Declining Efficiency of R&D in Pharma Corporations

Teaser

DEEP KNOWLEDGE ANALYTICS' *"PHARMA DIVISION"*

www.ai-pharma.dka.global

Goal and Applications of the Report

The goal of this report is to provide deep analysis of the prospects of pharma industry considering declining efficiency of R&D. Besides, it includes practical guide to the way for assembling the best possible solutions to deal with the declining efficiency of R&D. Analytical report comprises analysis of key market players in pharma industry for the specific understanding of how they should deal with the risk which arises while declining efficiency.

According to this purpose, the main reasons for declining trend in pharma industry were analyzed based on the tangible indicators. As a result, analytical report provides some recommendations for pharma corporations concerning the issue of finding the solutions to deal with this negative trend. It was also analyzed what strategic areas are appropriate for immediate AI adoption. Thus, quantitative analysis was enhanced by a qualitative one.

The system of metrics and criteria can be applied for the forecasting and predictive analytics in order to understand which companies could be successful and which ones will not survive from the pressure of reducing efficiency.

Thus, future prospects of pharma corporations regarding the evidence of R&D efficiency are described. Moreover, analytical report includes specific methods of how these prospects can be changed. These implications can be extremely useful for every institution operating in the field of AI for Drug Discovery. Except this, the possible impact of AI on the declining efficiency trend was investigated. These implications may be helpful regarding the usage of AI to deal with negative efficiency trends in biopharma industry.

The results of the report can be applied for:

- Complex and deep analysis of the pharma industry
- Optimizing the short and long-term strategies of biopharma corporations and other institutions related to the industry
- Determination of the most promising development directions for the pharma corporations' in order to maximize profits
- Risk assessment of the sector
- Predicting future dynamics and prospects of pharma industry
- Investigating the reasons for declining efficiency of R&D and suggesting solutions to deal with it

The parties who gain early access to this report will have deep expertise on how their strategic agendas can be optimized and stabilized in order to surpass the challenges and to utilize the opportunities related to these novel AI for Drug Discovery investment trends.

Industry Trends Analysis Framework

General characteristics of pharma corporations

Science activity of pharma corporations

Marketing of pharma corporations

Declining Efficiency of R&D

Product availability of pharma corporations

Financial position of pharma corporations

Technologies and methods to deal with declining efficiency trends

Declining Efficiency of R&D in Pharma Corporations

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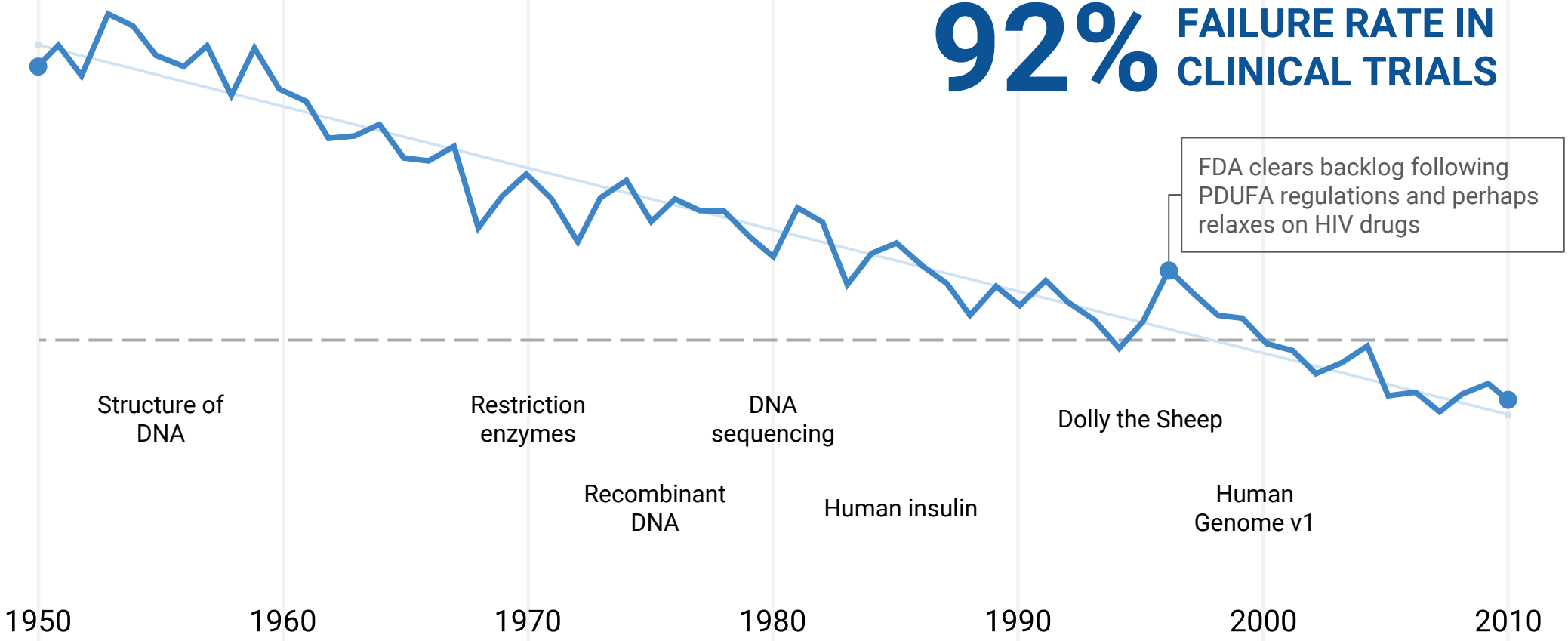
Pharma Efficiency is Declining Steadily

