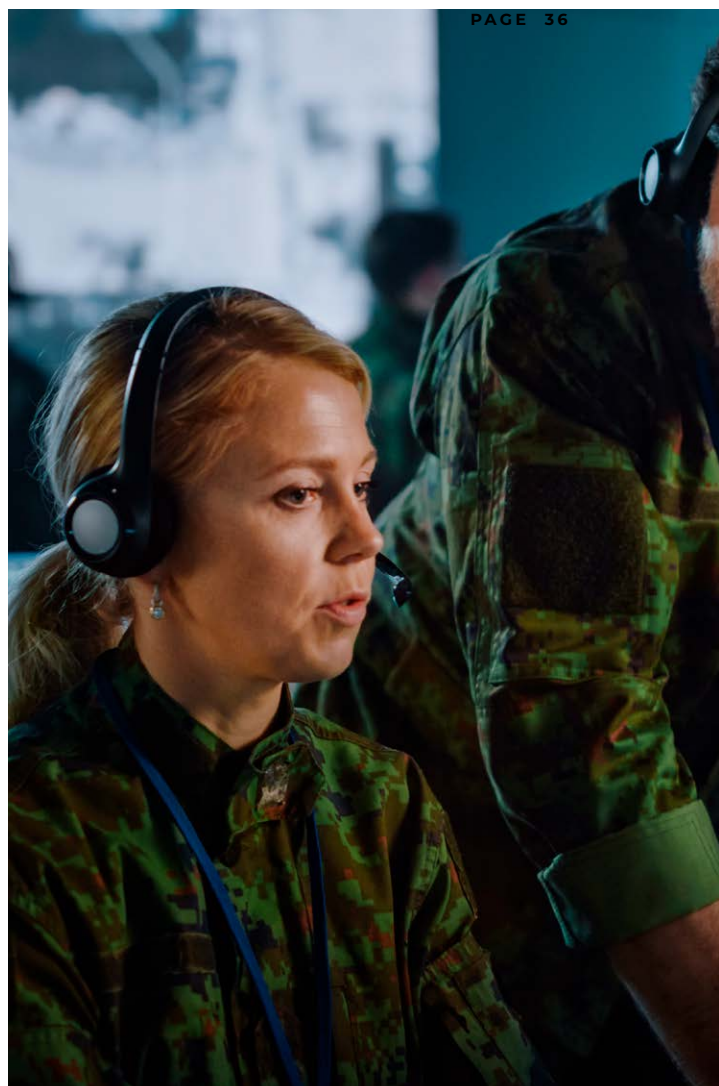
3. CREATE A DIGITAL FORGE, WHERE INNOVATION POWERED BY TECHNOLOGY BECOMES THE ENGINE ROOM

The final chapter in this report will look at how to generate a digital culture in more detail, but here we'll highlight the key benefits and areas to watch for when creating a 'digital forge':

- Offer tools that help people build new things easily. Provide them with access to technology, environments and, critically, the sponsorship for them to have the confidence to test and learn. Companies are increasingly moving towards a Learning -> Maturing -> Mastering approach to innovation, where quick proofs of concept are more beneficial than waiting and hoping for benefits to arrive from a full production solution.

- Provide robust mechanisms to propagate early innovation through environments and security boundaries so that it can be properly tested – this is key to fostering trust and a learning culture.

- Focus on data and what it can power. Once organisations have control of their data with the right security models, it can be put in the hands of those who can use it. This promotes data curiosity.

- Seek out examples of technology success in other sectors. Investigate what worked and what didn't and bring the best ideas home. Talking about success and building these links keeps thinking fresh.

- Keep pushing towards new technologies that make things easier. Cloud has been the greatest change in technology for the past 20 years and it's fuelling the move to digital. Cloud can play a big role in the defence sector, as it has strong security credentials.

