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Taking Healthcare to the Edge

Maintaining momentum in the post-pandemic transformation of healthcare

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Executive Summary

A global pandemic now extending into its second year has caused disruption, dislocation and distress in every sector of the economy. Nowhere has this been truer than healthcare. Around the world, healthcare organizations have scrambled to cope with huge surges in patient numbers. Pharmaceutical companies have worked in a race against time to develop life-saving vaccines. Public health initiatives have proceeded at a scale previously unimaginable. And the whole sector has supported this through an accelerated rate of digital innovation.

Indeed, one of the legacies of the pandemic in healthcare will be the step-change in adoption of technology, virtual solutions and digital services. By challenging health systems as never before, Covid-19 revealed their ability to adapt quickly, test and experiment, and devise new solutions in real-time. It has also forced changes in consumer habits: introducing many more people to telemedicine, remote monitoring tools and the ability to take far greater control over their health and wellbeing.

But the deployment of these digital tools could never have happened at such speed without the imperative of a crisis that left no alternative. So what happens when you take away this imperative?

As it emerges from the pandemic, the healthcare industry must find a way to ensure the momentum it has built behind its digital transformation continues – preventing health care professionals and patients alike from falling back into old habits, and transitioning short-term fixes into long-term solutions. But to do this it must overcome a number of significant barriers, not least the explosion of data brought about by such rapid digital growth.

Incorporating interviews with leading experts in the health industry and responses from IT leaders from 297 healthcare organizations globally, this eBook will examine **how the digital transformation of healthcare has accelerated over the past year, where it could advance to next, and how it will need to adapt to stop the process from stalling.**

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Accelerate: Healthcare transformation in a pandemic

The pandemic did not begin the digital revolution in healthcare, but it may have acted as its most important catalyst. "Before Covid everyone was thinking about digital transformation in healthcare and doing it in some form, but the constant complaint was that it was quite slow paced," says Effy Vayena, Professor of Bioethics at the Swiss Federal Institute of Technology. "What happened with the pandemic is that it gave people the feeling that there is no alternative."

To give you an example of the pace of change – **telemedicine**, which was only used by 11% of consumers in 2019, **rose to 46% last year** and is now predicted by McKinsey to grow into an industry that attracts around 20% of the existing aggregate spend on healthcare. That's around $250bn.

As well as facilitating new patient experiences, technology has been at the core of many of the most important interventions to combat the virus – from how we tracked its spread (through digital contact tracing) to how we studied it.

"That researchers could share genomic data so quickly was unprecedented in the history of studying viruses," Prof Vayena explains. "Within a month, scientists had sequenced the genome of the virus and it's because of that that we were able to do diagnostic tests."

Digital transformation also picked up speed among healthcare providers, as they found themselves pushed to their limits: having to manage huge volumes of patients, deal with staff who were ill or isolating, re-equip their facilities and re-engineer their protocols to limit the transmission of the virus.

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CHAPTER 1

Accelerate: Healthcare transformation in a pandemic

In response, many leaned on remote monitoring tools, digitized workflows, improved methods of data exchange and portable tools to provide the best care possible in constrained circumstances. In fact, our research showed that last year the healthcare sector was among the furthest ahead in terms of their adoption of advanced technologies and feeling a sense of urgency around this when compared with other industries.

With vast volumes of data being generated by the growing universe of user devices and IoT sensors, healthcare IT leaders needed the ability to harness, analyze, secure, and store the data at their disposal or risk grinding to a standstill, frustrating employees/customers, or losing their competitive advantage. This required moving networks to the Edge.

Our study showed that **86% of health IT leaders identified the need to implement integrated systems to handle data at the Edge as urgent,** 71% are already using or trialling Edge technologies and 74% are delivering new outcomes as a result. These include equipping healthcare providers with improved tools and applications (49%), ensuring continuous availability of patient data at the point of care (47%) and using IoT sensors to continuously monitor patient data in real-time and generate early-warning notifications at bedside (45%).

The "Edge" is defined as: the place where people, devices, and things connect to the digital world. It's where healthcare organizations collaborate with their customers, where medical device manufacturers build products and where doctors/nurses interact with their patients.