NMEs per $B R&D spent (inflation adjusted)

>$2.6B TO DEVELOP ONE DRUG

92% FAILURE RATE IN CLINICAL TRIALS



Source: Bernstein Research: The Long View - R&D Productivity, 2010

59 NEW DRUGS launched in 2018

Executive Summary

Efficiency of R&D in drug discovery of biopharma declines for many decades and this trend (known as Eroom`s Law) does not stop. Costs of R&D per drug are growing exponentially, yet sales per asset are definitely not increasing. Actually, sales per asset even contribute to the trend, since an average asset brings less revenue. R&D spending continues to increase. Late-stage R&D continues to be inherently risky. The share of oncology assets in late-stage pipelines is growing and becoming the greatest.

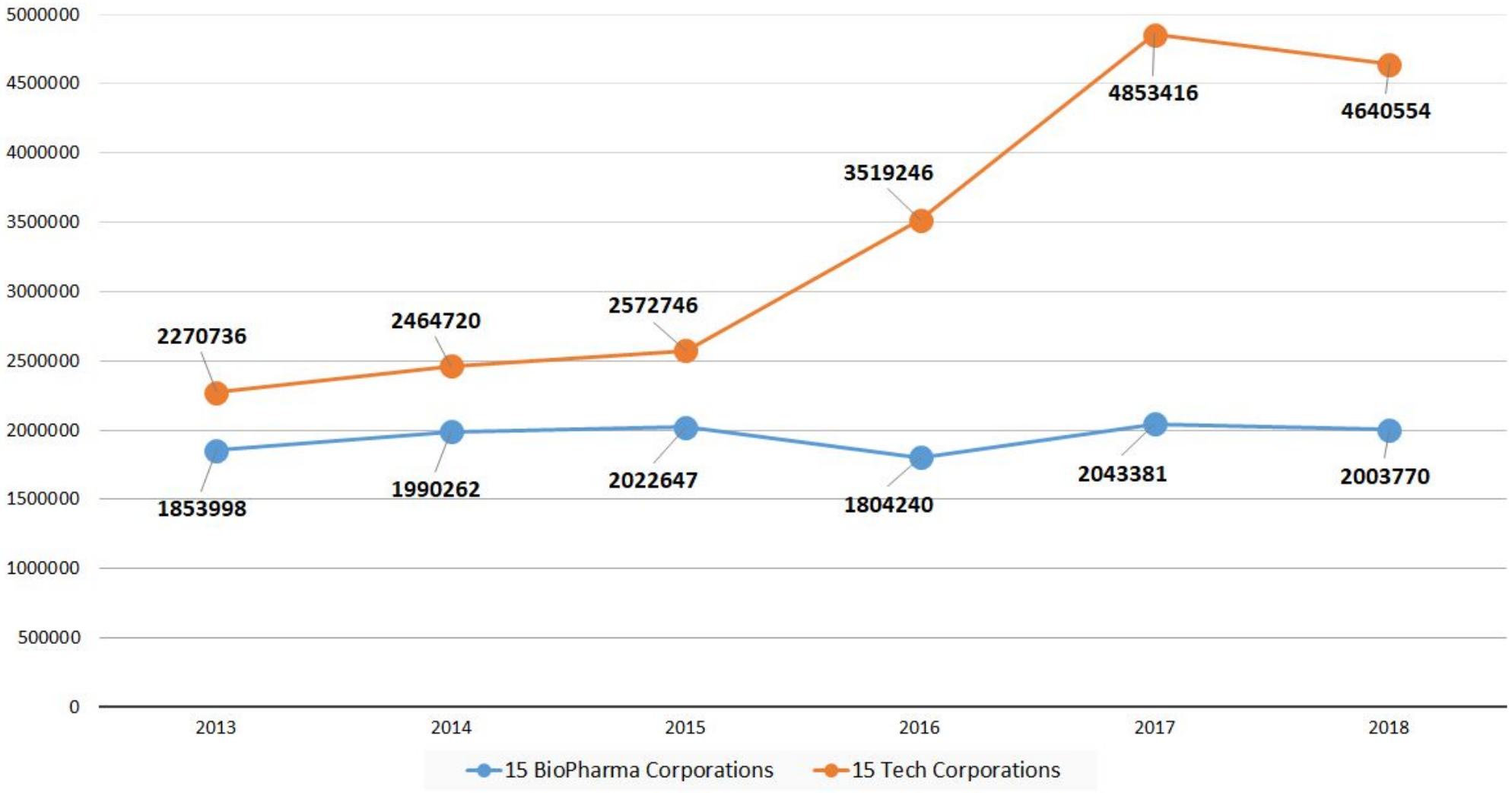
While big pharma has warmed to external sources of innovation from biotech, they continue to pursue a strategy that stresses large-scale, narrowly-focused research, rather than breadth of opportunity. The high-quality, low-volume, high-cost strategy makes corporations particularly vulnerable to the failure rate. As a result, limited output has left the industry dependent on monopolistic pricing and a target for potentially devastating political intervention. Under the current business model, pharma cannot reign-in drug prices without accelerating the decline that Stott has documented.

