Novasecta

INSIGHTS

What Pharma Should Do About Artificial Intelligence (AI)

Given the transformative potential of AI, companies must understand its benefits and develop strategies that meet each of their unique situations.

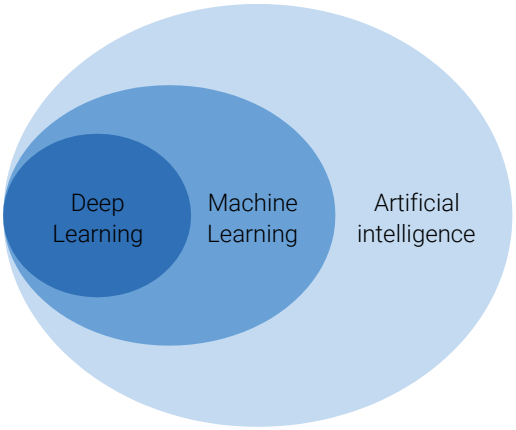
AI has the potential to provide huge benefits to the pharmaceutical industry, from improving R&D productivity through to more effective sales representative deployment and better supply chain management. Adoption of AI is lagging other sectors, with initial forays mainly being led by big pharma who have deep pockets and are willing to try new innovations. For many however, it remains misunderstood, or even feared. Given the transformative potential of AI, companies must understand its benefits and develop strategies that meet each of their unique situations. Those that do will be well informed to make decisions; those that don't may be left out of the next industrial revolution.

AI is maths not malevolent robots

AI is 'intelligence' that is demonstrated by a machine, where by the perception is that the machine demonstrates a degree of 'cognitive' functions, in the way a human or animal might. This is different from natural intelligence which is innate to humans and animals. As a term, AI has spawned many definitions but at its most basic, it is mathematics. It uses data that is fed into linked algorithms to create conditional probabilities (as opposed to certainties – a key difference) about desired outputs.

AI also has a number of subsets. Machine learning (ML) is a subset of AI and describes the ability of an algorithm to learn with experience. This is the area of AI with which we probably have the greatest familiarity. Take Netflix. It combines your preferences with data from similar profiles and uses an algorithm to make recommendations about which films or programs you will enjoy. Based on the feedback you give it (i.e. you watch what it recommends), it refines its recommendations further. Deep learning is the next layer down. Here the machine teaches itself to improve unsupervised.

The world of Artificial Intelligence



AI and its subsets are set up to replicate or even replace cognitive tasks that a human could do. Netflix could employ people to make recommendations, but it would be time consuming, inconsistent and costly. Addressing this is the principal benefit of AI – it does something a human could do, freeing up time for things that only a human can do. It is for this reason that AI is being hailed as the next industrial revolution.

The concept of AI has been around for some time, but the availability and low cost of cloud computing, big data and raw computing power has made it more accessible and applicable to a broader range of applications. This means that in all industries and sectors, AI is being applied in one way or another.

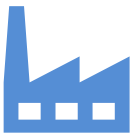
Though AI has many benefits, it does however have an image problem. The public perception is that it will replace people and/or jobs and at its most extreme, AI could lead humans to be controlled by robots. In fact, the best AI augments rather than replaces human activity. Similar fears were raised during the first industrial revolution, and though job losses did occur, as with AI, new technology creates more jobs in its place. This may mean that governments and companies need to support those affected by such change. Within the pharma industry, there is a fairly typical sense that AI 'is for tech companies' and is not applicable for pharma. As society becomes more familiar with what AI is and what it can do, many of these fears will be allayed and the technology and its benefits will become more widespread.

Do believe the hype

For the pharma industry, AI has a huge variety of potential applications – it's not just one 'thing'. Companies are applying it across the pharmaceutical value chain from R&D through to commercial and into manufacturing. Additionally, AI has benefits in many back-office functions such as invoice processing that are non-pharma specific.

Illustrative Areas of Benefit for the Pharma Industry with AI





R&D	*Sales and Marketing*	*Manufacturing*
Drug repurposing	Customer targeting	Demand planning
Clinical trial recruitment	Call planning	Batch consistency
Novel candidate creation	Sales forecasting	Write-off reduction

R&D is the area in which there is currently the greatest excitement and investment. R&D productivity continues to be an industry wide challenge, with the cost of developing products continuing to rise. Many companies have turned to M&A activity to plug pipeline gaps, but this does not address

one of the fundamental problems with R&D – it is very human-capital intensive and reliant on individual expertise in specific areas for success. AI has the potential to increase R&D productivity by addressing both of these challenges. It can be applied to drug repurposing, clinical trial recruitment and measuring patient responses to drugs, all tasks that are currently highly human intensive. For example, companies like Berg are combining patient biomarkers with AI to better understand the patient response to innovative medicines. This has the potential to not only make clinical trials more efficient and effective, it also will mean that patients in the 'real world' get drugs that are more effective for them based on their unique biology.

