UNLEASHING
the intelligent enterprise for patients

Life Sciences Technology Vision 2018

Content

Introduction

THE COMBINATORIAL EFFECT

of socio-economic pressures, scientific advancements and the consumerization of the patient experience are driving significant change in the life sciences industry.

Fortunately, advances in technology including data availability, cheaper computing power and the evolution of machine learning and artificial intelligence (AI) are making the ability to respond to these changes more achievable than ever before.

Companies are using technology as a catalyst to morph both in form and purpose. Unleashing the "intelligent enterprise" marks the beginning of seismic industry changes which will have positive results for patients and the broader economics of the healthcare system.

Broad socio-economic trends such as rising healthcare costs and the silver tsunami of aging populations are creating significant incentives for change. Surging healthcare costs are prompting payers and government to demand proof of the efficacy of any treatments before payment will be released. The era of outcome-based payments, long predicted, is finally becoming reality across the industry.

This shift to consumerization in healthcare is being driven by the impact of people's experiences in other sectors (where consumers receive relevant and affordable services at the point of need) and the availability of patient-centric technologies—from connected devices, personalized diagnostics, drone-based delivery services, blockchain-enabled authenticity of medicine to algorithms that learn from patterns in electronic medical records (EMR) results. This all brings medicine and treatment that is relevant, applicable and easily consumed by the modern patient.

Breakthroughs in science are also changing the industry's rules: genomic data availability, nanobots, CRISPR-Cas9 genome editing techniques, T-cell immunotherapy and many other advances are unleashing new potential in personalized treatments and specialized medicines.

The 46 new molecular entities (NMEs) approved by the U.S. Food and Drug Administration (FDA) in 2017 topped the all-time high of NMEs approved in any year except 1996.[1]

The FDA's recent approval of Abilify MyCite,[2] takes things further—providing data on compliance and paving the way for more effective tracking of patient outcomes.

The availability of data—EMR, genomic, lifestyle and behavioral—is changing the game. We now have more data available than ever before. While countries and governments move to protect personal data (e.g., GDPR in the EU), recent surveys of patients show that they are willing to share their data if it results in a better outcome for their health.[3]

Big global technology companies are heavily investing in the healthcare space. They are looking to disrupt the traditional business models by leveraging data and AI to completely change our understanding of disease, wellness and patient outcomes. The emergence of health platforms, centered around the patient and

specific disease areas, will pave the way for the next wave of industry business models where groups of companies will come together to solve the issues facing patient/health consumer populations.

We are already witnessing innovation collaborations between large pharma and companies like Google (e.g., Onduo from Sanofi and Verily[4]) as well as potentially game-changing partnerships between Amazon, Berkshire Hathaway and JP Morgan.[5]

Individually, each of these drivers would be a powerful force for change. But as they converge, they are forcing tectonic shifts across the industry landscape. One thing is abundantly clear: similar to what has happened in other industries, the points of "value creation" and realization will shift in the new digitally enabled economy; life sciences companies will need to change and morph their business models and their approaches to partnerships as well as fully embrace technological advances to be relevant participants in the new health-and wellness-based economies. In the face of such tumultuous change, collaboration is not simply desirable, it is the imperative for success.

JOINING FORCES

Data and the intelligent interpretation of that data changed the face of retail.

A similar revolution will happen in healthcare as science, technology and regulation all advance to change how and where patients' health and wellness needs are met. There is no doubt that for life sciences, data is key to future success.

Some data in life sciences is still difficult to come by. But life sciences CIOs must reimagine their technology architectures and determine how to extend their enterprises into an ecosystem of partners that's wider than before and provides more opportunity to embrace multiple data sources.

The combinatorial impact of the availability of data, massive advances in computing power, and the application of "intelligence" (predictive and cognitive analytics, etc.) will drive change in traditionally siloed business models. These will enable a more continuous and virtuous cycle of interaction between patients and healthcare companies that will help deliver better outcomes.

This new "intelligent enterprise" will research, develop, distribute and commercialize solutions for patients and healthcare consumers in ways that are very different from the past.

They will be more agile, responsive, partnership-based, experience-focused and will drive an entirely different outcome for the broader healthcare system.

These new priorities align closely with the 2018 Accenture Technology Vision[6], whose overarching theme is the "Intelligent Enterprise Unleashed." This reflects how leading companies are moving beyond providing products and services. Instead, they are applying technology to change the way people work and live—creating deeper relationships with people, new affiliations and businesses across industries, and new partnerships to invent entirely new products and services.

The union of GSK and Verily to establish Galvini Bioelectronics is a good example of these new partnerships.[7] This brings together GSK's world-class drug discovery with Verily's expertise in miniaturization, low-power electronics, data analytics, and agile software development.

