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The digital challenge of bringing a Covid-19 vaccine to market

As the first Covid-19 vaccines are rolled out across the world, we speak to **Johnson & Johnson Enterprise** CIO Jim Swanson about the rapidly reconfigured IT strategies that have supported the development of its vaccine candidate.

By Sam Forsdick

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Since the World Health Organization declared the coronavirus outbreak an international public health emergency in early 2020, governments, drug-makers and scientists around the world have mobilized vast resources in their quest to produce vaccines for the disease.

The challenge for all has been to accelerate the complex development processes — which normally takes up to 10 years — without sacrificing patient safety, and at the same time prepare for the large-scale and rapid production of the resulting vaccine.

One of the first pharmaceutical companies to begin the investigation into a potential Covid-19 vaccine was Johnson & Johnson, which announced its plans in late January 2020 and has now been granted emergency approval by the US Food and Drug Administration after it was judged to be safe and effective.

Enterprise CIO Jim Swanson was only four months into his new role at the US multinational when the pandemic struck. And even though 15 years earlier he had served as CIO for J&J Pharmaceutical R&D, it was clearly a daunting return. "I would never have wished for such a situation as a way to test your abilities in your first year [in a new job]; it certainly has been a case of learning at the edge," Swanson says.

A core element of Johnson & Johnson's technology strategy is to accelerate business outcomes, which are aligned to the company's 'must-win' programs, he says. However, once it became clear that the virus was spreading fast in China and beyond, these were quickly re-evaluated and vaccine development became a new primary goal — alongside reinforced employee safety and supporting the supply chain and distribution for core medical products.

"We quickly readjusted our portfolio to address new priorities," Swanson says. "Thankfully the must-win model gave us the framework to do that and to organize the business around those [reset] objectives. As must-wins evolve, you also evolve your resources."

Accelerating vaccine development

To address the evolving challenges, Johnson & Johnson brought together cross-discipline teams. As well as Swanson, those included the heads of HR, facilities, supply chain, legal and others at the top level.

IT played a key role as the world changed, Swanson explains. "We applied a lot of technology and data to help inform decision-making. In China, we were able to test and learn in an agile way and then apply those learnings to our other markets as the virus moved across the globe."

Accelerating the development of the vaccine also required much creative thinking from that senior team. "We had to look for ways to take a seven- or eight-year process and condense it down into a one- to one-and-a-half-year process," Swanson says. "With such complex problems, there isn't a playbook; you're inventing the process as you go, without ever compromising on safety."

Simulating success

Digital twinning and operational modeling have played major roles in readying the production processes for the lead vaccine candidate, which is being developed by the company's Janssen group. "Digital twinning is allowing us to dynamically make changes 'in silico' before we make them on the floor, which is a huge value-add to acceleration," Swanson says.

Extensive use was made of simulation software to test hypotheses before implementing changes. This meant that the team could trial different ways to increase yield or assess the benefits of different 'molecular scaffolding' within a computer model.

"You can do those tests in real time and run a number of simulations without having to spend a dime to change the shop floor," Swanson adds. "Once the simulations are there, you can then apply it and test whether the model was rich enough to validate those changes. You can learn quickly and apply it in a rapid fashion."

The approach helps to "reduce the cost of delivering innovation," says Swanson. In support of that, Johnson & Johnson is building a common data layer across all aspects of its manufacturing supply chain, which will allow it to have the data it needs "to feed the models and make them richer and more insightful."

For Swanson, data is "the fuel for this engine. That means having to constantly curate, ingest, assess and make available

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data for the key decisions we're trying to drive. And as you're applying data, the models just get smarter."

Powered by such data, the digital twin technology and operational models have enabled Johnson & Johnson to make a four-times improvement in the production of its candidate vaccine. "That goes a long way to helping achieve our goal of delivering a billion doses [in 2021]," says Swanson. "It provides a great example of pulling together technology, business and domain expertise to achieve a significant outcome, while still ensuring the quality of the product."

Running in parallel

Unlike the double-dose approach associated with many other vaccines, Johnson & Johnson's aim has been to provide a single-shot inoculation. The pharma giant based its Covid-19 candidate on an existing vaccine development platform, which had previously been used for its Ebola and HIV vaccines.

Swanson says Johnson & Johnson does not see Covid-19 vaccine development as competition between rivals. "We want as many vaccine approaches in the marketplace as possible, with all manufacturers working together to get the whole population vaccinated and eradicate this horrible disease as quickly as possible. It really is an [industry] partnership the likes of which we've never seen before."

In parallel with its R&D, Johnson & Johnson began scaling up its logistics capabilities while clinical trials were still under way, in order to ensure the speed of delivery. Under normal circumstances, scaling up supply chain logistics prior to concluding clinical trials would represent a significant commercial risk. But as Swanson says, on this occasion "you can't wait until you have all that scientific and clinical studies data [completed] before you start to scale up. You can't do that if you are going to hit the timelines we're trying to hit."

But he adds: "While we are running multiple things in parallel in order to accelerate the launch of the vaccine, we never take shortcuts with safety; safety is always primary to what we do."

Learnings from the pandemic

The acceleration of processes and leveraging of data across the company presents new opportunities for improving operations in the future. Swanson says: "We certainly had automation prior to the pandemic but what we've been able to do since is highlight where its application was on the maturity curve and grow those capabilities."

That proved particularly valuable during the shift of many Johnson & Johnson employees to home working, with numbers soaring from 30,000 to 150,000. The consequent surge in IT service desk calls presented an opportunity to deploy AI-based process automation tools to handle routine service requests at scale and speed. Swanson hopes that the use of automation across the business can help to free up his global team of 4,400 IT and data specialists to concentrate on more complex issues.

"We've set the goal of creating over half a billion dollars of value from automation over the next three years," says Swanson. "But there are also other benefits as it unlocks the value our people can create by providing insight from data."

He adds: "This has really been a wake-up call to how important data is, in combination with our models, to really accelerate our insights and thinking. That was a journey we were on before the pandemic and it's a journey that we're going to accelerate as we go forward. ■

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Tel: +44 20 7775 7775 Email: editor@i-cio.com