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CHAPTER 1

# Accelerate: Healthcare transformation in a pandemic

Of course, all these developments were built on pre-existing solutions and ideas, which were already been explored in pockets of the sector – as was evidenced by almost three quarters of IT leaders who said that pre-pandemic their organization had started to implement trials or applications in areas of technology including **artificial intelligence (74%)**, **Internet of Things (IoT) (76%)** and **machine learning (71%).**

But what differs today is the sense of collective momentum the sector now has behind its digital transformation – and the possibilities people are starting to see for where all this connected technology could take us next. Gone are the trials – we've gone all in… at least for now.

CASE STUDY:
A forerunner in the field of cancer research, the Netherlands Cancer Institute (NKI) began working with Aruba in 2019 to invest in network solutions that would enable employee mobility, data at the bedside, connectivity for a range of modern healthcare devices and digital patient records as well as create the optimum environment to host world-class research talent.

Its investment paid off and it was able to simplify the exchange of data between research teams; improve productivity for specialist medical teams, with faster access to critical data, whenever and wherever; and pave the way for continued digital innovation, including healthcare IoT.

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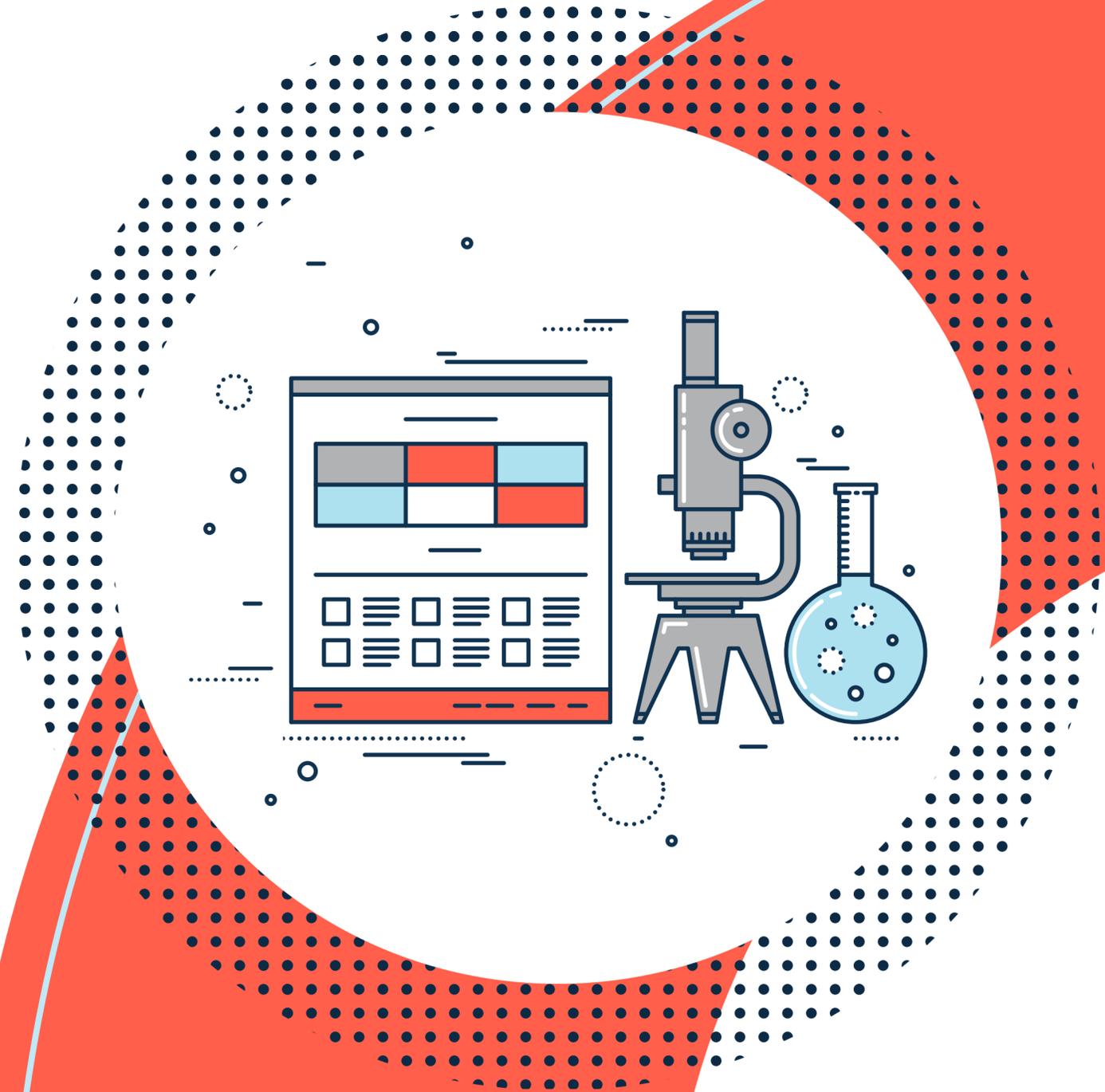
CHAPTER 2