The solution to the problem is changing the business model of pharma to favor more agile early stage drug discovery, a much larger number of initial pool of projects (with minimal investment, via outsourcing, partnering, or VC funds), and an efficient process of project prioritization. In this sense, pharmaceutical corporations will have to embrace a more venture fund-like approach, given its naturally inherent risk of failure.

Development of AI for drug discovery may cause an additional boost in productivity and bring innovation for big pharma corporations. One opportunity to pharma is to use solutions of young pharma AI startups by making acquisitions. Some corporations that already apply AI for drug discovery have already shown positive changes in financial indicators.

However, it is very likely that negative trends can be overcome only by a combination of technological and managerial innovations in the industry.

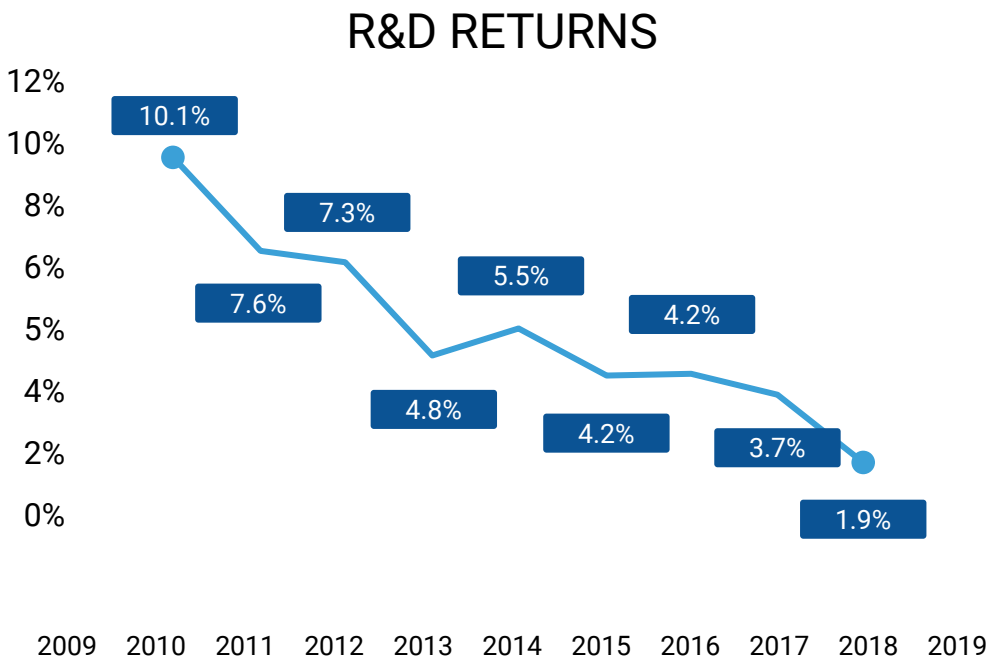
Combined Capitalization of 15 Tech Corporations vs 15 Biopharma Corporations



As can be seen in the figure to the above, the combined capitalization of the 15 BioPharma corporations profiled in this report has remained on the same level for the past 5 years while the capitalization of the 15 IT & Tech corporations profiled in this report is growing significantly. This can be considered as evidence that the BioPharma industry is stagnating in general, while the IT & Tech industry is progressing. This is why it is so notable that the number of IT-corporations has already matched the number of BioPharma corporations active in this subsector.

Declining R&D Efficiency of Biopharma Corporations

	2010	2018
The cost to bring an asset to market	$1,188M	$2,168M
Forecast peak sales per asset	$816M	$407M



Efficiency of R&D in drug discovery of biopharma corporations continued to decline in the last 8 years.

Costs of R&D per drug are growing exponentially, yet sales per asset are definitely not increasing. Actually, sales per asset even contribute to the trend, since an average asset brings less revenue.

R&D spending continues to increase. Late-stage R&D continues to be inherently risky. The share of oncology assets in late-stage pipelines is growing and becoming the greatest.

Clinical cycle times have also continued to increase, which contributes to the negative trend.

Smaller, more specialized corporations become more competitive since they have higher projected pipeline values.

Pharma corporations need to consider new approaches in their R&D process, such as the development of artificial intelligence and implementation of experience of biotech startups.

