

From Virtual to Reality

Six imperatives for
becoming an AI-ready
healthcare business



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Introduction

The power of Artificial Intelligence (AI) is already radically reshaping our everyday lives as it transforms sectors such as retail, hospitality, logistics, and manufacturing around the world. Every day, tens of millions of us search online for the lowest air fares, ask Siri or Alexa to check the weather forecast, watch a movie that Netflix recommends, or tap Waze to find the shortest route home. These types of AI-based innovations are fundamentally altering how we live our lives, enabling enterprises and entire sectors

to provide better services, as well as contributing to increased economic, social and environmental prosperity.

The emergence and increasing use of AI within global health organisations is mirroring those consumer behaviours and commercial sectors. The question for the global healthcare industry is no longer if, but when and how AI will begin that same transformation.

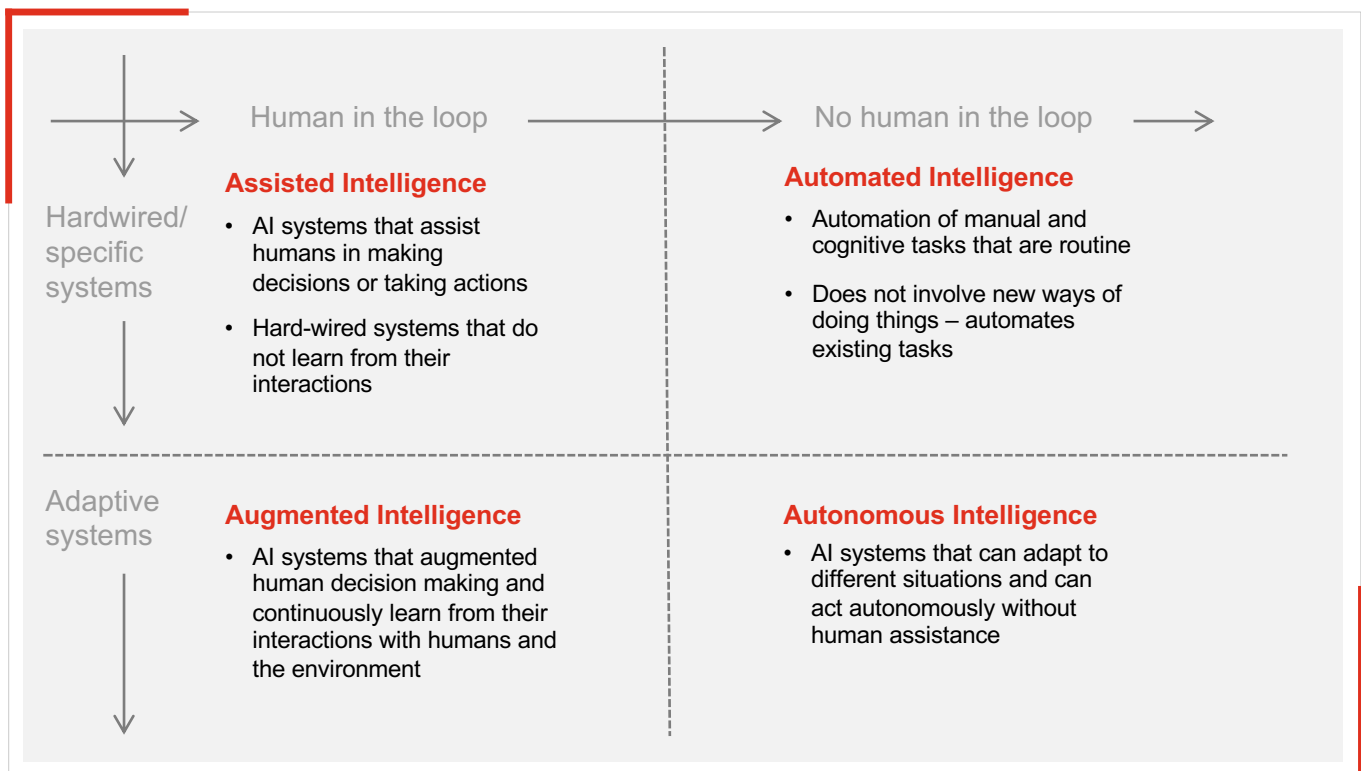


What do we mean by AI?

We define AI as we use it here broadly - as technology and systems 'that can sense the environment, think, learn, and take subsequent action in response to what they're sensing'.¹ We include machine learning as a component of AI. Simply put, AI is the collection of technologies that assist, augment, or substitute for human capabilities.

In our report *Sizing the prize: What's the real value of AI for your business and how can you capitalize?*² we

identified four categories of AI applications for enterprises, based on the type of system and the degree of human involvement in decision making. These categories vary in their level of sophistication and provide a framework for health organisations to think about when applying AI innovation - from automated (the simplest) to autonomous (the most complex).



Adapted from PwC's report *Sizing the prize: What's the real value of AI for your business and how can you capitalise?*



Data, data and more data

Massive amounts of high quality, reliable data is required for effective AI. No matter which category your business may fall into, any company’s ultimate success with AI is fundamentally dependent upon a single immutable factor – the ability to collect, store and analyse ‘big data’, quality data, and then deploy the resulting information and insight throughout the organisation or into a commercial solution.

Designing, building and/or enhancing your technology infrastructure to support these data-fed AI applications and workloads is the critical first step for every AI implementation.

Considerations include: source data and mode of collection; necessary storage capacity to reliably deal with this data (for example, will you be using the data for real-time decision-making or in post-processing); networking (for example, deep learning algorithms are highly dependent on communications and demand increases as AI efforts expand); processing and analytics capability; and security.

Data lies at the complex heart of AI and the growth of the Internet of Things (IoT) ecosystem in health adds further layers to that complexity. But beyond the infrastructure, you will also need people - data analysts, data scientists,

developers, cybersecurity experts, network engineers and IT professionals with a variety of skills not only to build and maintain the infrastructure that supports AI technologies within your organisation but with knowledge and skills in areas such as machine learning, natural language processing and deep learning.

