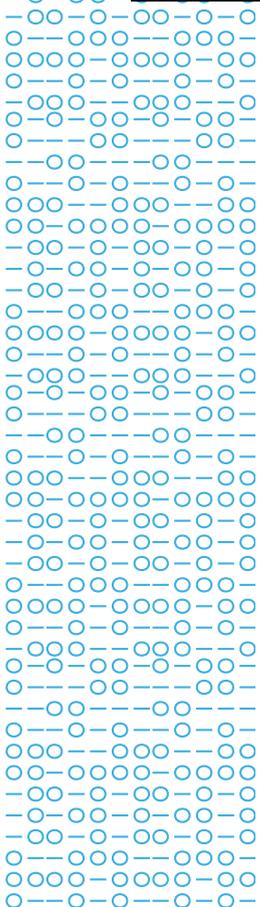# A Powerful Pairing

Research report on technology talent's resolve to decode the world's biggest healthcare challenges

U NOVARTIS | Reimagining Medicine

The digital moment has arrived for healthcare and pharmaceuticals, and our industry is at an inflection point.

The global COVID-19 pandemic sparked a seismic shift in the adoption and scaling of digital technologies across the healthcare sector at a pace never before seen. Almost overnight, organizations had to dial-up their efforts to develop, manufacture and ultimately bring medicines to patients in a socially-distant world.

It has shown us that we *must* grasp the clear opportunities that the powerful pairing of data science and technology provides to not only reshape our sector, but also to create better experiences for patients and physicians.

At a time when it still takes 12.5 years and $2.5 billion to bring a drug to market, it has never felt so critical that we embrace this powerful pairing. We must dare to approach complex biology as a computational challenge, upend traditional approaches to customer engagement and revolutionize the way we work to reimagine medicine.

Attracting and nurturing highly sought-after technology talent into the sector while continuing to create compelling development opportunities for our own bright minds is key to making this happen. We need the very best technology expertise working side by side with teams across the value chain – from research and development, to manufacturing and supply chain, and marketing and sales. All of this will help deliver better and faster outcomes.

This report explores how we might do this. It looks at technology talent's shifting perceptions of healthcare and pharmaceuticals in the wake of the global COVID-19 pandemic.

The findings shine a light on fascinating themes about this talent's broad ambitions. In the report, we delve into their evolving views about broader healthcare issues, as well as their potential role in the fight against the pandemic.

But realizing the potential of this digital moment is about more than individual talent. It also requires a concerted, industry-wide effort and true collaboration.

At Novartis, our strategy is underpinned by the core belief that powerful opportunities exist when you combine pure science with data science and digital technology. So, we have included perspectives from industry experts at Microsoft, BenevolentAI and Massachusetts Institute of Technology (MIT) to aid us in exploring this digital inflection point.

The overall results are loud and clear – and extremely encouraging. Respondents and participants told us of their growing belief that data-driven decisions can and will revolutionize the entire healthcare value chain and improve patient outcomes. There is an appetite and ambition to apply their skills and expertise to solving the world's most challenging healthcare issues.

Around the world, COVID-19 has put the spotlight on the role and impact of the healthcare industry and the opportunity to join in the work to reimagine medicine. These findings must galvanize us to ensure that there are no barriers to entry for those who want to come with us on that journey.

Bertrand Bodson
Chief Digital Officer, Novartis

Research executive summary

Research methodology

The research in this report looks at technology talent's understanding of the powerful opportunities that exist when you pair science with technology and data science to help solve the world's most important healthcare challenges. It also considers a potential perception shift that those working in technology may have experienced when it comes to healthcare and pharmaceuticals, in the wake of the global COVID-19 pandemic.

The results of this Powerful Pairing Research are based on a 21-question survey fielded among 2,500 technology professionals across five countries (USA, UK, Germany, China, India). The online survey was fielded between May 23 and June 2, 2020. It was carried out in partnership with TRUE Global Intelligence and Vitreous World. Respondents come from a broad spectrum of sectors, as well as technology roles and years of experience. Results are reported at the 95% confidence level with a margin of error of +/- 2.5% at the total market level and +/- 4.4% at the market level.

COVID-19 as the catalyst to a healthcare 'brain-train', redirecting technology talent towards aspirational healthcare sector

Healthcare and pharma is now one of the most aspirational industries to work in for technology talent

The research identifies a shift in technology professionals' perceptions of the industries where their skills could be put to best use. Technology employees find the healthcare and pharmaceutical industries to be nearly as attractive as the technology sector itself, as a career destination. Furthermore, they find healthcare and pharma more than twice as appealing as financial services, telecoms, manufacturing, and more than three times as attractive as tourism, media and communications as a sector and career path.