Advance: Digital transformation for long-term gains

If you look at 2020 as a foundation year for radically accelerated digital transformation in healthcare, the possibilities for the future could be truly exciting.

We know, for example, that **40% of healthcare IT Leaders are already using the Edge** for more effective health monitoring and remote advice, targeting a reduced number of hospital admissions as a result – but digital transformation doesn't need to stop there.

Moran Cerf, a neuroscience and business professor at Northwestern University, points to the growing role in the future of pre-emptive medicine, with digital monitoring systems that prompt patients to take action when they are already ill but not showing symptoms of the illness. "Every day you get some kind of check, and by doing this we know you are sick before you have symptoms. And because we know, we can tell you that you are getting sick, and if you do the following things now then you probably won't get any symptoms at all."

He also highlights how telemedicine may evolve into a personalized service offered by employers as a benefit. "The company has its own doctor, who knows everyone and has access to all the records. They can vaccinate the entire company for the flu, they can provide health education and they can be available whenever someone need them: personalized medicine from a doctor you know and who knows you. This also means that the doctor will have knowledge of similar symptoms among the group and would be able to make inferences faster from that data than from individual patient information alone. It would be similar to doctors in small villages previously who knew that you must have the same disease as your neighbour because you both visited the same morning."

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Advance: Digital transformation for long-term gains

The experience of the last year could also lead to change in how health innovations are tested and delivered to market, Effy Vayena believes. "The classic model is the randomized clinical trial, but that takes time. **What we've seen during the pandemic is a more observational approach, using real-world data and analyzing and assessing it on the go. An application gets tested as it is used in its real context, not in a perfectly designed system."** This, she suggests, is another pre-existing development now set to gain traction faster than it would have otherwise.

The opportunities for progress may be clear, but digital transformation in healthcare has never been as simple as finding and implementing good ideas. Digital healthcare has no boundaries: outside the hospital and doctor's surgery it lives at home, in the office, on the phones and wearables that we carry around with us.

The edge of healthcare's virtual network is unimaginably vast, and the volumes of data generated by medical devices, apps and real-time monitoring systems are becoming similarly so.

And it is this data, or the lack of its control, that represents the biggest threat to the continued momentum of digital transformation – for healthcare organizations, their IT teams and the patients who come through their (virtual) doors.

> **"What we've seen during the pandemic is a more observational approach, using real-world data and analyzing and assessing it on the go."**
>
> Effy Vayena

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CHAPTER 3

Adapt: Harnessing the data deluge to sustain transformation momentum

In healthcare, data represents some of the most private, sensitive and personal information about people's lives. And it must be treated accordingly. There will be no digital transformation in healthcare without the ability to gain the patient's trust and use this data for their benefit.

But that is far easier said than done. Even before the pandemic, **data in healthcare was growing at an estimated compound annual rate of 36%.** And in the last year, that rate of growth has skyrocketed. One analysis found that, as of summer 2020, app downloads had grown year-on-year by almost 200% for services supporting mental health, 482% for managing diabetes, and 1294% for diet and weight loss.

Meanwhile even earlier last year, 33% of IT leaders in healthcare were saying there was too much data for their systems to handle, and 32% that they could not process the data they collected quickly enough to act.

Imagine what that must look like now. And healthcare data is not just proliferating, it is moving – out of centralized cloud and data centre environments and to the Edge of the network: where monitoring systems, apps and wearables collect real-time data on people's health and wellbeing, on the go.

To underpin long-term digital transformation in healthcare, this data needs to be processed efficiently, analyzed intelligently and above all stored securely – and both medical professionals and patients need to trust in this process. And that requires the right network infrastructure and systems in the right place.

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So what are the main barriers to healthcare organizations getting on top of their data, and what steps must they take to overcome them so they can continue their digital progress in the coming years.