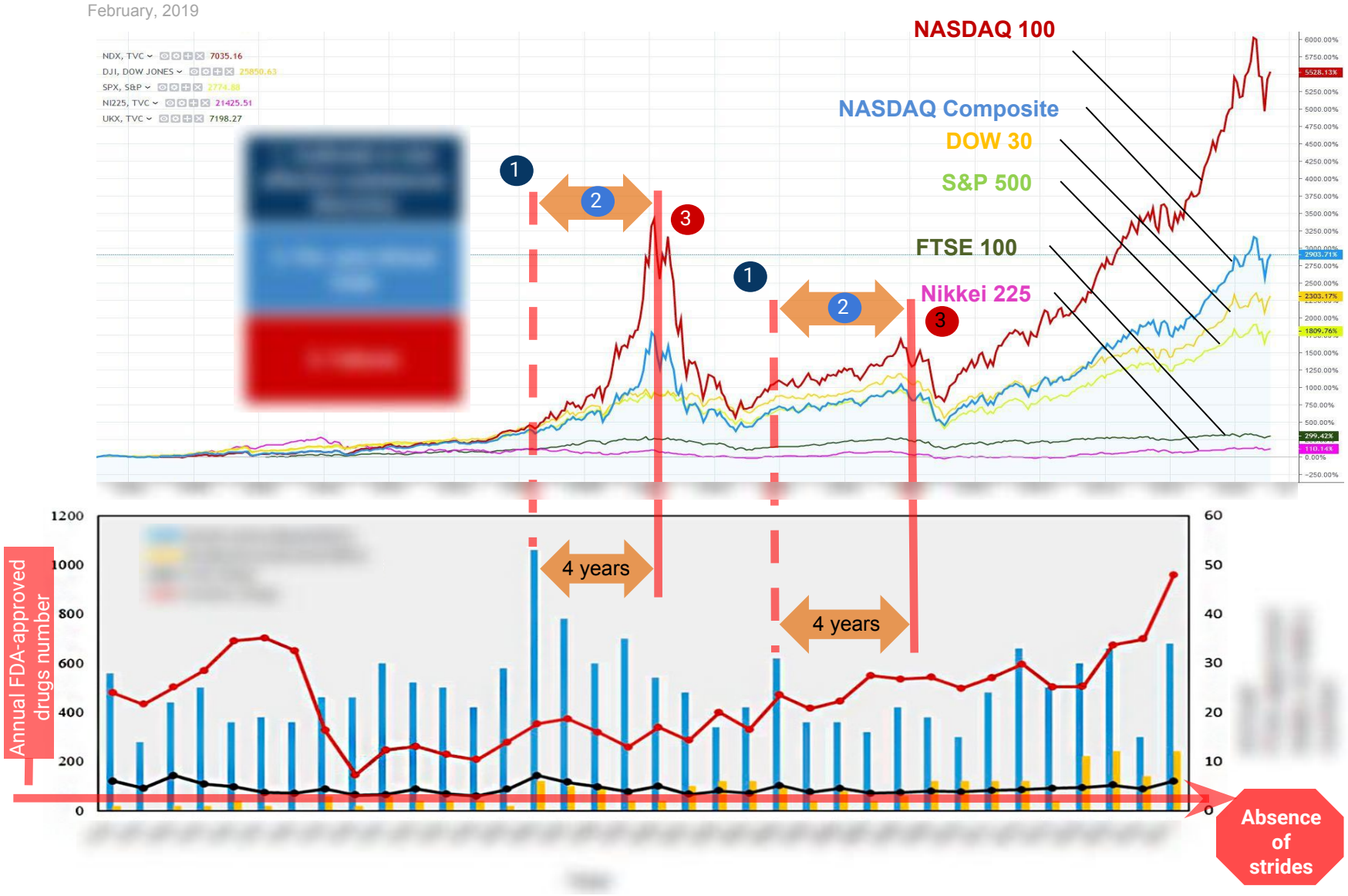
There is, however, some progress in de-risking and increasing returns from existing late-stage pipeline assets.

Sources

Unlocking R&D productivity Measuring the return from pharmaceutical innovation 2018 by Deloitte

Pharmaceutical R&D Breakdown Overview

SEARCHING FOR CORRELATION BETWEEN MAIN STOCK MARKET INDICES AND PHARMA PRODUCTION



Sources adapted from tradingview.com, Zhong H. et al., Pharmaceutics, 2018 (doi:10.3390/pharmaceutics10040263)

Why Productivity of R&D in Pharmaceutical Industry is Declining?

Market opportunity is growing

✔

Drug value is stable and high

✔

Sales are growing, and revenues as well

✔

Innovation and R&D is, in fact, efficient and disruptive. Pharma constantly launches blockbusters

✔

(e.g. Sovaldi/Harvoni, Keytruda, Kalydeco are some of the recent blockbusters, which had a transformative impact on medicine, with decent revenues streams)

WHY THE PRODUCTIVITY and PROFITS are falling?