CHAPTER 6 – THE NEED TO EMBRACE A NEW DIGITAL CULTURE

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SUSAN DAVIS

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THE FINAL CHAPTER OF THIS REPORT EXAMINES ARGUABLY THE MOST IMPORTANT ASPECT OF BECOMING A FULLY-FLEDGED MEMBER OF THE DEFENCE INDUSTRY DIGITAL VALUE CHAIN – CREATING A DIGITAL CULTURE.

One industry that has achieved this in style is F1. An F1 team's ability to win depends on it properly harnessing the power of the information it generates, captures, analyses and correctly interprets at every stage of development, construction and racing. Success depends on embedding a digital culture across the whole team. Everyone must understand the value and importance of information, challenge the accuracy of the underlying data, use the tools consistently to analyse it and then rely on it. Teams are constantly looking for ways to capture new data, and to use it to create insights that drive the innovation that shaves milliseconds from a lap time. Every team member must understand their role in this end-to-end digital journey and the success it can bring, and be constantly on the lookout for new tools and technologies which combine the worlds of engineering machinery and IT.

Of course, the worlds of F1 and defence are very different in many ways. Responsibilities differ and the consequences of failure are more serious. However, there are some important similarities too. Like F1, new technologies in the defence industry are being developed and introduced to society at an increasingly rapid pace. For example, in recent years virtual/augmented reality and AI have made huge advances and quickly becoming talking points[18]. New technologies offer the potential to disrupt and reshape the way we approach society's challenges, and the stakes couldn't be greater than within the defence sector, where a new technology could be used to gain an offensive/defensive edge against competing or enemy nations. General Sir Nick Carter, the former Chief of the Defence Staff, the operational head of the British Armed Forces, summed this up by stating: "…we must modernise at the pace of relevance to be able to handle future threats.[19]"
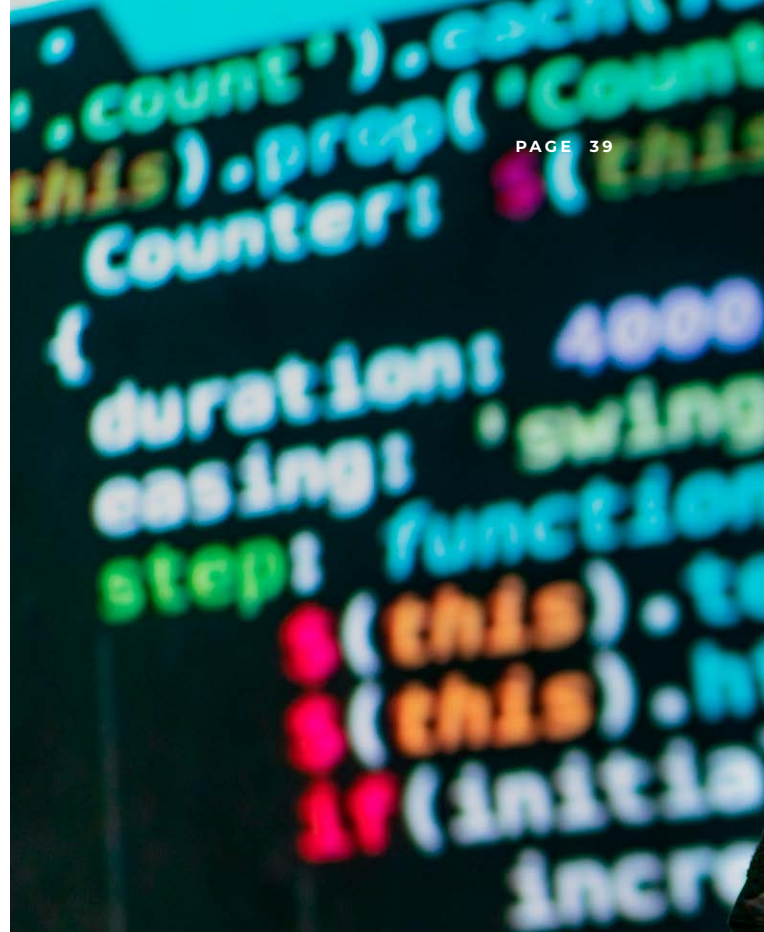
It's clear that new technologies can offer strategic and tactical advantages to national defence. Governments are aware of this and have committed large budgets to keep pace, for example the UK MOD is investing around £6.6bn in science and technology research and development between 2021 and 2025, including on cutting edge technologies such as AI, space systems and cybersecurity[20].