STEP 1:
PROCESS DATA EFFICIENTLY

In order to process data efficiently – companies must follow it to the Edge of the network, capturing it in real-time at its source versus transferring it back to a centralized hub. Even the sub-millisecond latency of sending data back-and-forth to the cloud can undermine the effectiveness of a system and, ultimately, the desired outcomes that depend on it. **"Even if organizations don't yet know it, they are heading to the Edge: the latency and cost benefits will become too important to ignore,"** says Ayesha Khanna, CEO of ADDO AI, an artificial intelligence advisory firm.

As she suggests, capacity at the Edge has particular relevance for healthcare, underpinning the ability to make data-driven clinical decisions. "It's going to be very important in hospitals, where so much information and decision-making needs to be done in real time. In healthcare it's about better practice but also cost savings, such as reducing energy usage by having sensors that can automatically switch on-and-off."

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STEP 2:
ANALYZE DATA INTELLIGENTLY

Of course, capturing all that data is one thing, but being able to act on it is something else entirely. Enter Artificial Intelligence (AI) and automation.

We are already seeing a growing role of AI in diagnosis, patient care and pharmaceutical development. Even before the pandemic, **74% of IT leaders in healthcare** were either **trialling or running AI applications on their network** to deliver powerful insight, according to our research. As AI becomes more sophisticated and machine learning models get access to more and more data, its significance to healthcare will continue to grow. Already it is an intrinsic part of the remote monitoring systems that prompt people to take pre-emptive action to avoid illness, as well as being used to improve the accuracy of medical imaging and control drug dosage.

In relation to the pandemic AI has played an important role in helping researchers to identify the properties of the virus, develop and test vaccines in record time, and continue to track and respond to mutations.

Closer to home for IT leaders, AI and automation also has a core role to play in their ability to stay on top of network troubleshooting and issues resolution. Rather than having to spend hours monitoring and responding manually to every problem, AI can function as the network engineer's sixth sense: getting straight to the problem, presenting a recommended solution and actioning it at the push of a button. This in turn, frees up team time for innovation versus network management, and to unlock the data in the network to support digital transformation.

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STEP 3:
STORE DATA SECURELY

Despite the uptake of digital services in the past year, the industry cannot take for granted that this equates to user confidence. "People have certainly realized how much they can do online and that it's often easier, faster and more efficient," Prof Vayena says. "But if you ask people whether they feel their privacy is protected, they're still very worried about data protection. We've normalized the technology and prepared the ground, but there's still a missing piece around confidence and trust."

And the first step towards building this trust is for people to know that their data is secure.

Against a backdrop of rising IoT use in hospitals, homes and everywhere in between, however, healthcare networks find themselves having to police growing levels of device and app connectivity. And this is a big worry for healthcare IT leaders, with **61% saying that connecting IoT devices at the Edge would make their business more vulnerable.**

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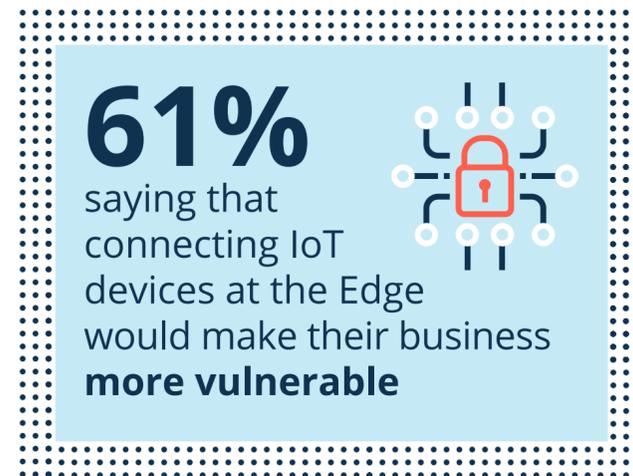
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Adapt: Harnessing the data deluge to sustain transformation momentum

This issue has only been compounded by the circumstances of the last year, with the surge in digital health services leading to a parallel wave of cyberattacks. One analysis found that **reported security breaches were 35.6% higher in the second half of last year than the first** – with the number of patient records compromised rising by 180%.