Earlier in the drug development pathway, pharmacological target identification is an area with a huge failure rate and is consequently of great interest to AI-focused companies. Currently, target identification often relies on human expertise to judge whether a molecule may or may not interact with the target site. This requires experience, is often conducted linearly (as often one site is tested at a time) and is consequently labour intensive. AI can run *in silico* experiments that test multiple sites and predict what the effect may be. This then narrows down, based on data, the sites that should warrant further human exploration. This is the essence of the benefit of AI – it augments human activity. In fact, the most effective application of AI, is where human input and refinement to the algorithm is a key part of the process.

There is already a plethora of small companies providing AI R&D services

Commercial applications of AI are growing but are currently less diverse than their R&D cousins. Sales representatives are often the greatest commercial cost for any pharmaceutical company, and ensuring that they are as effective as possible has long been a priority. This has created an ecosystem of support functions and processes that could benefit from AI. Identifying which customers are most likely to use a company's products and targeting them accordingly has long been a controversial issue. Representatives often feel they know customers better than anyone else, whereas the head office typically uses a deeper analytical approach to set target customer lists. AI has the potential to provide an objective, data-backed view of which customers should be targeted, and dynamically change these over time. The goal is that a representative doesn't have to plan who to see, AI guides them who to see, generating greater sales (and sales bonus) in the process.

Aktana is one of the leaders in the field of developing commercial applications for AI in the pharma industry. With representatives having an increasing amount of raw data, there is a need for analysis, something that sales teams lack time and sometimes capability to do. By applying machine learning to both raw data and each brand's unique requirements, Aktana enables representatives to focus on the human interaction that leads to a sale.

Invest for unproven success

It is indeed ironic that an industry that has for years been so comfortable with scientific risk is so fearful of taking a different type of technology risk. This has led to pharma companies approaching AI with mostly only limited enthusiasm. Novartis is one exception, standing out by putting AI and data at the heart of its business, investing in the technology across the value chain - as the CEO Vas Narasimhan says:

> **"we are going big on data and digital"**

Big pharma is making the greatest investment in AI, reflecting its deep pockets and willingness to make at-risk investments. That companies are investing at all highlights that many in the industry feel that even though AI is not proven, it is worth doing the experiment.

Companies of all sizes and areas of focus are investing in a variety of AI applications

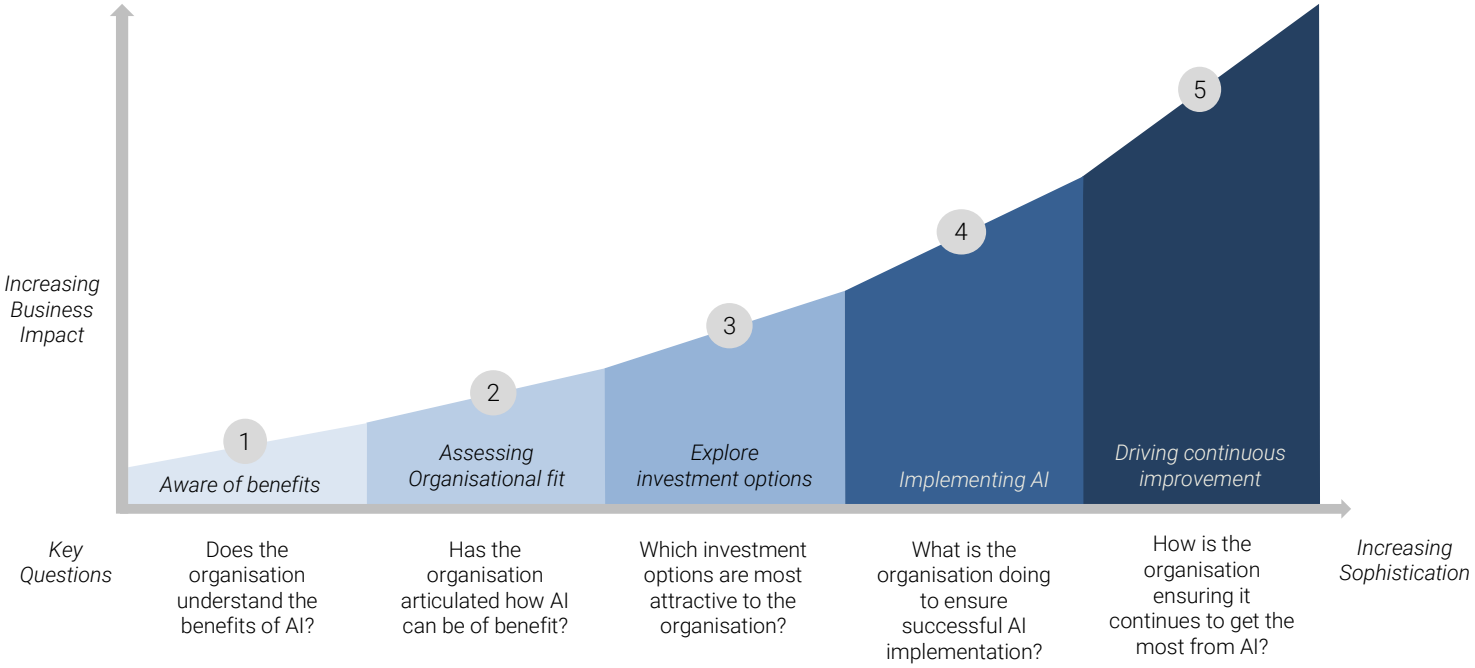
Pharmaceutical company	*AI Partner Company*	*Application of AI*
AbbVie	Aicure	Medicines adherence
Allergan	Numedii	Molecule repurposing for new therapeutic areas
AstraZeneca	Alibaba	Patient diagnosis and treatment
Bayer	Turbine.ai	Molecule repurposing for new therapeutic areas
Bristol-Myers Squibb	Sirenas	Target identification
Celgene	Medidata	Clinical trial optimisation
Evotec	Exscientia	Drug discovery and design
Gilead	GNS Healthcare	Disease progression modelling
GSK	Cloud Pharmaceuticals	Drug discovery
Merck	Numerate	Lead identification
Novartis	Aktana	Salesforce effectiveness
Novo Nordisk	Diagnos	Patient risk assessment
Pfizer	XtalPi	Drug discovery
Sanofi	Recursion Pharmaceuticals	Drug repurposing