Despite the ready availability of new technologies, and no shortage of funding or government support, industries can be slow to implement these new technologies, with adoption remaining a key challenge. For example, less than three years ago the most capable computer on board a UK fighting platform, the F-35 jet, could perform 400bn operations per second, which is equivalent to 800 times less processing power than technology available in some modern trucks[21].

In this chapter we discuss some of the factors influencing the technology adoption challenge and potential ways to address them.

GETTING AHEAD OF THE TECHNOLOGY

In most areas of business, new technological developments are never-ending. The traditional 'do it once and forget it' philosophy has been replaced by ongoing monitoring of what's coming over the horizon, how it can be proactively used and what its impact will be – at both macro and micro levels.

Taking this approach puts organisations in the driving seat, building awareness and knowledge and enabling forward planning with clearly projected benefits. Often, organisations need to experiment with new technology, sometimes piloting its use to test its potential, relevance, ease of use and impact. Recent examples include drones, the metaverse and chatbots. With some of these, their use isn't always obvious – but their impact, if well deployed and broadly adopted, could be hugely valuable.

TECHNOLOGY CHANGE MANAGEMENT

Employee feedback via open dialogue sessions, pilot programme launches or bringing in industry specialists is crucial to facilitate a smooth transition when switching platforms[22]. Other ways in which organisations in the defence sector could get ahead of the technology curve include:

- creating an innovation network that continually identifies opportunities to adopt the latest technology, even when it's still in development. This network should also have a role in prioritising pilot programmes and their progression through a gated process to full-scale deployment and adoption.

- using AI tools, alongside industry and consulting insights, to understand trends in technology and how they'll deliver value for the defence industry. Insight from tools like Faethm showcase and analyse the new technologies coming into the industry and their impact, from a granular, task-level for individual roles, all the way to the enterprise as a whole.

- applying business metrics to innovation and adoption, so that progressing with pilots and scaling activities with new technology is actively prioritised, with funding embracing awareness building, stakeholder engagement and culture change.

BUILDING TRUST AND OVERCOMING SCEPTICISM

Workforces often view the introduction of new technologies with suspicion, based on resistance to change and doubts about its ability to live up to its hype. There's often concern that mobile app-centric approaches could compromise security.

Conversely, others may push for automation and, while low-code/no-code solutions can be deployed without troubling central IT, certain freedoms put additional complexity and risk into business operations. So, it's important to strike an appropriate balance in the democratisation of data with the need to encourage innovation, skills acquisition and continuous development, in a complex political and regulatory environment that can be seen as a barrier to innovation at speed.

PUTTING YOUR PEOPLE AND THEIR EXPERIENCE AT THE CENTRE OF TRANSFORMATION

Progressive organisations adopting new technology use opportunities to integrate the views of their people from the outset, ensuring the human-centricity of the solution. This often includes using personas to see how the combined impacts of many projects can be navigated. This lens informs the appropriate pace of change and enables training requirements to use micro-segmentation and multiple communications channels, thereby enabling individuals to best digest and absorb the information.