This era of AI for healthcare can feel overpowering for many people and organisations. **Where to start?**



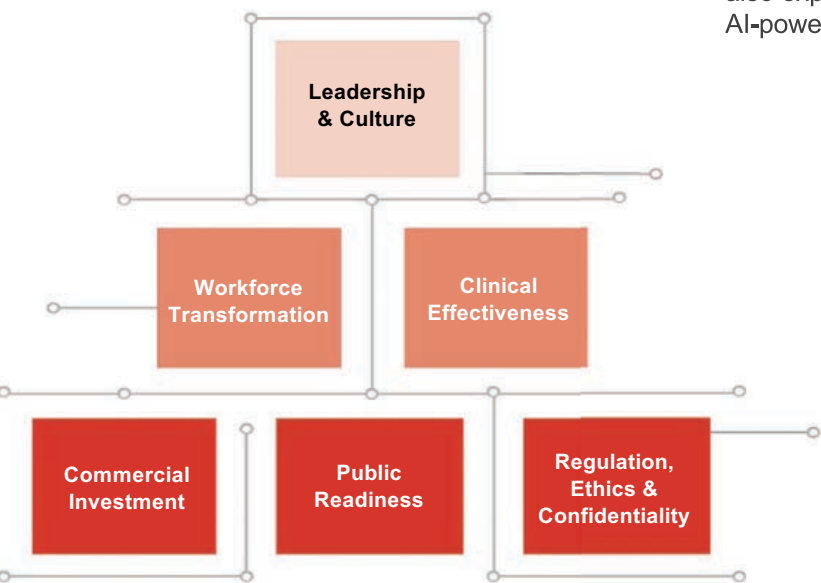
The six imperatives for transformation

The first step for any transformation is to realise and then accept the need for change. The next and most complex steps are to successfully implement that change.

Through our on-going work and research, we have identified six key areas that are imperatives for healthcare businesses to address if they are to successfully implement AI within their organisations:

Focusing on these six imperatives will enable us to make the impact of these technological advancements our new reality: From Virtual to Reality.

At the heart of this report we dig deeply into the key enablers as well as the key challenges that were raised in our research, highlighting the ways in which the industry is adopting AI, both globally and across the Middle East. We also explore what’s necessary to successfully enable an AI-powered healthcare environment.



The public is ready, are you?

Business readiness

In 2017, as part of our *What Doctor?* report, we explored how willing people were to engage with AI for their healthcare and what might encourage them to broadly adopt such solutions. Our survey revealed there is not only an increasing willingness for AI integration across healthcare in the Middle East, but that this willingness is comparably higher than in many other parts of the world.³

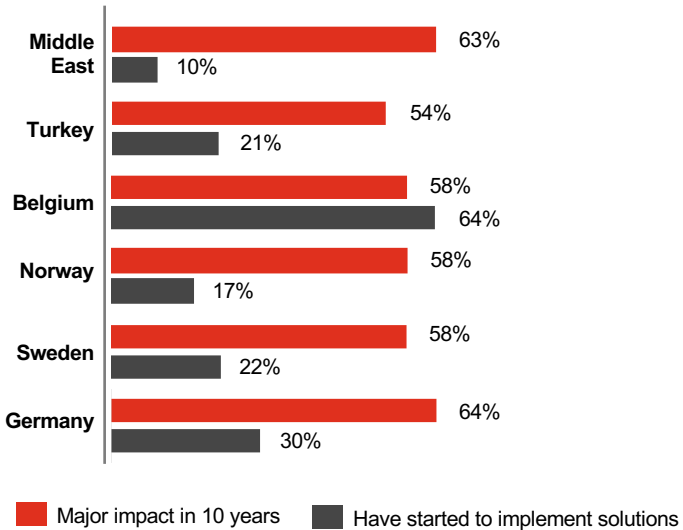
The public's attitude towards AI raises new questions for healthcare industry leaders. Given their readiness to embrace this new wave of technology, what are business leaders doing about it? With this question in mind we reached out to over 160 healthcare leaders in both the public and the private sectors across Europe and the Middle East to understand three things:

- The impact business leaders believe AI will have on their business over the next 5 to 10 years;
- Their readiness to embrace AI and whether they are preparing their business for this change; and
- The key challenges and enablers for implementing AI services and solutions within their organisations.



Our findings suggest that many businesses across Europe and the Middle East are only at the beginning of AI implementation for their organisations. In particular, in the Middle East we found a large gap (approximately 50%) between public readiness and business readiness. Almost two thirds of the business leaders who participated in our research in the Middle East believe that AI will have a major impact on their business over the next 10 years, yet fewer than 10% have started doing something about it, falling far behind European respondents.

Business Impact vs Implementation



Challenges and enablers

What is holding these organisations back from implementing what is certain to have a major impact on the success of their businesses? We asked these healthcare business leaders across Europe and the Middle East about the challenges they were facing and what they perceived as the necessary enablers for AI adoption within their organisations.

Just over one third of our cohort are currently exploring the practicalities of what they need to be doing now. These organisations tend to have an existing technology infrastructure in which to embed AI, a convincing business case for the added value of AI, and the financial resources to invest in AI implementation.

On the other hand, comparatively few have begun such a journey. Just one fifth of these business leaders are starting to think about AI for their business, while fully one quarter feel they are not prepared for this new era of healthcare at all. These businesses cited a lack of leadership support and financial resources, and the readiness of their workforce to support an AI implementation.

When asked what was necessary to enable moving forward with AI, these same leaders cited leadership support and investment resources as the top enablers, followed closely by an enabling regulatory environment. Interestingly, while public readiness remains a fundamental element for success, there still appears to be a perception among business that the public is not yet ready to embrace AI in healthcare.

Key Enablers

Leadership support	Investment resources	Regulatory environment
Value-added Business Case	Workforce readiness	Public readiness



Practical implementation of AI in health organisations

AI transformation is being adopted across many industries at pace. With AI technology advancing so rapidly, now is the time for the healthcare industry to start exploring and developing its vast potential.

Getting from the 'Why' to the 'How' of AI implementation is a large leap for most health organisations. In part this is due to the unique barriers to adoption that the healthcare industry faces – from legacy infrastructure and regulatory uncertainty, to ethics and confidentiality issues. Even among those who are convinced of the need to invest in AI, many simply lack the ability to implement the new technology.

Based on our research and ongoing work in market we've identified six key areas that are imperatives for healthcare businesses to address if they are to successfully implement AI within their organisations:

Leadership & Culture

We start with leadership because transformation requires shedding legacy thinking and reshaping the organisational culture from the top-down. What main capabilities do healthcare leaders need to advocate the change and how do they influence a culture of change within and throughout their organisation? How are our regions' health leaders advocating this change, and what are they doing to encourage growth and investment in AI?