As this analysis shows, companies are using external partners to explore the benefits of AI. This is unsurprising given AI's relatively unproven nature and requirement for a capability set that, currently, pharma companies lack. However, the AI landscape is extremely diverse, driven primarily by intense investment from US venture capital companies. Such investment is welcome, but since many of these companies will not stand the test of time and pharma needs to carefully understand what each offers before investing. An ability to ask the right questions will cut through the hype and find partner companies that can deliver intended results.

Think before you act

Given the clear benefits of AI, senior leaders need to at the very least understand what it is, what its potential benefits are and how it may (or may not) fit with the direction of the organisation – in short, they need an AI strategy. Novasecta's experience is that most companies are aware of AI's benefits and are now either assessing how it fits within the organisation, or exploring investment options. A select group are actively implementing AI, with only one or two driving continuous improvement.

Most pharmaceutical companies are either assessing AI for organisational fit or exploring investment options



Novasecta sees many companies pursing an 'AI first' strategy which says 'we must be in AI'. While this sentiment towards innovation is to be applauded, companies run the risk of repeating mistakes seen with 'digital' – thinking about the technology first, and identifying what problem it fixes second. Given the hype and hope around AI, it is easy to become giddy with excitement and rush to solutions, which usually to leads to poor investment choices and subsequent returns. To ground themselves, organisations need to ask 3 key questions:

What does is mean for us?

- Does the organisation understand what AI is?
- Can the organisation articulate its benefits?
- Which area of the business is most likely to benefit from AI?
- How does AI fit within our corporate, commercial, R&D and digital strategies?

What's out there?

- What are other companies doing that we can learn from?
- What are the most appropriate investment options given the company's unique circumstance?
- Who are the leading AI companies in our chosen areas?

What should we invest in?

- How will we know it's been a success?
- How will we implement AI successfully?

Engage the humans

Having made the decision to invest in AI, companies need to engage employees every step of the way to get the most from it. This is critical, as the greatest benefits of AI are achieved with human input. For some employees, AI is a threat that is to be resisted; others may be excited but confused. Leaders need to cater for all levels of belief and to actively build the organisations 'AIQ'. Making AI easy to understand will lead to greater adoption and subsequent business results. In addition to engaging the organisation, leaders need to go 'to war' to recruit the best talent. They will also need to change and challenge existing business processes – a failure to do this will mean AI benefits will not be realised.

Don't get left behind

That AI has benefits for the pharma industry is clear. Whether it is right for each company depends on each individual organisation, but leaders need to understand potential benefits and develop a strategy for their own unique situations. An absence of a strategy may lead to awkward questions from shareholders, and leaders may not be replaced by robots, but by other humans.

Novasecta is a specialist strategy consulting firm for pharmaceutical companies.

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