Employee experience (EX)-led transformations focus on the needs of employees, to ensure that the adoption and value of new technology is maximised. For example, BAE Systems has built its own EX capability, in which the workforce is treated as a customer and the new technology is the product. By mapping the daily working patterns of different groups of employees into personas and journeys, an understanding of the everyday technical and
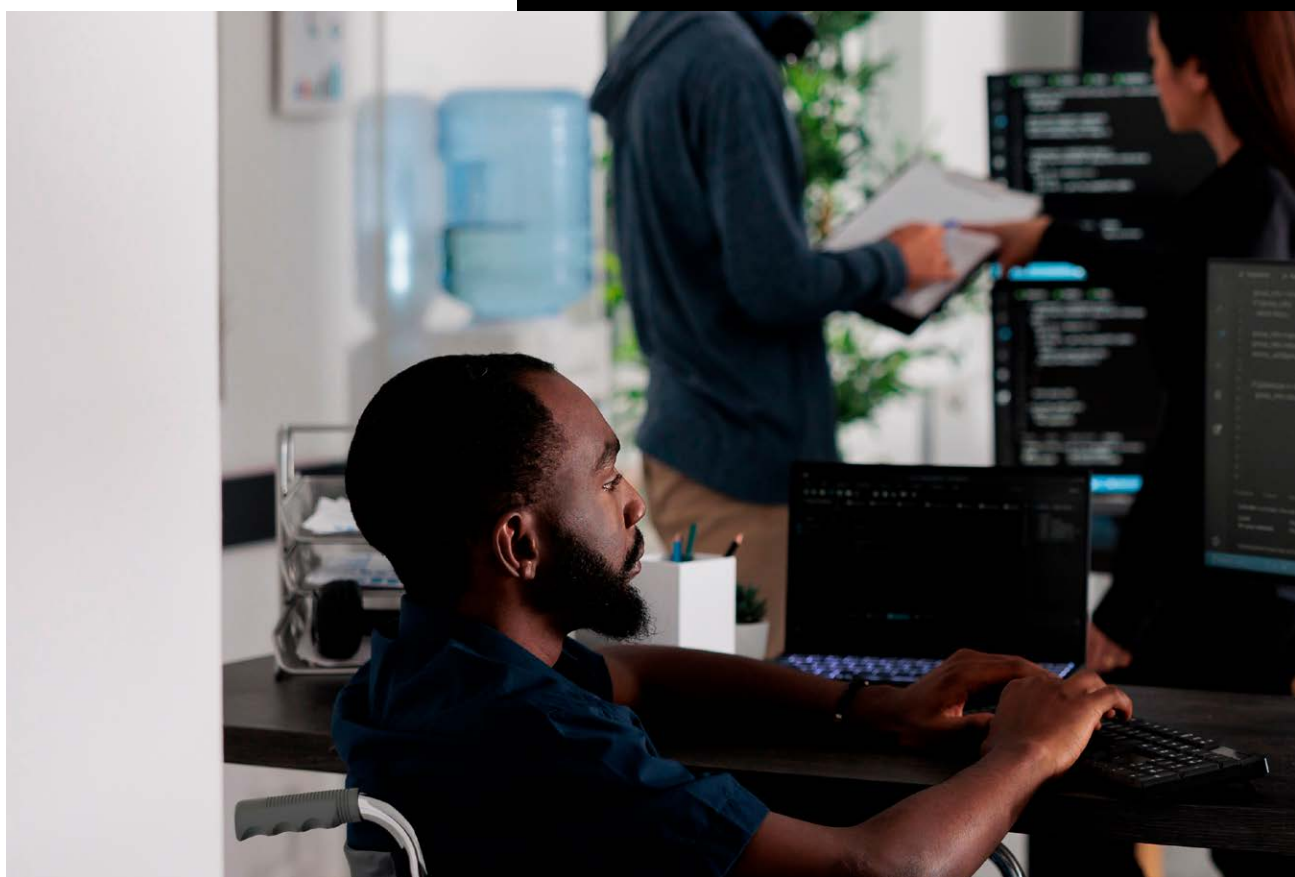
emotional needs of the workforce can be established before trying to implement new technology.