The goal? Uniting health and high-tech to create a new reality of miniaturized, precision electrical therapies that interprets the electronic signals between individual patients' nervous systems and their organs. These therapies will spot and correct the irregular patterns that are found in specific disease states, including metabolic and endocrine disorders, such as type-2 diabetes.[8] This need for a new collaborative mindset is clearly understood by the 103 life sciences executives we surveyed for this year's Technology Vision.[9]

99% of life sciences executives expect the volume of data exchanged with their ecosystem partners to increase over the next two years.[10]

Data and partnerships with new data providers in the healthcare space is also a powerful driver of acquisition strategies, as exemplified by Roche's[11] acquisition of Flatiron Health in February 2018.

As well as being a market leader in oncology-specific electronic health record (EHR) software, Flatiron is also a leader in the curation and development of real-world evidence for cancer research. Drawing on an extensive U.S. network of community oncology practices and academic medical centers, Flatiron has created a technology platform that can learn from the experience of each individual patient. As such, the acquisition

uniquely positions Roche to advance the use of real-world evidence in treating cancer patients.

This situation is a bellwether for an industry in which we're not only seeing greater inter-reliance and inter-dependence when it comes to data, but also where connecting data across different partners and ecosystem players is essential to understand the true impact treatments have on people's health.

Accenture Technology Vision 2018 for Life Sciences focuses on three of the five trends identified in the cross-industry report that have the greatest near-term influence on the industry as it reconfigures itself to deliver better patient and economic outcomes.

DATA VERACITY
The Importance of Trust

Delivering on the new industry standard of value-based outcomes requires a comprehensive picture of every patient.
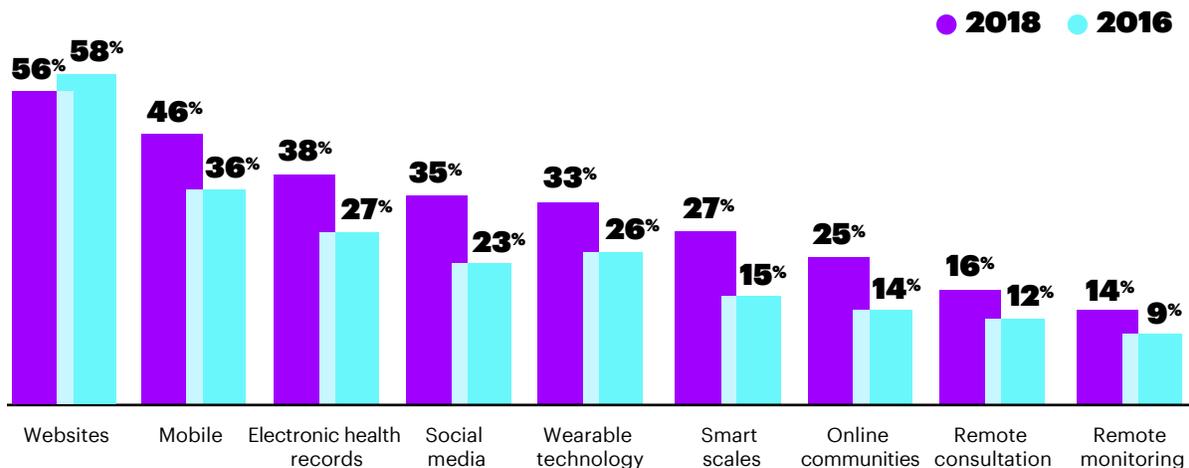
And that's something no business can achieve solely from the data it holds internally. As healthcare becomes ever more consumerized, and technologies grow in sophistication, the range of data sources will continue to proliferate. The "platform" world (as exemplified by WeChat and Amazon) that has facilitated advances in other sectors is a natural next stage of evolution for the multiplicity of parties/data sources/services that need to come together to affect a person's health.

In large platform environments (albeit under some form of "air locked"/protected data exchange protocols customized for regulated and sensitive personal data), companies can come together to share the necessary information to drive more desirable outcomes for the patient and the broader healthcare system.

But whether companies are accessing the data flowing from a patient's wearable device, retrieving financial information or tapping into a patient's EMR or genomic data, one thing is certain: the range of data that they need to access to deliver better outcomes—not just products—will grow exponentially.

Healthcare consumers are increasingly using technology to manage their health

● **2018** ● **2016**

	Websites	Mobile	Electronic health records	Social media	Wearable technology	Smart scales	Online communities	Remote consultation	Remote monitoring
2018	56%	46%	38%	35%	33%	27%	25%	16%	14%
2016	58%	36%	27%	23%	26%	15%	14%	12%	9%

Source: Accenture Technology Vision 2018

Take Nanowear, for example. This New York City-based developer of patented, textile-based nanosensor technology provides medical professionals with accurate and continuous diagnostic data transmitted wirelessly through a non-invasive undergarment.[12] Combined with the company's "alert analytics" product, it can be used for personalized management of chronic conditions, such as congestive heart failure.[13]

Consider what Apple has done with the inclusion of health data-sharing capabilities in the latest release of its iOS mobile operating system. This gives patients the means to access and share their EMR and other clinical data and is currently being trialed by 12 hospital systems in the U.S.[14]

Along with the challenge of managing these exploding quantities of data, life sciences companies must also understand and assure the "truth" of the data they use and exchange with others. Right now, there's clearly work to be done in this important space.