The challenge for healthcare organizations is how to lock down their data enough to reassure users without freezing out further digital transformation. A Zero Trust approach to security is part of the answer here, but network visibility and device identification also become key – providing a single-pane-of-glass view of increasingly fragmented networks (extending across hospitals, remote clinics and patients homes) and

giving IT teams the ability to grant differentiated levels of data access according to device or user group.

It is perhaps unsurprising therefore, that network access control emerged as the second most popular area (53%) for security investment by healthcare organizations last year, followed by AI-powered security analytics and attack detection (48%).

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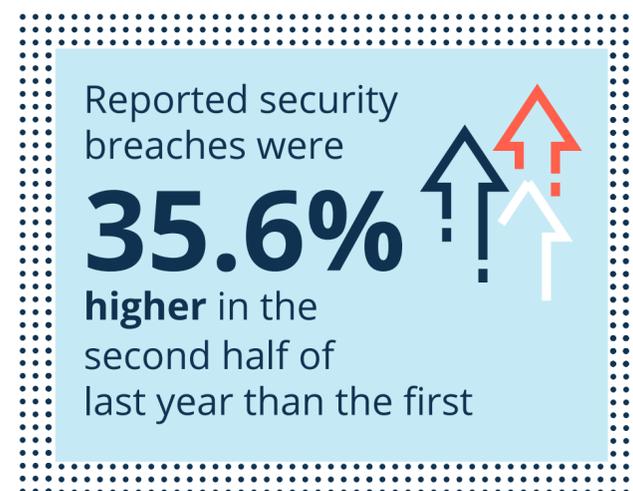
Conclusion

During the pandemic, healthcare turned to digital tools and solutions out of necessity. Approaches that had previously only been trialled, used with caution or never attempted were deployed for lack of any available alternative. Looking ahead, choice is likely to re-enter the equation. Healthcare providers, clinicians and patients will again have more of a say in how healthcare is delivered. Digital transformation will need to be driven deliberately, and more buttoned up than ever.

The ability for healthcare to manage data at the Edge is becoming intrinsically tied to its continued digital evolution. The Edge will fundamentally change not just **how healthcare organizations are designed, built and used, but also their role in how healthcare is provided.** And this is also why it is now critical that the sector evolves its network capabilities to ensure it has the infrastructure and solutions in place to support the next-generation technologies and experiences that will define their organization's digital transformation in 2021 and beyond.

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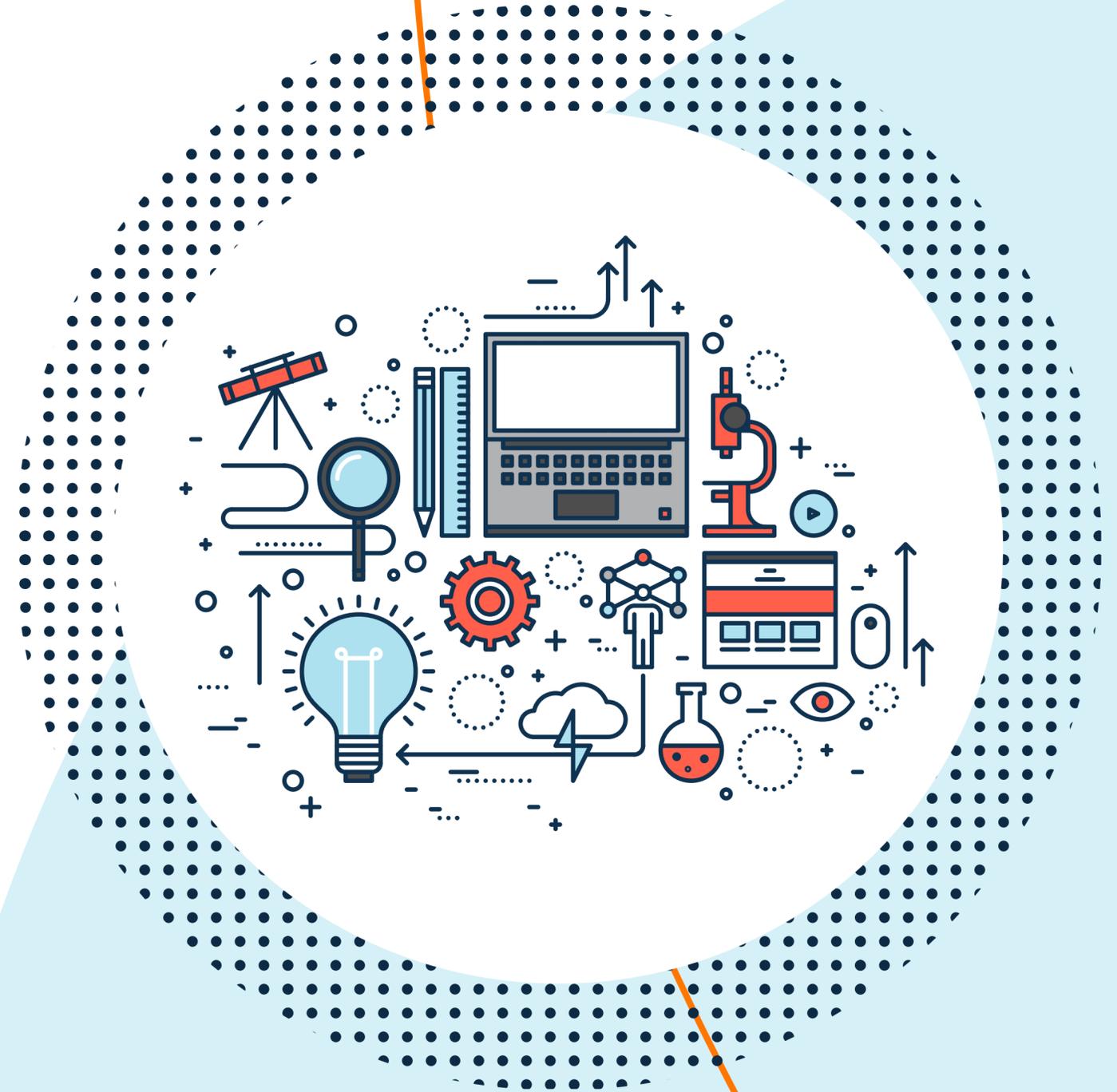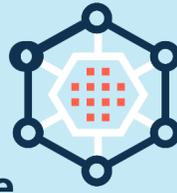
Research Methodology