For example, home-working data analysts may be found in multiple functions within the defence industry, but they'll have a shared requirement for technology that gathers data globally from multiple sources. They also need to avoid being continually interrupted and so may seek technology that helps to provide access to their information through online knowledge bases or chatbots.

Knowing this helps to inform the level of change required, based on their needs and how to position the technology and make sure it's clearly connected to their daily work. Having solutions to both emotional and functional requirements makes it easier to win over hearts and minds. Adopting a new tool may be logical, but its predecessor may not be creating enough pain for it to be easily replaced.

There are a multitude of techniques associated with this form of adoption mindset, including design thinking. Design thinking is an attitude and methodology used for problem-solving and innovation, anchored around human-centred design[23], which involves treating employees as customers and using data and employee insights. As technology continues to emerge at a dizzying pace, performing one-off change and adoption exercises isn't enough. Organisations are instead installing processes of both continual improvement and analysis of employee insights. The focus is on the tools and technology in use, to understand issues as they arise and enable a prioritised backlog of adoption initiatives to be created.

This approach can work well as part of a Net Promoter System, in which those who are detractors, due to the tools and technology they are using, can be identified and their insights used to improve adoption. Alternatively, they can be contacted to provide further insights into what they really need to feel confident to adopt new technologies. This is a new development, with technology adoption now continually monitored and improved. It also means that adoption initiatives are co-created, typically around the needs of employees, increasing the likelihood of success.

The key to successful adoption at scale is focusing on design that maximises ease-of-use. It must now be intuitive and seamless, and so UX/UI designers need to be built into the solution development process from the outset. They should be positioned at the heart of the solution and user testing, and then as part of the adoption and continual improvement team, on hand to implement smart fixes and enhancements to features and functionality.

ADAPTING CULTURE AND LEARNING TO MEET NEW WORKFORCE SKILL REQUIREMENTS

Technology is impacting jobs across every sector and in every workplace[24]. For organisations to stay relevant and competitive, they must identify new skills requirements and be able to rapidly adapt to recruit employees with those skillsets and upskill their current workforce.

One way to enhance upskilling and improve adoption is to move away from one-off classroom-based learning, to a more blended and just-in-time approach. In essence, this means training that's classroom-based in part, but coupled with easily accessible and interactive guides when using the new technology that can support the user in the moment, while they're in the flow of daily work.

It's also key to consider the backdrop of the current culture, for example:

- what's rewarded

- how success is communicated

- who the current heroes are

- how a new culture might emerge

- where tradition is valued and can be used as a catalyst to promote new rewards and recognition .

Building continual learning and development into that new culture sets an organisation up for success.

BUILDING INCLUSIVE DESIGN INTO TRANSFORMATIONS

Today's workforce is incredibly diverse. This leads to a range of different needs and requirements in the workplace, and it's important to design and implement technology solutions that are accessible to the largest number of people possible – referred to as 'inclusive design'. It's not just about considering physical challenges but also fostering a sense of belonging and inclusion. To design inclusively we should:

- avoid stereotyping

- acknowledge people can be fearful of new technologies and change in general

- reinforce the fact that all can play an active role in developing the future

- build empathy with the workforce through regular communication

- collect data to determine and deliver the right support.

A practical tool to aid inclusive design and stimulate conversations is Cards for Humanity, an online tool to help designers overcome unconscious bias. It works like a card game, dealing random user scenarios to challenge creatives' perspectives and encourage inclusive design.

"Technology will create structural churn, with a quarter of companies seeing job decline from new technology adoption and more than half seeing job growth. But the human-machine frontier is shifting to new terrain. While expectations of the displacement of physical and manual work by machines has decreased, tasks requiring reasoning, communicating and coordinating – all traits with a comparative advantage for humans – are expected to be more automatable in the future."