"Information technology has become so central to everything that goes on in healthcare and in medical science, and the development of new drugs and new diagnostics. What we've found continuously is that there are direct applications of technology, which involve very large amounts of computation, up-to-date data science, machine learning and other AI techniques. Those same fundamental technologies are important for providing – to individual scientists, or groups of scientists who are trying to collaborate, or whole enterprises that are trying to work together – the tools that they need in order to coordinate and collaborate most effectively, and so we've had really tremendous learning experiences."

Peter Lee, Corporate Vice President of AI and Research, Microsoft

Interest in healthcare and pharma is now far higher than in traditionally-popular industries

Regardless of the sector they currently work in, the two industries that technology professionals would consider switching to are technology and healthcare and pharma (49% for each). This interest rises to 58% for workers based in India and 55% for those based in China.

"The pandemic has made me more aware of medical causes around the world and how important they are. Through work in this sector, you can save countless human lives."
Male, 30, CIO/CTO China

Healthcare and pharma is considerably more attractive than traditional sectors for technology professionals, with only 28% reporting that they would consider switching to finance and banking or 24% to telecoms, pointing to a clear shift in career mindset.

This increased interest in healthcare and pharma is in part due to the role the sector has played during the COVID-19 pandemic. The current health crisis has shone a light on the meaningful aspects of working in the healthcare sector. In fact, across all five countries surveyed, 72% report they are more likely to consider working in the industry now than they were six months ago. As one technology professional

Technology professionals believe that the healthcare and pharmaceutical industry's digital moment has arrived.

86%

noted, "the pandemic has brought healthcare and pharma more into the news and makes you realize just what an important area of business and innovation it is. Working in that industry would give a great deal of personal satisfaction that you were positively contributing to society."

Perception that *now* is the time for healthcare and pharma when it comes to data and digital
Overwhelmingly, technology professionals see an opportunity for growth, innovation and creativity for professionals like themselves in the healthcare sector, with 86% of respondents believing that now is the digital moment for the industry. The impact of COVID-19 has helped them understand this, with verbatim comments such as [it has helped me] "realize just what an important area of business and innovation healthcare is", and that perceptions of the industry have "now become broader… compared to before the pandemic".

"All these trends are about to change the way that we think about data science and AI in medicine. COVID-19 has just accelerated the speed with which those trends will impact our lives. This is, without a doubt, the single most significant tipping point that's occurred since the completion of the sequencing of the human genome."

Professor Andrew Lo, Charles E. and Susan T. Harris Professor of Finance, MIT Sloan School of Management

Technology employees want to use their skills to help heal the world, but perceived lack of industry understanding could hold them back

Technology talent wants to work in healthcare and pharma industry more than before

83% of technology professionals reported a willingness to work in the healthcare and pharma industry. This willingness is increasing, with 72% reporting they are more likely to consider/continue working in healthcare and pharma compared to six months ago.

The industry's reputation has enhanced in the eyes of technology professionals – partly because of its response to COVID-19

The healthcare and pharma response to COVID-19 has resulted in a reputational lift among technology professionals. A significant majority of those surveyed (73%) state their opinions have improved due to the sector's reaction to the pandemic. They think that the industry has been effective in tackling the pandemic (72%) and believe that the application of data science has been a crucial factor in the sector's response to it (85%).

Technology professionals reflected on the ability and shifts the healthcare industry has demonstrated throughout the pandemic, positively affecting their opinion of the sector and giving them a deeper perspective of what a career in healthcare might mean. As one UK respondent commented, "the

"Reaching this stage for vaccine development so quickly is a testament for the pharma industry. Hats off to all the scientists who work tirelessly to find a solution."
Female, 35, Senior Vice President, India