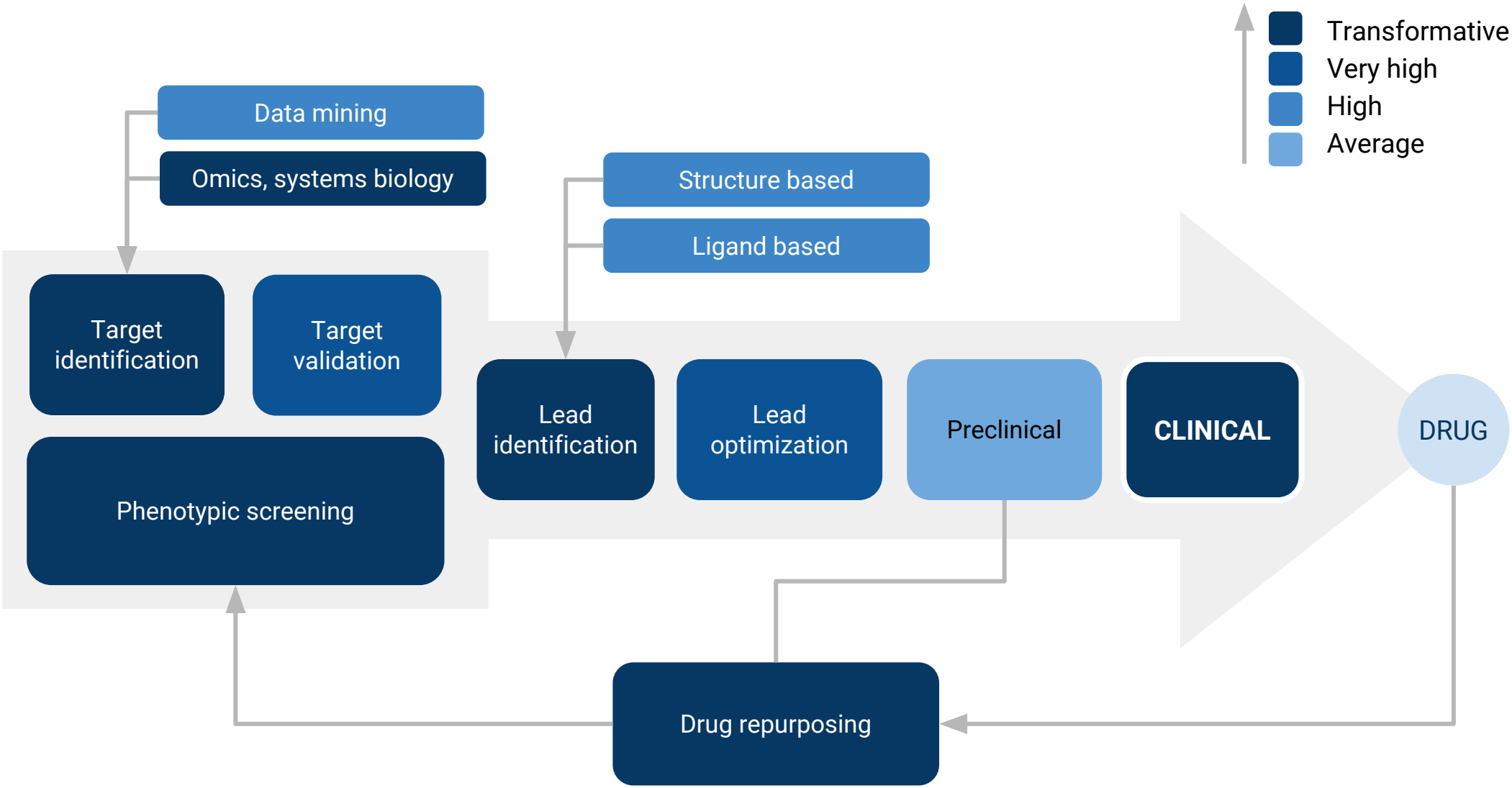
The cumulative cost of R&D is growing **too fast**, **mainly** because of high failure rate at late projects.

X

Less than 10% success rate of commercial launch is inevitably leading to decline in profit, no matter how much money pharma is making, considering that the cost of R&D for one project might well go beyond a billion dollar ceiling.

Source forbes.com

The "Heat Map" of AI Potential Value for Various R&D Areas



Solutions: Changing the Business Model of Generating R&D Assets

A PREFERRED BUSINESS MODEL FOR PHARMACEUTICAL corporations

This innovation strategy might be, in some ways, borrowed from Technology Giants, which are notoriously good at agile management of R&D, and leveraging open-source communities.

Solutions: Increasing Efficiency of Clinical Trials is a Strategic Component of Success for Big Pharma

Another important area where pharma has to substantially increase efficiency is in Clinical Trials management and performance. This is a major bottleneck in the overall productivity of pharma industry, and the important contributor to the overall cost of R&D.

7.5 yrs

Average time frame of a clinical trial from start to finish

$161M-$2B

Approximate cost per drug during the clinical trial process

~ 80% of clinical trials **fail to meet enrollment timelines,** and one-third of Phase III clinical study terminations are due to enrollment difficulties.