World Economic Forum, 2023

ADAPTING EMPLOYEE ROLES

The role of the employee will change as new technologies begin to remove repetitive tasks, such as automation of key processes or using AI to outsource lower-impact, decision-making tasks. A whole new breed of technology is developing to make decisions on behalf of organisations, which broadly fall into three categories:

- Human in the loop – a person can start or stop any action instigated by an intelligent system

- Human on the loop – a person can still stop any action instigated by an intelligent system, although the action would be started without the need for a person to pre-approve it

- Human out of the loop – the process is fully automated and approved by the intelligent system.

The choice of technology will be driven by the organisation's strategic direction, risk appetite and cost benefit analysis of implementation.

As employee roles change, it's also fundamental to consider how to allow colleagues to focus, to allow them to think and best provide their knowledge and value, without the increasing distraction from new applications, pop-ups and alerts.

DELIVERING CRITICAL RESULTS

Delivering transformation in a way that demonstrates respect for your workforce allows the acceleration of benefits, de-risking of the operating environment, while retaining critical skills.

Creating a new range of jobs which are exciting and attract the best UK and global talent really needs to be where the magic happens, and is key to differentiating businesses for the future. Fundamentally, to deliver essential results, it's not just about new technology, but also about developing and leveraging new structures and operating models, redefining how to collaborate within organisations, and enabling interoperability with partners.

It's by addressing these challenges holistically that organisations will be best placed to adopt the technologies of the future and adapt to their new requirements.

The potential results from implementing and leveraging new technologies are mouthwatering. However, the defence industry must help employees adapt to innovations within an evolved business culture, and successfully manage the change process to optimise these outcomes.

AFTERWORD

TOGETHER, LET'S COMMIT TO A NEW DIGITAL CULTURE

New talent is interviewing you and not the other way around. Global organisations like Facebook, Google, and Amazon are hiring hundreds of thousands of graduates with a diverse range of backgrounds and skills to build and lead exciting new digital projects embracing the metaverse, quantum computing and AI. The fight is well and truly on, and nowhere more so than in the defence industry.

This report has highlighted the rapid, significant pressures and technology changes impacting the industry, from new, connected IT throughout the defence supply chain, to the new opportunities that exist to connect this traditional IT to recent developments in operational technology.

Capgemini has spent more than 30 years providing IT, engineering and consulting services to the defence industry. We are seeing, and indeed experiencing, the essential changes that companies across the sector must make to successfully compete in the market, stay ahead of challenging geopolitical actors and to keep our citizens safe.

The industry, its business and IT leaders, and each organisation in the supply chain must embrace change on three fronts:

1

DEFINING DIGITAL CAPABILITIES

The Connected Theatre requires every organisation to understand their role in the successful and safe delivery of relevant, timely and accurate information. Increasingly this requires more sophisticated collaboration. And in order to provide all of our citizens, in or out of theatre, with the protection they deserve, we must commit to defining, understanding and delivering our digital capabilities.

This extends from the back-office ERP systems through data catalogues and dictionaries, all the way to manufacturing monitoring solutions and into the execution of in-theatre, multi-service operations, whether that be in peacekeeping or other engagements.

2

POWERING A DIGITAL CULTURE

Each employee has a role to play in the delivery of an organisation's digital capabilities. Understanding the absolute need for collection of accurate data, trusting its analysis and conclusions, and always being aware of everyone's personal role in the journey from data to action, is critical.

It is incumbent on all of us to want to use new technologies and to accept that our day-to-day activities are constantly changing, as new technology is developed and deployed. It's important as an industry that we commit to helping our employees understand the need to adopt a truly digital culture.

3

DRIVING DIGITAL INNOVATION

It is widely accepted that the world today is in the middle of a digital technology revolution. In less than three years, humanity is able to store more information than has been available since the beginning of civilisation.

Being able to collect, analyse, react and change faster than competitors, challenging actors or rogue states, provides a vital edge that can support insightful proactiveness, faster reactions, improved performance, and most importantly, increased safety. Committing to staying on top of digital innovation is a huge part of realising a digital culture.