Workforce Transformation

New ways of working will emerge. Job roles will change. Physical environments will adjust. What will the workforce of the future look like? Will AI replace jobs in the healthcare sector? How do we prepare and educate our workforce of the future?

Clinical Effectiveness

Maintaining a focus on patient outcomes is the prime directive for clinical effectiveness. Where are we best placed to have the most impact? How do we define and design the solutions and services that are aligned to what we do best?

Commercial Investment

AI has the potential to add trillions of dollars to the global economy. What are the steps we need to take to begin investing in AI? Are we investing in those areas where we can make the most impact as well as the best returns?

Public Readiness

Our *What Doctor?* report highlights the public readiness to integrate AI into their healthcare services. But there are caveats. How do we promote trust as the continuing driving force behind public adoption?

Regulation, Ethics & Confidentiality

Regulation is constantly evolving in the healthcare industry. How do we strike the right balance between regulation and innovation? How do we promote 'responsible AI' to address the ethical and data confidentiality concerns surrounding AI?

In the following chapter we explore these six 'imperatives'. We look at each in turn as necessary for building AI capability into our healthcare businesses and organisations, delve into the global perspective, and shine a spotlight on some of the changes happening in the Middle East.

The six imperatives for successful AI implementation

Leadership & Culture



The global perspective

What differentiates AI from other technologies or data analytic tools? And why is AI becoming so increasingly important for healthcare?

At its simplest, AI enables decision making on the vast amount of unstructured data out there. AI aggregates and structures that data, learns from it and identifies patterns, which then can provide an organisation with deep insights. These insights are used to improve and expand the business, and create new customer experiences. For a hospital, this might mean understanding bottlenecks in the facility to better plan patient flow and staffing. Or this insight might lead to new approaches for treatment within communities instead of in hospitals, which has been shown to decrease risk of hospital readmissions.

The continuing emergence of new AI technologies is fundamentally transforming the ways we work, inherently changing an organisation's DNA culture. As this pace of change is accelerating, healthcare leaders are under pressure to learn, adapt and stay ahead in a rapidly changing environment. In particular, they are dealing with unprecedented organisational change, requiring them to reassess their organisation's vision, values and processes, and their employee's motivations and beliefs. In addition, they face the growing challenge of finding the right talent.

Eight main capabilities underpin an 'AI-ready' healthcare leader that includes aspects of managing organisational culture:

- 1. Thinks strategically and with foresight.** Creates a compelling vision of the AI future, keeps up to date with AI trends and anticipates and evaluates the environmental factors that may impact the organisation;
- 2. Agile.** Thinks expansively as to how data driven and environmental insights can be used, has an innovative and experimental mindset - fostering a culture that encourages taking calculated risks and collaborates through cross-functional AI transformation teams;
- 3. Simplifies complexity.** Creates an AI roadmap that connects all parts of the organisation, promotes open feedback and continuously aligns resources and people to AI strategy;
- 4. Technologically aware.** Familiar with the technologies and competitive pressures that impact the organisation, creates the right incentives to leverage new AI learnings and insights, segments the AI learning process into actionable steps and conducts comparative analysis based on current technology;
- 5. Critical decision maker.** Assesses the scope and significance of AI-related decisions, is courageous in taking decisions and trying new approaches for AI initiatives, and balances the need for speed and rigour when activating their plan;





6. **Drives transformation.**

Leverages key influencers and committed people within the organisation to help lead the AI transformation, has a clear and deep understanding of the 'burning platform' for change, and creates energy as a leader, acting as a champion for AI transformation;

create complementary partnerships, and challenges the status quo in all technology-related matters;

8. **Empowers others.** Creates a culture of change by empowering others at all levels throughout the organisation to drive the change initiative.

7. **Fosters innovation and challenge.**

Continuously looks for new opportunities, finds the right internal and external alliances to



Middle East spotlight

Leading by example is an integral part of the success of any initiative and within the Middle East we are seeing fundamental change at the leadership level within government. For example, the first Minister for Artificial Intelligence in the United Arab Emirates (UAE), Omar bin Sultan Al Olama, was appointed in October 2017.⁴ The key focus for the Minister is exploring practical ways in which governments can and should govern this new technology by aligning key stakeholders and bringing together the right people for collaborative discussions.⁵

With the UAE government committed to an AI-powered society, Artificial Intelligence Week Middle East - the first-ever AI event in the Middle East - was held in Dubai September 2018 and included a focused health track. The theme for the event was 'Personalised and predictive: the new era for AI-powered patient care' with talks from the regional and international pioneers on the different applications for AI in healthcare.

The Kingdom of Saudi Arabia (KSA) has embarked on a similar journey in an effort to achieve its Vision 2030. The National Transformation Program 2020 outlines objectives to improve the efficiency and effectiveness of the healthcare sector through digital transformation and the use of emerging technologies such as AI.⁶ In November 2017, a similar appointment was made, with Ahmed Altheneyan becoming the first deputy minister for technology, industry and digital capacities at the Ministry of Communications and Information Technology (MCIT).⁷



ACTION

Create a company-wide AI implementation working group to explore these first three fundamental areas:

1. Understand the customer or societal problem you are trying to solve with AI;
2. Map out how you will create an organisational culture of change;
3. Identify what you will need as individuals and as part of this working group to spearhead this transformation.

Workforce Transformation



The global perspective

AI does not replace jobs, it replaces tasks. The most common fear surrounding the increasing use of technology and AI throughout the workplace is the threat to jobs. Just as automation has replaced workers on the factory assembly line and in call centres, our healthcare workplace and workforce of the future is certain to look very different.