Strategic Areas for Immediate AI Adoption

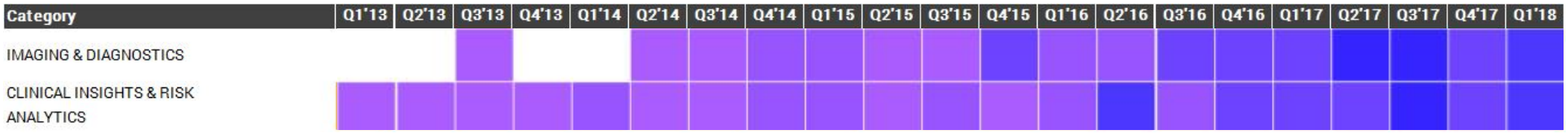
In the light of the above two bottlenecks in pharmaceutical productivity — prioritizing early discovery projects, and performing clinical trials, it seems that AI can play a disrupting role for both areas. A highly competitive nature of the current pharmaceutical market dictates the highest priority of it. Namely, AI can be adopted as the following:

1. [illegible]

2. [illegible]

Startups are requesting permission to collect medical records from doctors on patients' behalf, since it is hard for patients to access their own records from all the health institutions they've visited.

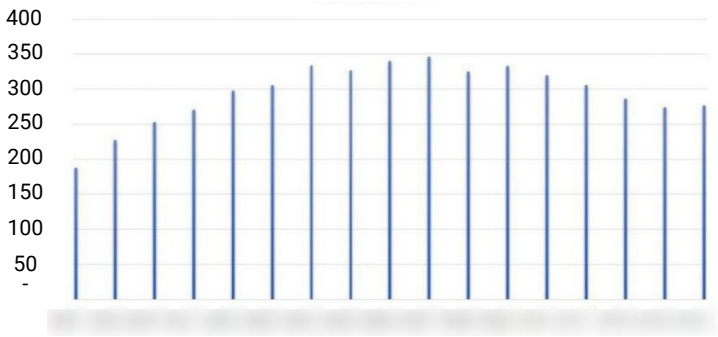
On the B2B side, startups are now using deep learning and natural language processing to automate clinical trial matching by directly partnering with health institutions.



Source CBInsights, The Future Of Clinical Trials

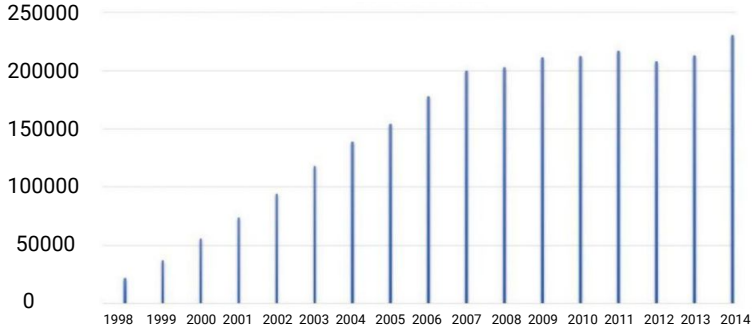
Sales Performance

Average revenue per drug each year from 1998 to 2014 $ million



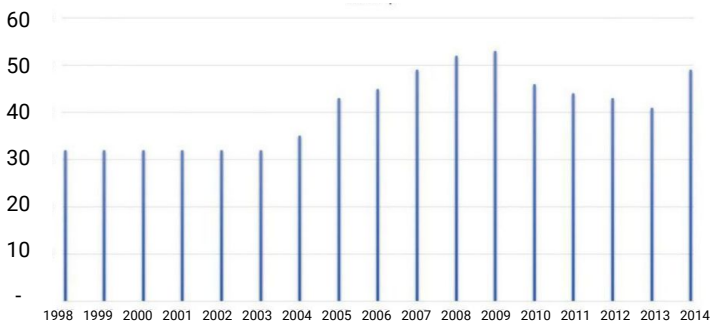
The graph above shows, how average revenue per drug was stably growing from 1998 up to 2007. Starting from 2008, a clear decline till 2013 can be seen, which was stabilized in 2014.

Annual pharmaceutical industry sales from 1998 to 2014 $ million



This diagram demonstrates, that from 1998 to 2014 annual pharmaceutical industry sales were strongly growing, with a slight decline in 2012.