We hope this report has provided pause for thought, but more importantly a call to action. <u>Get in touch now</u> to join us in creating a new digital culture, for the protection of us all.

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REFERENCES

1 Ministry of Defence Outcome Delivery Plan: 2021 to 2022 UK GOV

2 MOD Departmental resources: 2022 – GOV.UK

3 Digital Strategy for Defence – GOV.UK

4 Data Strategy for Defence – GOV.UK

5 Capgemini Accelerates the Global Airline Industry by becoming one of the first business partners of Airbus' Skywise Digital Platform – Capgemini.com

6 Will Roper's 'Disruptive Agility for a Disruptive World' Keynote, for AFA's vASC 2020

7 How Data Analytics Automation Is Powering McLaren – Forbes

8 PM announces new international coalition to develop the next generation of combat aircraft – GOV.UK

9 Comment: Manufacturing in 2023 will mean doing more with less – The Engineer.co.uk

10 Research Briefing – Skills and labour shortages – Parliament UK

11 An open letter to the Government regarding the teaching of engineering in our schools – The IET, UK

12 Look at the person, not the CV, BAE Systems, UK

13 Capgemini brings 1,500 new Digital roles to the UK in 2021 – Capgemini.com

14 Capgemini Ranked #1 in the Everest Group Engineering Services Top 50 Service Providers Report for 2022 – Capgemini.com

15 Opinion – How are Aerospace & Defence Manufacturers adapting to attracting top talent in an increasingly competitive market – Capgemini.com

16 Leading in Learning | Available at: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/HumanCapital/gx-cons-hc-learning-solutions-placemat.pdf.

17 Getting to Equal | Available at: https://www.accenture.com/content/dam/accenture/final/a-com-migration/thought-leadership-assets/accenture-equality-equals-innovation-gender-equality-research-report-iwd-2019.pdf.

18 www.globalgovernmentforum.com. (2023). ChatGPT a threat to national security, warns Pentagon AI chief. [online] Available at: https://www.globalgovernmentforum.com/agencies-dont-have-the-tools-to-head-off-chatgpt-threat-to-national-security-warns-pentagons-ai-chief/ [Accessed 19 Jun. 2023].

19 assets.publishing.service.gov.uk. (2021). Integrated Operating Concept 2025. [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1014659/Integrated_Operating_Concept_2025.pdf [Accessed 19 Jun. 2023].

20 GOV.UK. (2023). Ministry of Defence's Science and Technology portfolio. [online] Available at: https://www.gov.uk/government/publications/defence-science-and-technology-programmes-and-projects/ministry-of-defences-science-and-technology-portfolio#:~:text=Over%20the%20next%204%20years.

21 Deverell, C. (2020). Forget Darpa. The British military is far too slow in embracing tech. [online] Wired UK. Available at: https://www.wired.co.uk/article/uk-security-defence-review.

22 Panel®, E. (n.d.). Council Post: Change Management: 13 Ways To Introduce New Technology. [online] Forbes. Available at: https://www.forbes.com/sites/forbeshumanresourcescouncil/2022/03/11/change-management-13-ways-to-introduce-new-technology/?sh=7bc84ce96dc8 [Accessed 19 Jun.2023].

23 Business Insights Blog. (2022). What Is Design Thinking & Why Is It Important? | HBS Online. [online] Available at: https://online.hbs.edu/blog/post/what-is-design-thinking#:~:text=Design%20thinking%20is%20a%20mindset [Accessed 19 Jun. 2023].

24 World Economic Forum. (2023). The Future of Jobs Report 2023. [online] Available at: https://www.weforum.org/reports/the-future-of-jobs-report-2023. https://www.weforum.org/reports/the-future-of-jobs-report 2023/#:~:text=The%20Future%20of%20Jobs%20Report%202023%20explores%20how%20jobs%20and,the%20workplace%20of%20the%20future.

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