# 1/3 of life sciences executives have high confidence in their data, and validate it extensively.[15]

One in four executives also said that they validate data sources to some extent, and believe there is a lot more they need to do to ensure data quality.[16] Looking ahead, the more that life sciences companies need to create services and products in an ecosystem built around the patient, the more important it will become to verify, validate, interpret and act upon the data.

It is highly likely that new business models and potentially even new companies will emerge that will safely exchange data across the various components of the healthcare landscape. Each company participating in this landscape will need to have a clear view of their data needs and their abilities to create/capture data to participate effectively.

There are still many sources of data that need to be secured for the healthcare environment to operate effectively. Every organization will need to continue to work to secure the datasets that are critical for them to effectively deliver on their purpose within the large (and increasingly more connected) ecosystem.

As companies move from being product-led to playing a role in driving outcomes for patients and the healthcare system, data and intelligence will be fundamental. To prepare for that, companies need to:

01 Define the company's role in the new data-informed, patient-centric, outcomes-driven healthcare environment.

02 Set up a data intelligence capability in line with the company mission and goals.

03 Understand and verify the sources of internal and external data needed to drive that mission.

04 Understand and build the security and analytics capabilities to drive intelligence from the data that can assist the organization in fulfilling its mission.

05 Create strategic partnerships and acquisitions in areas where gaps exist and data is needed to deliver on their promise/purpose.
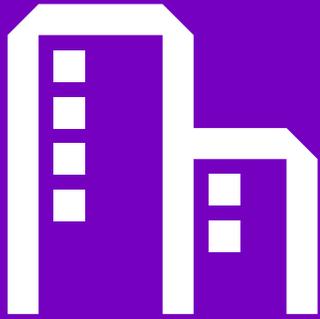
FRICTIONLESS BUSINESS

Built to Partner at Scale

Companies in all industries increasingly compete through strategic partnerships, and when these partnerships are technology-based, they can expand partner networks faster and into more ecosystems than ever before.

But legacy business systems—often built in silos and only intended to operate within the business—weren't constructed to support these technology-based partnerships. Now, as life sciences companies expand their networks to engage in ecosystems that will include start-ups, other life sciences companies, payers and providers, these outdated systems will present major obstacles to growth.

From a technology perspective, the large-scale, internally focused systems that have served companies well over the past 30 years of globalization will need to be re-architected at strategic points to be more agile and more frictionless.

To develop agile and frictionless environments, two technologies will play key roles:

MICROSERVICES
An architecture approach using a suite of tools such as application programming interfaces, containers and the cloud to break applications into simple, discrete services, enabling companies to rapidly integrate and scale with many new partners.
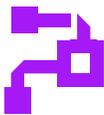
BLOCKCHAIN
Where information is replicated and shared among a network of partners, enabling companies to manage and operate those relationships, with trust being delegated to the system. Delegating trust to a blockchain using smart contracts allows businesses to outline the terms of a given relationship, and then release data or execute programs with partners meeting those terms.

This is already happening today. Take Factom[17], for example, in blockchain. Factom is partnering with medical records provider HealthNautica to store a range of medical documents on a public blockchain which will be especially useful for many developing nations that still document medical records on paper. Factom's and HealthNautica's blockchain-based solution will give clinicians and providers borderless tools that can follow individual patients throughout their lives, regardless of how often they move.[18]

In another example, Accenture is working with DHL on a blockchain-based prototype to track drugs from point of origin to patient, safeguarding patients by preventing tampering and the risk of counterfeit compounds. As many as one million lives are lost annually because of counterfeit medications, according to Interpol. And it's estimated that up to 30 percent of pharmaceutical products sold in emerging markets are counterfeit.

DHL and Accenture's blockchain-based serialization prototype has nodes in six geographies to track pharmaceuticals across the supply chain. The ledger tracking these medicines can be shared with stakeholders, including manufacturers, warehouses, distributors, pharmacies, hospitals and doctors.[19]

Those that invest in the technology required to build frictionless businesses today will redefine how their businesses interact and transact in the future and will therefore redefine the role of the organization within the ecosystem and how it delivers value. The new flexible "frictionless" architecture will be one of the fundamental building blocks of Industry 4.0 definition of enterprises for life sciences.