The number of drugs that sold $1 billion or more in each year from 1998 to 2014

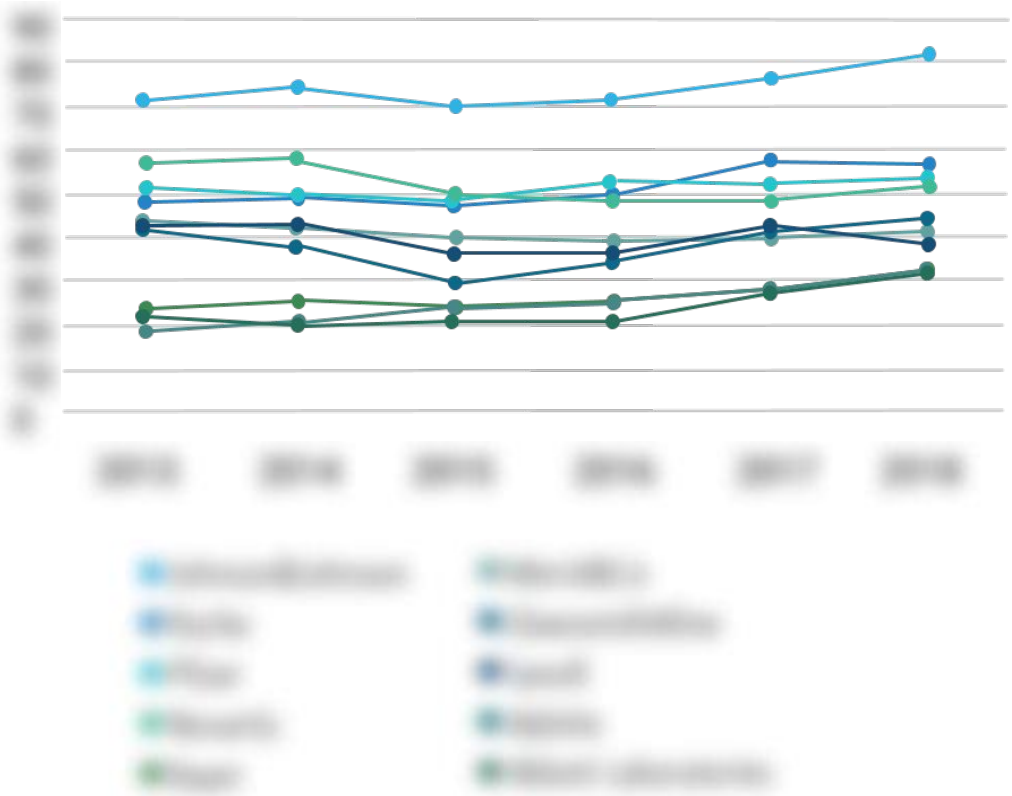


The figure above shows a general growth of number of drugs, which sold $1 billion or more, with a slight decrease during 2010-2013 years and with a further increase in 2014.

Source EvaluatePharma ®, November, 2015, Evaluate LTD., www.evaluate.com

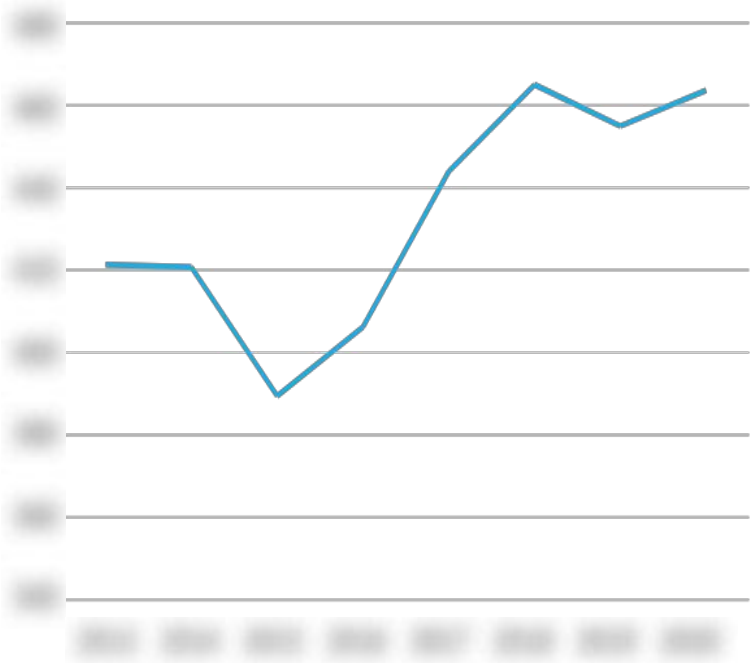
Top-10: Revenue

REVENUE OF TOP-10 corporations ($B)



From the graph above we can see, that in general, corporations either stay on the same level of revenue, or raise it. There are only a couple of aforementioned corporations, which lost a certain amount of their revenue between 2013 and 2018.

TOTAL REVENUE OF TOP-10 corporations ($B)



Emerging from the previous graph, the one above demonstrates a total revenue of top-10 corporations. And, as it has been said, the general trend of increase is clear. However, there was a perceptible decline in 2014-2015 and a minor decline, forecasted in 2019.