healthcare sector has been relentlessly active in fighting against the pandemic. It is actively testing and treating patients. It has also been vocal in informing the general public about the situation and how to stay safe during this time of crisis."
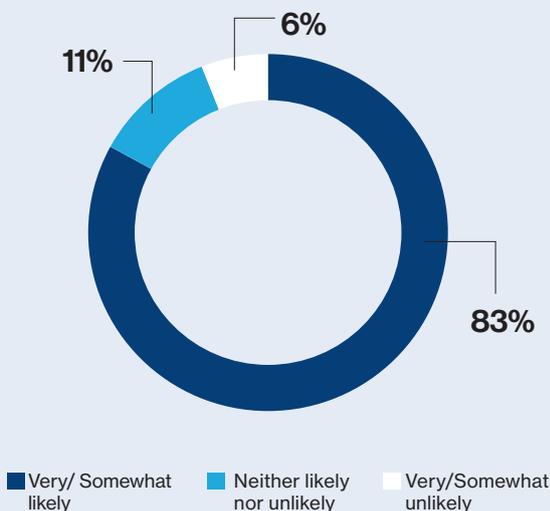
Technology talent has a strong aspiration to focus on innovation and do innovative work – and see an opportunity to do this in healthcare and pharma

Innovation is a crucial driver among technology professionals, who state that the technology and innovation focus of a company is the top factor when considering any new position, regardless of sector.
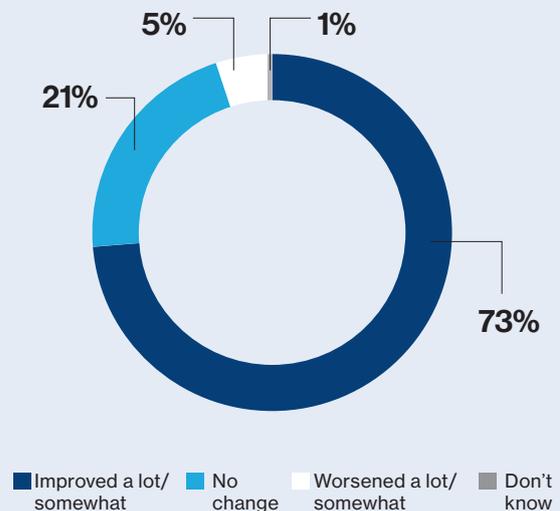
"I like to be innovative; I want to save lives."
Male, 35, CEO/Chairman, USA

Likeliness to work in the healthcare and pharmaceutical industry

6%
11%
83%

- Very/ Somewhat likely
- Neither likely nor unlikely
- Very/Somewhat unlikely

Impact of COVID-19 reaction on healthcare and pharmaceutical industry perception

5%
1%
21%
73%

- Improved a lot/ somewhat
- No change
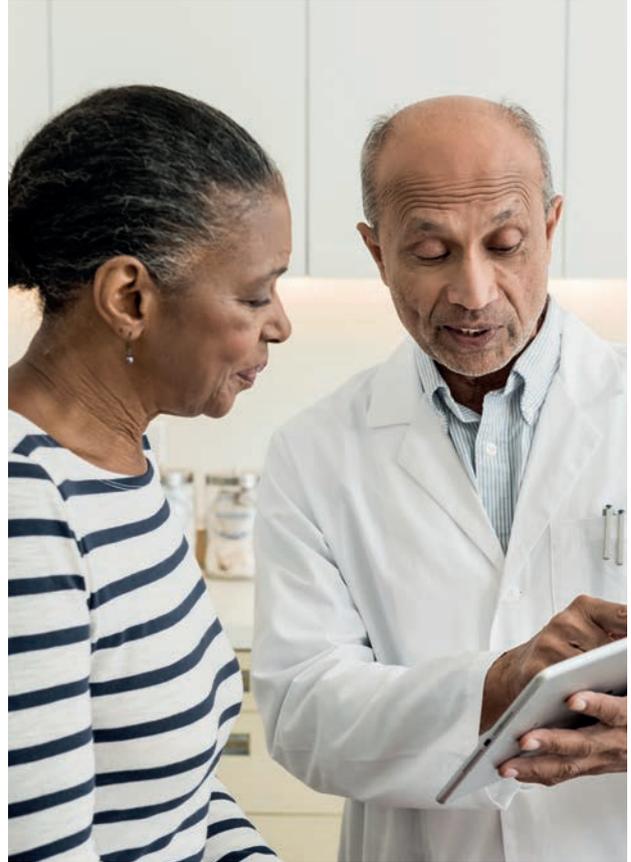- Worsened a lot/ somewhat
- Don't know

Technology talent sees innovation potential in the healthcare and pharma sector, with the top reason to apply for a job being the opportunity to innovate through technology (52%).

Not only do technology professionals associate innovation with the healthcare sector (50%), but they also view the industry as an area where emerging technologies, such as AI and machine learning, have significant potential (55%). By combining this love of innovation and favorable opinion of the healthcare and pharma sector (82%), technology professionals are intrigued by the possibilities the industry can offer.