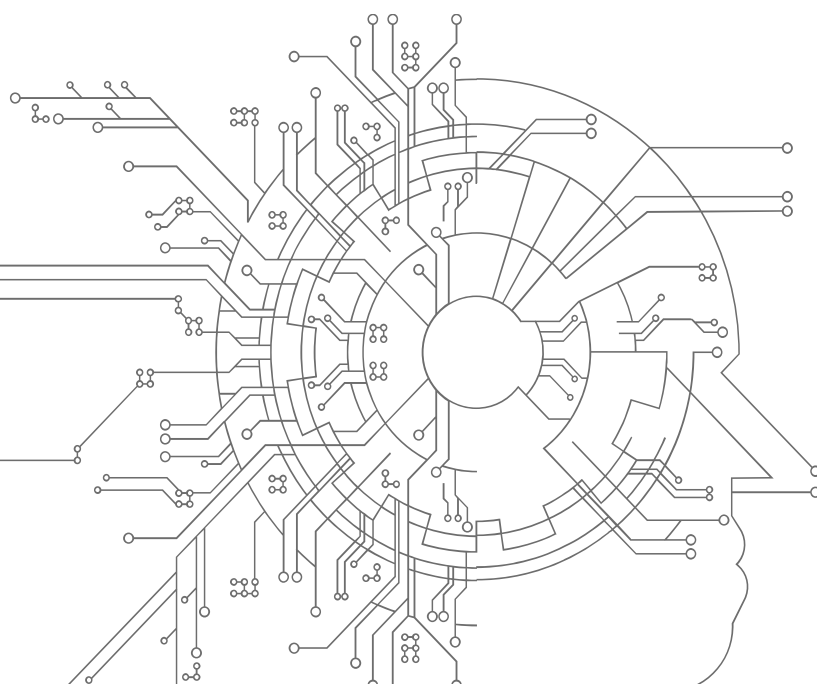
According to PwC's most recent comprehensive *Future of Work* survey, 37% of respondents were excited about the future compared to only 18% who were worried.⁸ And we believe that the potential for job skills augmentation outweighs that of job loss or replacement. However, people will need to learn new skills and supplement old ones, and do so quickly.

We need to profoundly change the way people work and the way they think about work. The biggest impact on jobs in healthcare in the immediate future will likely be in medical diagnosis. For example, major disease areas that currently use AI diagnostic tools include cancer, neurology and cardiology. AI helps healthcare professionals unlock the vast amounts of unstructured health data to enable better, more accurate diagnoses, exponentially faster than a human being.⁹

This requires human doctors and other health professionals to liaise with and trust AI as part of the diagnosis process. Freed from routine tasks, AI will help shorten waiting times and ultimately allow clinical staff to focus more on the patient instead of the symptom or the illness. As Andrew Fryer of Microsoft UK clearly says: "AI will work best alongside humans, not against them".¹⁰

The critical skills that healthcare organisations need will become the ultimate prize. PwC's study suggests automation of routine tasks encourages the increase in specialisation and the emergence of 'pivotal' people. By replacing those tasks that are routine and repetitive, machines can then strengthen the comparative advantage of problem-solvers, innovators, designers and leaders. Those skills that can't be performed by AI become more pivotal and therefore more sought after by employers.

"Medical decisions are complex and I doubt a machine will ever be able to imitate genuine human compassion" Margaret Chan, Director General of the World Health Organisation, on the need for human oversight.¹¹





Middle East spotlight

In the UAE the Minister of AI is incorporating educational initiatives into certain sectors, including healthcare. With a focus on training the next generation, an inaugural 'AI camp' was created in collaboration with Harvard University in Boston. The Ministry of Education selected 38 Emirati students from Grades 9-11 to attend and learn about the use of AI, machine learning and coding.¹² There is now also an official UAE AI Camp that is being run under the Ministry of Artificial Intelligence where they provide courses in AI.¹³

Specifically within healthcare, Dr. Ali Abdul Kareem Al Obaidli, Chairman of SEHA's AI committee, spoke at AI Week about SEHA's introduction of AI across its 17 hospitals, acknowledging that "we are entering into an era of Augmented Intelligence... with AI no longer being perceived as a luxury but a necessity". He also spoke of how AI has become a topic on every internal staff meeting's agenda held at SEHA, in order to ensure that literacy on the topic is embedded across the entire organisation.¹⁴

And in September 2018, the American University in Beirut Medical Center (AUBMC) and Association of Academic Health Centres (AAHC) hosted a conference with Columbia University/Narrative Medicine Program and two other Schools of Medicine in Lebanon. Entitled 'Transformation of Medical Education in the New Era', the conference focused on the new technologies and medical knowledge physicians must master as AI reshapes their role, as well as the changing medical school curricula.¹⁵



ACTION

Work with and empower your Learning & Development and Human Capital teams to identify opportunities for upskilling staff:

1. Define what your workforce of the future will should look like;
2. Identify AI trainings to provide an overview and broad understanding of the new technologies throughout our organisation;
3. Identify specific trainings to enable a deeper understanding of the applications and current use case for AI in healthcare;
4. Develop and introduce an AI training curriculum to augment existing skills in your organisation.

Clinical Effectiveness



The global perspective

At the heart of value-based healthcare is clinical effectiveness, which uses evidence to improve the efficacy of clinical practice and delivery of care - in other words, improving patients' total experience of healthcare, before, during, and after delivery of healthcare services.

The application of AI in healthcare is already having a profound impact, yet despite the successes, the bulk of AI research to date remains focused on the early detection of four limited disease areas, three of which are leading causes of death throughout the world:¹⁶

- **Oncology:** Assisting the diagnosis of cancer. For example, in China, where the healthcare system has long grappled with a scarcity of medical professionals, Tencent's Miying, an AI-powered imaging product, is helping doctors detect early signs of cancer in nearly 100 hospitals across the country.
- **Neurology:** Restoring control of movement in patients with quadriplegia, and detecting the early onset of dementia. UK-based Cognition is using AI in the early detection of dementia, enabling doctors to help patients delay progression of and better manage their disease.
- **Cardiology:** Diagnosing heart disease through cardiac imaging. In India, Apollo Hospitals is partnering with Microsoft to use AI for early detection of cardiac disease.
- **Ophthalmology:** Diagnosing congenital cataract disease, and diabetic retinopathy through images. An AI solution by Los Angeles based start-up VoxelCloud is already being used by ophthalmologists at Peking Union Medical College to quickly screen patients for diabetic retinopathy.¹⁷