Aruba commissioned independent market research company Vanson Bourne to conduct a global quantitative study with **297 IT decision makers, from healthcare organizations with at least 500 employees,** in May 2020. All interviews were conducted using a rigorous multilevel screening process to ensure that only suitable candidates were given the opportunity to participate. This research formed the baseline to measure progress made in the past year. Further interviews with experts in neuroscience, ethics, AI and policy helped to shape a view of the advances and challenges yet to come in the sector.

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Expert Bios

Dr. Ayesha Khanna is the Co-Founder and CEO of ADDO AI, an artificial intelligence (AI) solutions firm and incubator. She has been a strategic advisor on artificial intelligence, smart cities and fintech to leading corporations and governments. Ayesha serves on the Board of Infocomm Media Development Authority (IMDA), the Singapore government's agency that develops and regulates its world-class technology sector to drive the country's digital economy and power its Smart Nation vision. Ayesha is also a member of the World Economic Forum's Global Future Councils, a community of international experts who provide thought leadership on the impact and governance of emerging technologies like artificial intelligence.

Moran Cerf is a trail-blazing neuroscientist whose work is re-defining how we think about human consciousness, emotion and decision-making. He is Professor of Neuroscience and Business at the Kellogg School of Management and at Northwestern University's Neuroscience Programme. He is also a member of the university's Institute on Complex Systems and was a visiting faculty member at the MIT Media Lab. His work has received wide attention in the mainstream media such as the Scientific American Mind, Wired, The New Scientist, Time, BBC and CNN. In addition, he is a scientific consultant on films and TV shows such as Bull, Limitless, Falling Water and more.

Professor Effy Vayena leads an interdisciplinary team at the Health Ethics and Policy Lab at the University of Zurich, where she focuses on ethical and policy challenges in precision medicine and digital health. Her research centres around the medical applications of big data, that is, the exceptionally large and wide-reaching datasets currently available to healthcare officials and governments. She studied Medical History and Bioethics at the University of Minnesota before completing her habilitation in Bioethics and Health Policy at the University of Zurich. She spent several years working for the WHO, for whom she continues to act as a consultant. She is a visiting faculty member of the Harvard Centre for Bioethics at the Harvard Medical School, a faculty associate at the Berkman Klein Centre for Internet and Society at Harvard University.

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