That said, there is still a barrier to entry: technology talent wants to work in the industry but fears knowledge gap

Clearly, technology professionals are interested, and see ample opportunity in the healthcare and pharma sector, and this has been amplified by COVID-19. However, for some, they don't feel they have enough industry knowledge (40%), nor do they always feel qualified (20%), to consider applying for a role in the sector. Lack of industry knowledge was felt acutely as a barrier among technology talent in India (46%), while professionals in the UK (24%) were most likely to point to qualifications as a barrier – with one male respondent in the US revealing fears of not having the "technical know-how" to join the industry.

"My only concern would be not having proper knowledge."

Male, 31, Supervisor, India

Technology talent sees innovation potential in the healthcare and pharma sector, with the top reason to apply for a job being the opportunity to innovate through technology.

52%

BARRIERS TO ENTRY

40%
don't feel they have enough industry knowledge

20%
don't always feel qualified

"Human biology is one of the most complex information systems, and any variation in the underlying biological processes can cause symptoms and diseases to occur. Diseases have long been defined by symptoms or location in the body, not by their underlying molecular mechanisms, pathways or the biological processes specific to a patient.

We also know that research studies are not engaging enough with under-represented and vulnerable populations, or if they are, they often fail to capture the diversity of these different patient groups well enough. However, new advances in technology and the exponential growth and availability of multi-dimensional clinical data are presenting progressive opportunities to redefine our approach to drug discovery and develop more inclusive and efficacious treatments.

In order to accurately treat a disease, we need to analyze what we already know about human biology and interpret those results to produce actionable biological insights that can be very quickly tested in the lab. At BenevolentAI, we do this by applying machine learning models to identify patient groups by the clinical signature of their disease. This precision medicine-guided approach allows us to understand more about the mechanism of a disease and its link to the clinical outcome of a patient, improve diagnosis and optimize treatments.

We believe one of the strongest routes to solving such an intractable problem is to combine forces and focus on key research questions around patient stratification. Our strength comes from this integrated approach where we focus our collective energy on a single disease with one common goal. We develop a deep understanding of that disease and tailor our machine learning models and algorithms to reason about it. By encouraging our scientists and technologies to co-create new technologies and tools in this way, we are able to draw more meaningful conclusions and patterns.

We work in cross-functional squads of machine learning researchers, translational medicine specialists, software engineers, product managers and data scientists all in one space. We split ourselves into different workflows, and use different data, models and theories. Having such high-performing teams working with a singular focus is extremely powerful and enables us to achieve our ambitious mission of treating disease and move further away from the traditional approach of 'one drug fits all'.

This approach becomes even more exciting when we have the opportunity to partner with others, bringing together our different strengths and fusing human ingenuity with technological excellence. Working with Novartis Global Drug Development, we are investigating new indications for and patient responders to Novartis' clinical oncology programs. By working together, we can develop more targeted cancer therapies with a greater understanding of which patients they will help, and we hope one day soon more patients will survive because of it."

Anne Phelan, Chief Scientific Officer, BenevolentAI

Technology professionals believe they can revolutionize future healthcare outcomes

Technology talent believes that what it brings (mindset, data driven approach) can have a truly positive impact on the entire healthcare value chain
Technology professionals believe that technology will result in a considerable impact on the industry, with 89% saying that data science is important to the development and delivery of healthcare industry solutions and services.

This faith in the potential effect of technology grows with data scientists (e.g. professionals with a focus on AI, machine learning or data science/engineering), who believe the benefits of applying data science to healthcare are improved diagnostic accuracy (64%), increased efficiency (59%), ability to predict disease prevalence (54%) and improvements to existing healthcare systems (52%).

Data scientists reflected a feeling of responsibility and leading an era of change within society, something they would take with them to the healthcare sector. As one technology professional from the US stated, "In time, data driven decisions will become common and we, as data scientists, will be at the forefront of a new revolution".

"What's interesting to me is that there are huge opportunities for innovation across the healthcare value chain. Not only do you need the data, the talent, and the ability to build the algorithms, you also need to be able to accelerate clinical development – so bringing solutions to bear to clinical trials, to approval and post marketing, and being able to essentially make that part of the spectrum go faster too. I believe that the merging of healthcare and technology is a full-stack opportunity. It's about drug discovery of course, but it's also truthfully about clinical development and healthcare implementation, and all pieces coming together."