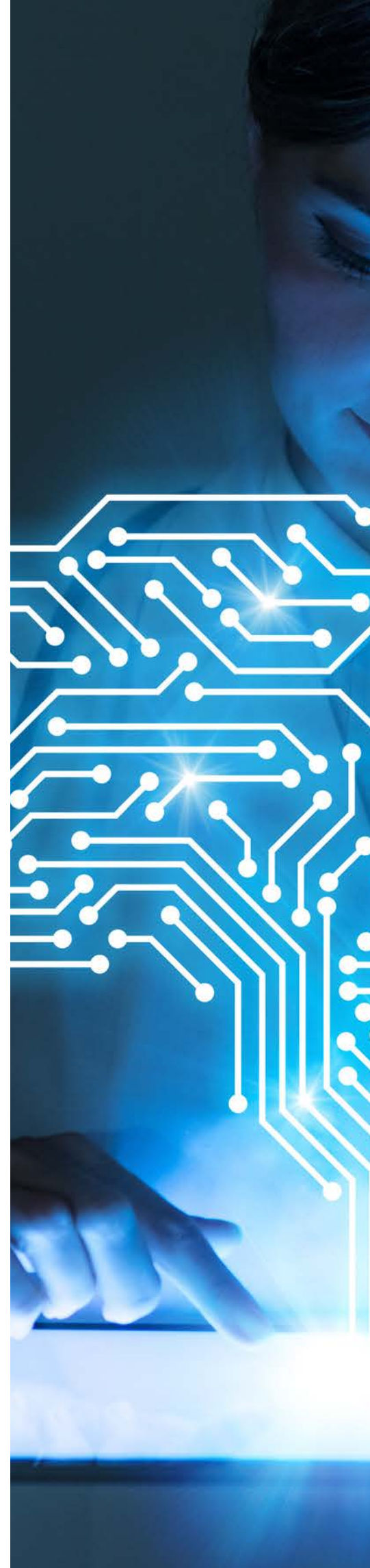
Beyond these disease areas, there are three broad fields where AI can benefit from increased investment to substantially improve clinical effectiveness:

1. Medical imaging

Machine learning algorithms are supplementing the skills of radiologists to enable faster and more accurate reading of radiology and pathology images, which in turn leads to earlier and more precise diagnoses. As it matures, this application of AI has the potential to scale for a wide range of diseases and to geographies where there is a shortage of doctors. Examples include the detection and diagnosis of stroke and analysis tools to measure blood flow in non-invasive coronary exams.¹⁸

2. Clinical decision support

Machine learning algorithms that use natural language processing (NLP) can extract meaning from text notes in Electronic Health Records (EHRs), helping physicians to make more effective clinical decisions. By mining and analysing data, AI technology can also predict whether a patient has a given illness or condition, and present alternative diagnoses for physicians to consider. Improving patient pathways is another area of focus; for example, Ayasdi uses machine learning, pattern recognition, visualisation tools, and simple interfaces to construct clinical workflows.





Efficacy, transferability and improved outcomes

The use cases provide a sense of the possibilities for AI in the healthcare space. In particular, linking AI to value-based care places AI firmly in the centre of quality improvement, enabling better 'data-realisation' - in other words, augmenting a physician's expertise to better predict health issues, make better decisions and take more effective actions.

But the context is so large, and the market is innovating so quickly, that it is vital to take a strategic approach to AI investment. We look at the imperative for commercial investment within the Middle East in the following section.

3. Health, wellness and consumer diagnostics

One of AI's biggest potential benefits is to help people stay healthy so they don't need a doctor, or at least not as often. The use of AI and the Internet of Medical Things (IoMT) in consumer health applications is already helping people to manage their own healthcare and to keep themselves well through healthier living.¹⁹

However, beyond the fitness trackers and stress-reduction apps, momentum is growing for the next big step: the wearable as a medical tool, combining AI-based smartphone apps and wearable hardware devices to

enable consumers to self-diagnose medical problems. For example, an app by Lucina Health leverages machine learning and a wealth of existing data to help women monitor their pregnancies, identifying potential risks and complications, and creating personalised pregnancy plans.

Imagine if you suffer from asthma or an irregular heartbeat, having a device in your pocket that could provide you with the data you need, could help prevent an attack. These 'diagnostic and assistive devices' may well be the next wave of AI that can directly impact consumer healthcare.²⁰



Middle East spotlight

At Arab Health 2018, the Ministry of Health and Prevention UAE showcased several technologies that are being implemented within their facilities to provide better care outcomes for their patients. The range of products vary widely - from IBM Watson for oncology diagnosis, to the AI-based Deprexis MS app which provides support to patients with MS who are suffering from depression.

In April of 2018, the DHA announced the promising preliminary results of the Chest X-Ray Screening AI Algorithm – developed in partnership with Agfa HealthCare over the past two years²¹ and deployed across 20 DHA medical fitness centres in Dubai. With nearly 5000 chest x-rays performed every day and with gaps in existing workflows, there was a need to improve screening turn-around times. The collaboration is the first AI validation in the UAE, resulting in a 95% success rate in the identification of tuberculous and a 28% reduction in screening turn-around times using AI.²²

There are many other examples of new technologies trying to launch in the Middle East, such as Dhonor, a blood and organ matching platform powered by blockchain and AI technologies to improve speed and accuracy of donor matching. The challenge is turning the proof of concept into a product that can be taken to market across the Middle East.



ACTION

Focus on patient outcomes and clinical effectiveness:

1. Identify specific AI products, services and/or solutions best aligned to your business needs;
2. Ensure that your performance scorecard is value-based, e.g. what are the patient outcomes you want to achieve?
3. Identify a way to collaborate with government to create a roadmap for product development and market entry;
4. Create a roadmap to turn a proof of concept into a viable commercial proposition, and ensure that the solution is scalable and transportable.

Commercial Investment



The global perspective

Our recent global study established a potential contribution to the global economy from AI innovation across all markets of up to USD 15.7 trillion by 2030. Of this, USD 6.6 trillion is likely to come from increased productivity and USD 9.1 trillion is likely to come from a shift in consumer demand and behaviour. The health sector shows the highest potential for growth²³ and - according to a Frost & Sullivan report - this will amount to approximately USD 6.6bn by 2021.²⁴ A further PwC study analysed the potential benefits from AI applications in healthcare by exploring three care pathways:

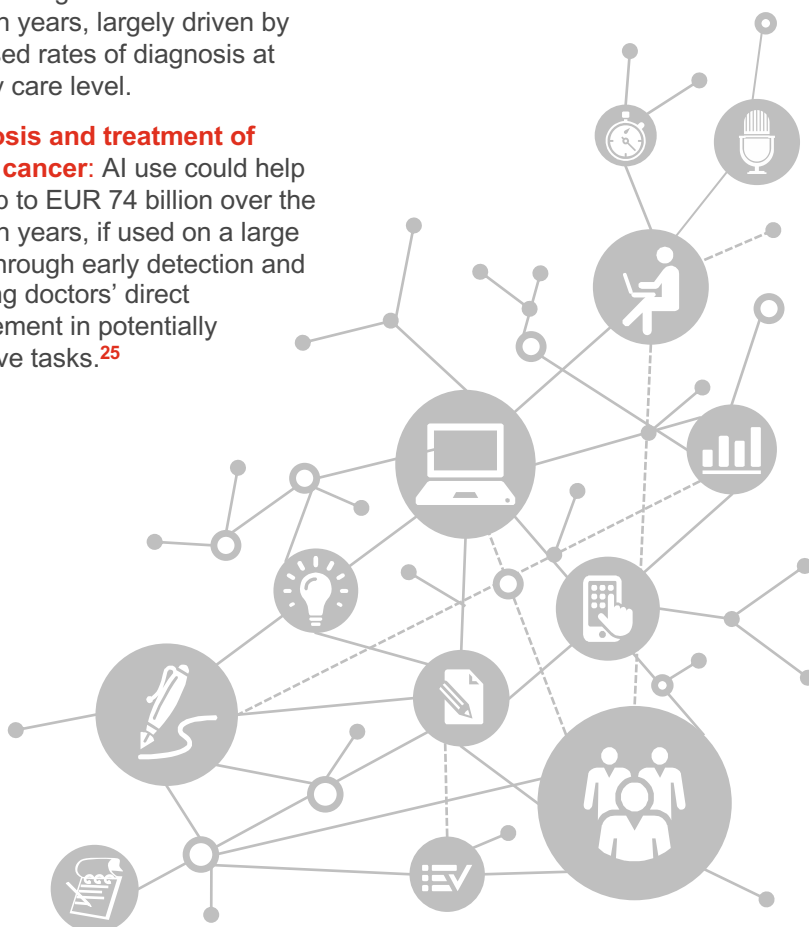
- **Prevention of childhood obesity:** AI use could yield cost savings of up to EUR 90 billion over the next ten years due to lower medical costs, and reduced losses from lower productivity and sick days.
- **Diagnosis of dementia:** AI use could help save up to EUR 8 billion in diagnostic costs over the next ten years, largely driven by increased rates of diagnosis at primary care level.
- **Diagnosis and treatment of breast cancer:** AI use could help save up to EUR 74 billion over the next ten years, if used on a large scale through early detection and reducing doctors' direct engagement in potentially repetitive tasks.²⁵

Large players such as IBM and Google are proving the economic cost savings from AI in healthcare; and the rest of the market is following. By February 2017, investors had poured over USD 1.79bn into acquisitions or funding for 106 AI start-ups in healthcare.²⁶

At the time of writing, AI applications are being deployed in the main areas of telemedicine, clinical decision support (IBM Watson), patient health management platforms (Babylon, Nexj), elimination of waste and fraud in payment processing (Optum), and in patient and care pathways (Mercy, Command Centre in Johns Hopkins).

Other options that are being explored for the near future are in the areas of precision medicine, AI blockchain for patient EMR and insurance, intelligent implants, and smart drugs which can transmit a signal to monitor patient compliance.

No longer is AI science fiction, it is evolving and transforming healthcare now.





Middle East spotlight

Across the region, the Middle East has been finding new ways to embrace the changing AI landscape. AI is at the forefront of some of the government's key strategic plans and initiatives, where it will eventually contribute up to USD 320 billion (Dh1.2 trillion) towards the Middle East GDP.²⁷

In the UAE, major initiatives are paving the way for AI, including: the Smart Dubai Strategy; a Dubai 3D Printing Strategy; and a Dubai Autonomous Transportation Strategy. Whereas in KSA, the Ministry of Health was allocated a USD 6 billion budget for technological advancements.²⁸

Investment in major health innovation continues, including: The development of a new city in the KSA, NEOM, that will heavily rely on AI and IoT²⁹; the digitisation of all health records by DHA; and apps such as Tummy Fish that encourage children to drink water. The Department of Health in Abu Dhabi has also implemented a preventive health program called the Weqaya, screening adult Emiratis and extracting data for various epidemiological studies. Mubadala has established the Abu Dhabi Telemedicine Centre in order to reduce emergency room visits and hospitalisation rates.

Dubai Future Accelerators (DFA) is a programme hosted by the Dubai Future Foundation and the Government of Dubai that invites entrepreneurs to submit proposals for emerging technologies. The winners are then flown to Dubai and given support to implement their solutions on a city-wide scale, providing them with access to state-of-the-art prototyping labs and partnering with the government.³⁰

The UAE has also signed a Memorandum of Understanding with India to explore new ways of collaboration to facilitate the growth of their AI initiatives. This partnership is estimated to generate economic benefits for both the UAE and India over the next 10 years of up to USD 20 billion (Dh 73.4 billion).³¹



ACTION

Develop and agree your investment strategy with your Board:

1. Assess your organisation for areas where small investments in AI could create savings;
2. Identify your competitive advantage and brainstorm on potential AI investments that can help enhance or complement your existing products;
3. Assess and decide on which business areas will require the most investment and help you achieve your AI goals;
4. Spend more time with your customers to understand their drivers for AI related solutions;
5. Agree on your growth strategy and be open to partnering with other suppliers.

Public Readiness



The global perspective

There is a growing enthusiasm among the general public to engage in new ways, with new technology, for their health and wellness needs.

In our *What Doctor?* report of 2017³² we explored the findings of a comprehensive survey we conducted with over 11,000 people across 12 countries in Europe, the Middle East and Africa. We wanted to better understand the public's appetite to engage with AI and Robotics for their healthcare needs, and the circumstances under which they would be willing to do so.

Trends did emerge across regions, with a clear distinction between developed and emerging economies:

- **Developed economies** were less willing to rely on AI as they have benefitted from a relatively high per capita health spend and a legacy of universal healthcare coverage providing good overall value.
- **Emerging economies** with relatively lower per capita health spend, mixed degrees of healthcare quality and provision and access constraints were significantly more willing to engage with the new technologies.³³

But behind those messages are three key themes that have implications for how these new technologies will shape healthcare in the years to come:



People are increasingly willing to engage with AI and robots if it means **better access** to healthcare



Speed and accuracy of diagnosis and treatment is a critical factor for this willingness



Trust in the technology is vital for wider use and adoption; the **'human touch'** remains a key component of the healthcare experience

This latter theme is a critical one for AI. It's a normal human reaction - we tend not to trust what we don't understand. And, as social beings we have a natural inclination to place our trust in people, not machines. These two elements may well be the greatest barriers to AI adoption in healthcare, because our very lives are at stake.