68% of life sciences executives believe blockchain and microservices are critical, or very critical, more so than most other industries which averaged 60 percent.[20]
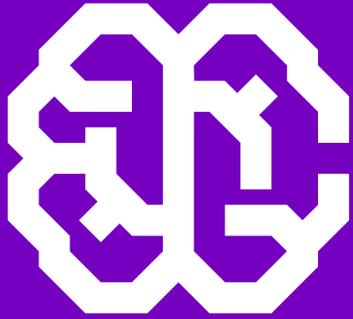
CITIZEN AI
Your New Team Member

Although many life sciences companies have eagerly embraced "entry-level" AI (robotic process automation, for example) to drive operational efficiency, particularly in research and development, the next stage of AI adoption offers far greater promise—as well as bigger challenges.

85% of life sciences executives say that AI is advancing faster than their organization's pace of adoption.[21]

This acknowledgement was the third highest of all industries surveyed, with health providers in the U.S. ranking at the top.[22]

But they urgently need to start catching up. For instance, over the next few years, life sciences companies must be ready to manage a surge in the volume and complexity of new products coming to market.[23] The late-stage industry pipeline is forecast to be sustained at a minimum of 40 NME approvals annually over the next five years.

There's clearly an opportunity for life sciences companies. The right AI tools will enable them to process and understand the data associated with these products and services more

efficiently and safely. This will ultimately ensure that new products reach the marketplace faster and with greater precision than ever before and will play a much more relevant role in individual patients' lives.

That said, AI is much more than a technology tool to support the processing of large volumes of data. As AI increases in sophistication, it becomes a co-worker, collaborator, trusted advisor and enabler of more rapid response to patients' and the healthcare ecosystem's needs.

AI can have as much influence as the people using it. And for the heavily scrutinized and regulated life sciences industry, this more advanced and

increasingly autonomous AI clearly gives rise to potentially life-and-death issues that go far beyond the commercial frame of reference that most other industries work within.

Life sciences companies will need to focus attention on ensuring that their AIs remain "healthy" (i.e., as unbiased, accountable and transparent as possible) throughout their use. In other words, by treating AIs like co-workers, life sciences businesses will have to give these tools the level of oversight and nurturing that they need. They will "raise" AI as a responsible representative of the business and partner in delivering better outcomes for patients.

Given the high stakes involved, it's understandable that the industry has, to date, been cautious in its broader adoption of AI. But there are clear signs that this is starting to change. In fact, some companies are making game-changing progress using AI to find and deliver better treatments for relevant patient segments.

That's what BenevolentAI[24] is doing. Its technology trawls the huge mass of existing scientific material, from videos to journals to clinical trial data —too much for a group of scientists to be able to harness unaided—to dramatically accelerate the pace of innovation and new drug development for rare disease groups.

A recent announcement from the company highlights the value that this can provide. Parkinson's UK and the Cure Parkinson's Trust (CPT) will take advantage of BenevolentAI's healthcare knowledge graph (containing 1.3 billion+ meaningful bioscience relationships) and platform capabilities to conduct potentially breakthrough research into the deduction and development of entirely new treatments.[25]

Chinese startup iCarbonX[26] is also active in this space. With backing from Tencent, among others, over the next five years, iCarbonX plans to analyze genomic data from a minimum one million people in China. Or take BenchSci.[27] It's created a machine-learning platform that enables bio-researchers to find and extract reagent usage data (detailing chemical reactions) from millions of scientific papers containing more than 1,257,999 antibody usages and three million images from vendors, independent organizations and user reviews.

The benefits? For biomedical researchers starting experiments, BenchSci provides a reagent intelligence platform that can transform published data into experiment-specific recommendations to reduce time, money and uncertainty in planning materials and methods.

AI is about much more than just software and automation. To be truly transformational, AI needs to be trusted, both by its "co-workers," and by patients. Put another way, its deployment must be both responsible and explainable; AI cannot operate as a black box so its decisions must be transparent and easy to explain. Crucially, life sciences companies that hesitate to consider their AI as something that must be "raised" to maturity will be left struggling to catch up with new regulations and public demands—or worse, have strict regulatory controls placed upon the use of AI for failure of the group to take responsibility.

Life sciences companies must establish a strong set of rules and governance around how they will automate business processes, using robotic process automation for use cases in research, clinical trials execution, regulatory compliance, and sales force enablement. They should also, as the automotive industry is doing right now, work with their compliance teams, agencies, and other industry partners, to make the AI they develop explainable, secure and safe for patients.

OPERATING ON SHIFTING GROUND

Technology and life sciences are, in effect, becoming one and the same.

As companies develop more personalized medicine, they're obtaining smarter datasets. They're bringing all this together with new, affordable and more accessible technologies to create a new vision of the life sciences industry that is intelligent, open, innovative and, above all else, unwaveringly focused on the patient.

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