Amy Abernethy, Principal Deputy Commissioner, FDA

"Algorithms are implemented to achieve a desired result which can be witnessed promptly. It's a futuristic profession and I acknowledge the fact that what we do now is going to have a big impact on everyone's future."
Male, 31, Data Science Engineer, UK

For technology talent, the intrinsic motivation is not just about what a company says, but rather what it does
Technology professionals look at the impact of the job they will have when choosing their career path. They place more weight on the technological and innovative aspects (43%) of the role rather than a company having a clear purpose (18%) or an engaging and empowering culture (21%). This isn't to say other aspects are not important, but rather that technology professionals desire a challenging, cutting-edge and innovative role above other factors.

Technology professionals say that data science is important to the development and delivery of healthcare industry solutions and services

89%

"Now take that same approach and apply it to drug and device development — bring chemists, bioengineers, clinicians, and artificial intelligence experts together and then see what happens. They won't be working on chemistry or biology or technology — they'll be solving real-world problems, like how to save the lives of COVID-19 patients. And that's the most exciting thing about data science. It gives us a platform to bring the full force of creativity of multiple disciplines with laser-like focus on the biggest challenges of the day."

Professor Andrew Lo, Charles E. and Susan T. Harris Professor of Finance, MIT Sloan School of Management

"At Novartis, we have elements of what is needed: we have the best subject matter expertise and scientists. But what is also required is the ability to compute at a massive scale to access the best algorithmic development capability and infuse that into Novartis. Hiring those skill sets within Novartis, partnering with the likes of Microsoft – as we have done – to solve those kinds of problems with machine learning and data science is critical."

Shahram Ebadollahi, Global Head of Data Science and AI, Novartis

When asked to reflect on what factors would drive them to pursue a career in the healthcare and pharma sector, their general employment motivations held true for the industry across markets: more than half (52%) would want an opportunity to innovate through technology, improve quality of care and make systems more efficient (49% for each), to solve real-world problems (48%), and to contribute to curing diseases (47%). Again, all this data points to technology professionals' desire to put their talents to work on projects that are truly innovative and deliver meaningful outcomes.

Motivations to pursue a career in healthcare and pharmaceutical sector when the following opportunity is provided

52%	49%	49%	48%	47%
to innovate through technology	to improve quality of care	to make systems more efficient	to solve real-world problems	to contribute to curing diseases

"Data is very important in this age of technology, and it is my job to ensure that the data used by my company is of the highest quality. That sense of responsibility makes it interesting."

Male, 32, Data Science Engineer, Germany

"The data scientists need to understand this too — they will never have enough knowledge on their own. But if they're open to collaboration, amazing things can happen."

Professor Andrew Lo, Charles E. and Susan T. Harris Professor of Finance, MIT Sloan School of Management

Conclusion

As a digital leader who has worked alongside some of the finest scientific minds across various industries, this report is hugely significant.

At Novartis, we are committed to 'going big on data and digital', empowering associates across the company to embrace data science and digital technologies to work in new ways and create better patient outcomes.

That's why the findings in this report are so important, and why we need to grasp this opportunity. It's so encouraging to see that technology professionals believe that data science can revolutionize future health outcomes and that their discipline can make a difference in our sector. In the context of a global pandemic, this reassurance is most welcome.