Middle East spotlight

Like many countries in the developed economies, the Middle East has a long history with universal healthcare coverage and spends two to three times more per capita on healthcare than those countries in emerging economies. However, the Middle East has historically been affected by workforce issues and capacity constraints.³⁴

We found that two thirds of the Middle East were willing to engage with AI and robotics for their healthcare needs and the country-specific findings were statistically the same across the region and across demographics. And, like their EMEA counterparts, their reasons for doing so were overwhelmingly linked to better and quicker access to healthcare. However, trust was a big issue for Middle East consumers and there was a high degree of concern that the adoption of AI and robotics would mean the loss of the human element.



ACTION

Public readiness remains a critical element to the advancement and further adoption of AI throughout healthcare:

1. Have an on-going dialogue with both consumer and patient groups; focus on those communication channels through which we can best effect change;
2. Utilise focus groups and/or create advisory panels of both consumers and patients for feedback and insight into those solutions that will have the most impact for individuals and the public health;
3. Introduce engagement mechanisms that will measure on-going perceptions and attitudes.



Regulation, Ethics & Confidentiality – Promoting ‘Responsible AI’

The global perspective

Imagine that the next time you see your doctor, he or she tells you that you have a life-threatening illness. The catch? A computer has performed your diagnosis, which is too complex for humans to entirely understand. But, as your doctor explains, the computer is almost always right.³⁵

AI is already helping healthcare professionals make incredibly accurate diagnoses and decisions about our health based on AI's ability to structure, connect and find patterns in the vast amounts of data. Yet how do we regulate what we can't fully explain? This question lies at the heart of the issues surrounding AI regulation.

The concept of ‘responsible AI’ – encompassing regulation, ethics and confidentiality - is growing as a global movement. The IEEE (which develops standards for the computer and electronics industries) and Google's DeepMind as well as The World Economic Forum's Centre for the Fourth Industrial Revolution have released sets of principles that focus on how to maximise the benefits of AI for society and limit its risks. These groups agree on many issues - such as the need to design AI systems with social impact, test systems carefully before release, monitor them rigorously afterwards, and establish tools and standards for auditing AI algorithms.³⁶

Regulation

The right regulatory environment is a critical enabler for implementing AI and remains a widely debated topic that's impacting innovation across the world. Regulation has always lagged behind the advancement of

technology and as innovation in this space continues, governments are only beginning to address many of the regulatory issues. In particular, the healthcare industry as a whole is highly regulated in many countries across the globe and governments are at risk of developing policies that are reactive rather than proactive.

On one end of the spectrum, Europe implemented the General Data Protection Regulation (GDPR) in May 2018, improving the protection of data for European Union (EU) citizens dealing with companies not only in Europe but all around the world.³⁷ It's an incredibly complex set of regulations that revolve primarily around the concepts of ‘personal data’ and ‘personal data processing’.

AI is a technology that relies on huge amounts of anonymised data and the processing of that data to provide insight, and GDPR is certain to have far-reaching implications. However, GDPR also provides Europe with the opportunity to pave the way in AI governance.

On the other end of the regulatory spectrum, China - with its aggressive AI strategy, government funding, and the largest population in the world - has fewer limitations on the use of its citizens personal data. This has attracted tech giants such as Alibaba, Tencent and Baidu to invest in AI research and development, making China a strong contender for becoming a world leader in the application of AI across industries.

However, China's Cybersecurity Law (CSL) that came into effect in June 2017 contains a framework not only for regulating network products and services, but it also contains a

Personal data in GDPR is defined as anything that can be used to directly or indirectly identify an individual. On the other hand, Personal Data Processing is defined as any operations performed on this personal data (whether those operations are automated or not).³⁸



provision that applies to personal information collected over these information networks, as well as the transfer of that information.³⁹ While we have yet to see the impact of CSL on the development of AI in China, an increasingly regulated market would make China less attractive for investors in AI.

Striking the right balance between regulation and innovation is the aim. This dynamic, fast moving technology requires a different approach to regulation, one that's more flexible and future-orientated. Regulatory oversight rather than specific regulation of AI may prove the more beneficial path to the continuing development of AI technology.

Ethics

Despite the speed of AI adoption in the healthcare industry (or because of it), no common ethical standards or frameworks have been developed. There are three key areas of concern around the ethics of AI in healthcare: bias and inclusion; social equality of AI adoption; and building trust through transparency. These ethical concerns must be addressed before we will see widespread adoption of AI technology in healthcare. That's the underlying message of a survey of CEOs that PwC conducted in 2017. Almost eight in ten CEOs who responded (76%) cited the potential for bias and lack of transparency of AI solutions as one of their top concerns around adopting AI, and 67% cited the potential to disrupt society.⁴⁰

Bias and Inclusion: The data used in developing AI systems is selective – for instance, certain clinical trials may exclude certain groups (e.g. women, children and elderly), introducing bias into the system. These systems in turn are being used in treatment of patients with different profiles (gender, ethnicity, etc.). To avoid bias, governments and health organisations must be aware of the history of the data on which an AI system or solution is based. At a minimum, the use of such systems should be transparent to the public, subject to accountability standards, and available for auditing.⁴¹

Social equality of AI adoption:

While AI can bring about rapid improvements in the practice of medicine, it may also exacerbate the global digital and social divide. The most vulnerable members of society, including the poor and the elderly, generally have more limited access to all technology, are often neglected in the accumulation of datasets, and potentially have the most to gain from AI-powered healthcare. After releasing an AI system, it is important for companies to monitor how it is being used across different communities and contexts, particularly when the predictions and decisions it influences can be life-changing.⁴²

Building trust through transparency:

As we've noted, trust is a huge factor in people's willingness to adopt AI systems. As AI's complex learning technology becomes more firmly embedded throughout our healthcare decision-making, trusting that 'machine reasoning' becomes a critical factor. Furthermore, accountability for decisions becomes less clear-cut; trust is built on accountability and accountability is built on transparency.