We need to pique the curiosity of talented professionals to come and join us. We need to remove barriers to entry and dispel the perception that if you are not a scientist, you are not going to work in the pharmaceutical industry. This is critical if we want to attract and encourage the best talent from across the world.
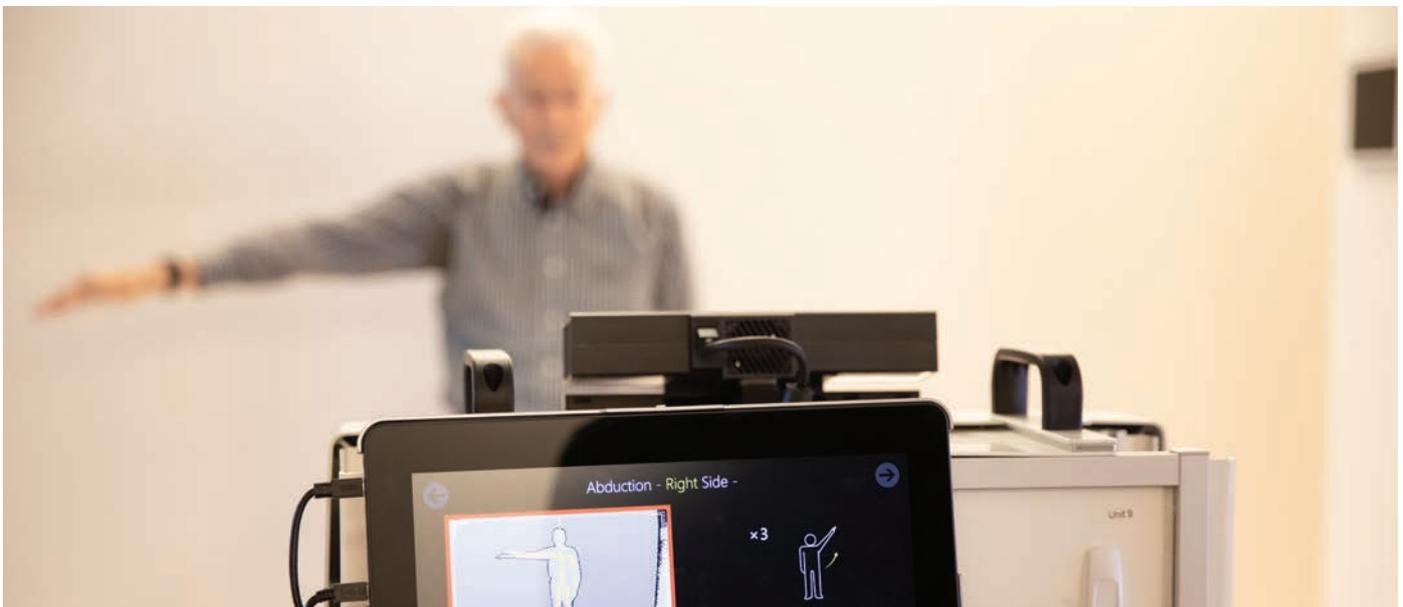
We know that a fusion of skills and adaptive approaches to problem solving achieves better outcomes. I firmly believe that a collaborative mindset empowers people to be at their best, and a safe and supportive environment allows teams to think innovatively.

As a company, we're on a journey to create a culture where individuals are curious, inspired and unbossed to bring different perspectives and skills together to challenge the status quo and seek solutions for some of the most intractable healthcare challenges.

These are ambitious goals and the stakes are high, which is why we must ensure there are no perceived barriers to entry, so talented tech experts from diverse backgrounds have the confidence to make the jump, join the industry and seize the moment. Now is the time to reimagine medicine.

Elizabeth Theophille
Head, Technology Architecture & Digital, Novartis

Novartis' data and digital ambition

As a leading global healthcare company powered by advanced therapy platforms and data science, Novartis has kicked-off an ambitious digital transformation to embed cutting-edge digital technologies and data science into all parts of its business.

By pivoting to become a more data-centric company, Novartis is fundamentally transforming the way it delivers innovative science, operational excellence and more personalized customer and patient experiences to answer three big *what if* questions:

What if we could transform how we innovate in R&D to bring medicines to patients two years faster – from daring to approach complex human biology as a computational to rethinking how we recruit for clinical trials.

What if we could rethink traditional approaches to customer engagement and reach twice as many patients twice as fast by creating more personalized experiences?

What if, with an eye to reinvest in R&D, we could revolutionize the way we work by optimizing and automating processes to drive breakthrough innovation, and reduce our costs by $1–2 billion?

Novartis is committed to realizing these big ambitions by focusing on four key areas:

Scaling 12 digital lighthouse projects: Enterprise programs that are embedding data science and digital technology across Novartis from R&D to manufacturing and our commercial organizations over a 3–5 year horizon.

Collaborating to make bold moves: To prepare for future disruptive healthcare scenarios, Novartis is making bold moves with external partners to transform standards of care, e.g. launching an AI-powered app for heart failure patients in China with Tencent.

Making Novartis Digital: Prioritizing digital learning, focusing on attracting and creating exciting opportunities for bright minds and investing in foundational platforms and capabilities is helping to make Novartis digital.

Becoming the #1 partner in the tech ecosystem: From nimble start-ups and innovative academic institutions to some of the biggest players in the industry, Novartis is keen to collaborate with the ecosystem to accelerate their digital transformation.

Reimagining medicine with data and digital to improve and extend people's lives.

For more on Novartis' digital strategy visit:
www.novartis.com/our-focus/data-and-digital