Data confidentiality

Collaboration between healthcare providers and AI system developers involves sharing patient data. This generates concerns about cyberattacks, data breaches, and privacy. In addition, while healthcare institutions hold vast amounts of patient data, little of it is collected with thought to the consent that might be legally required for sharing that data outside those institutions. Informed consent from patients for the use of their data is another vital element to ushering in this new era of healthcare. But, as David Martínez de Lecea, Chief Operating Officer of Narrativa, a Natural Language Generation AI company based in Dubai, says, there are trade-offs:

"Society needs to make a [fundamental] ethical decision. Do we want better healthcare or more privacy?"⁴³



Middle East spotlight

With regulators across the Middle East actively working on developing their regulatory frameworks, the region is in a unique position to develop new standards and become a hub for AI Research and Development.

In the UAE, the Council on Artificial Intelligence and Robotics is currently developing a 'curriculum for ethics' in AI and Robotics to help ensure human values are at the centre of all development of emerging technologies. The council will also act informally as an ethics advisory group to the UAE Ministry for AI.⁴⁴

The Department of Health in Abu Dhabi has become the first in the region to publish a policy for the use of AI within the healthcare sector that encourages and supports the development of AI-related technologies for healthcare. Further, both the DHA and MOHAP have established AI committees looking into the applicability and roll-out of AI across their organisations and into policies.⁴⁵

We spoke with Dr. Marwan AlMulla, the CEO of the DHA's Health Regulation Sector and he echoed the sentiment of the Middle East wanting to be at the heart of this AI-powered healthcare revolution. Cascading AI initiatives to all sectors across the UAE provides a base from which the region can launch. The challenge, in his view, is that innovation is happening so fast creating a challenge for regulators. The regulatory environment needs to be robust and flexible to be able to build timely, evidence-based frameworks, to allow for innovative solutions to be prudently incorporated, with patient safety at their centre.



ACTION

The Middle East can become a global Centre of Excellence for Research and Development on AI in healthcare. If we are to deliver on the promise of AI in healthcare, we need to shape the regulatory environment in which we operate and have an open dialogue about the future of that environment:

1. Collaborate with governments to create a clear governance structure and roadmap that will attract and nurture investment;
2. Encourage the development and regulation of broad AI principles (including on-going human oversight) rather than specific algorithms;
3. Create a national or regional AI advisory committee made up of government and business leaders to make policy recommendations;
4. Learn and adopt lessons from other countries and/or industries on building a roadmap for AI innovation and investment.



Where do we go from here?

Technology is rapidly reshaping our world. As we noted in our *What Doctor?* survey and report the explosion of healthcare data combined with the rise in demand from ageing populations around the world, rising costs, and a shortage of supply (both in the number of healthcare professionals needed to treat and care for an increasing number of sick people and the availability and access to a broader range of necessary services than ever before) has left a monumental gap that only technology can fill.

The general public is ready and willing to adopt these technologies for healthcare. We in healthcare must now adopt and harness these transformative powers and fulfill their promise. Our research has shown us that we're just beginning; we understand the potential of Artificial Intelligence to provide accessible, enduring healthcare. But we're struggling to overcome the challenges in making this necessary, fundamental shift toward AI-powered healthcare.

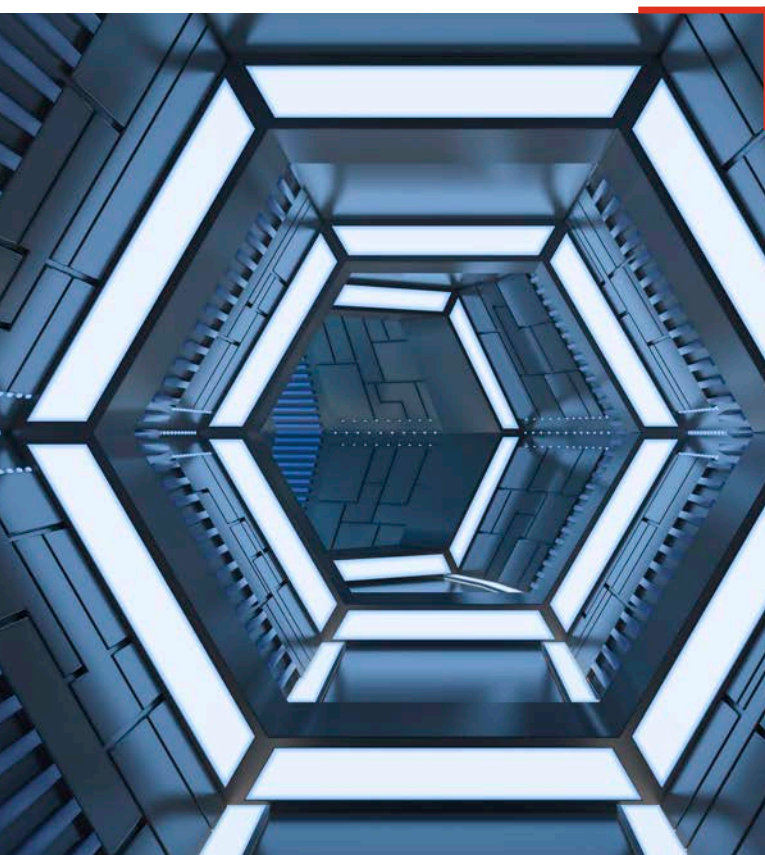
There is no doubt that these challenges are complex. Creating the right leadership and culture in which both our businesses and workforce can adapt and thrive,

continuing to improve clinical effectiveness, investing in and funding our businesses in the best ways, ensuring appropriate regulation, and addressing concerns about ethics and confidentiality – all while continuing to safeguard the public health – is a monumental task.

The key to surviving and thriving amid such disruption is to develop and execute a thoughtful business strategy. What is our vision for AI within our organisations? Who are the relevant people we need to involve and collaborate with to achieve this vision? What technology and talent do we need?

The on-going wave of AI innovation can feel overwhelming to many health organisations. But technology as a whole and AI in particular should be viewed as a unique opportunity to transform—to become more efficient, effective, and competitive – and ultimately to be part of creating a new reality of healthier living for everyone.

However, it's critical that we never lose sight of the human in this transformation.



"I don't think we should ever consider the role of artificial intelligence or technology without also considering the role of the human being," says Muir Gray, Chief Knowledge Officer of the UK National Health Service. "The question is what is the shape of healthcare going to be like in the future, and what is the role of the human being—both the person we call the patient and the person we call the clinician."⁴⁶





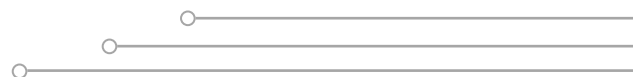
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If you would be interested in a consultation about the potential of AI within your business, please feel free to get in touch.



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