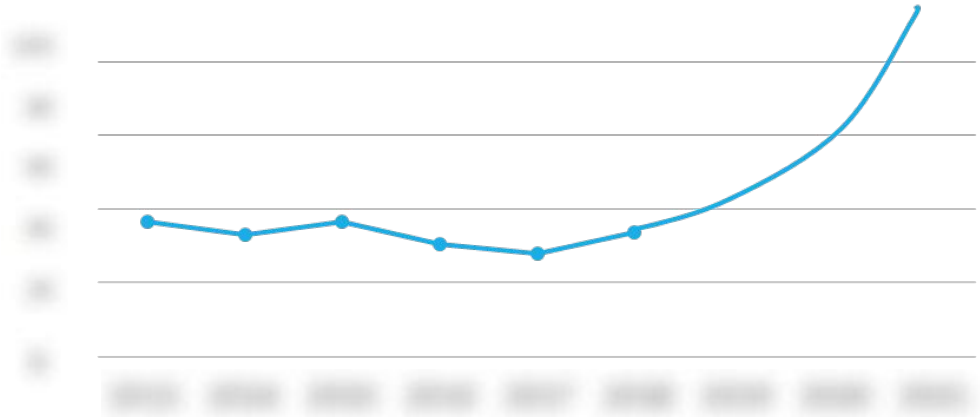
Future of Biopharma Industry

Predictions about the future: positive scenario

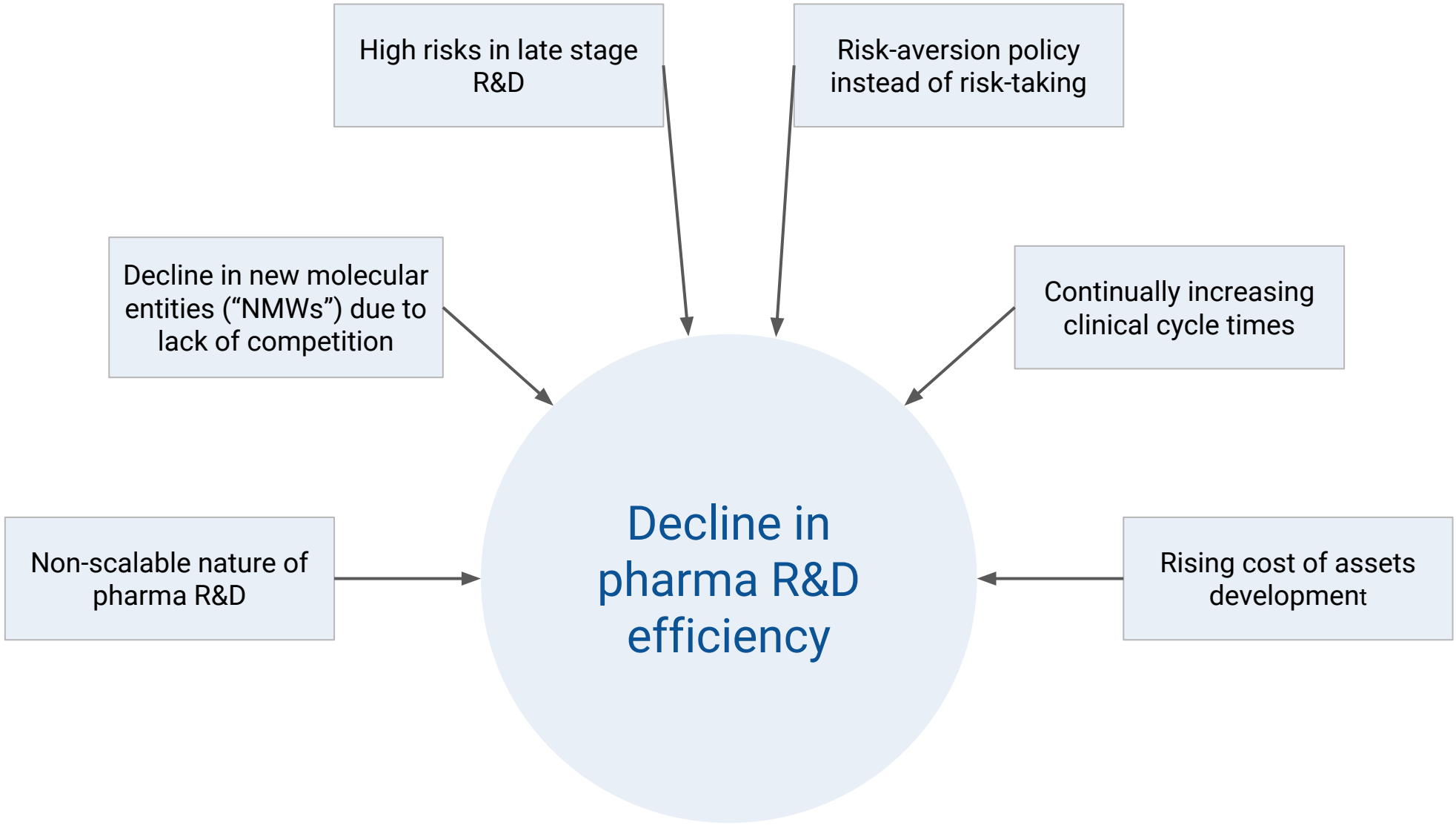
3D printed drugs	Body sensors	Genuinely customized medicine	Empowered patients	AR and VR

TOTAL NET PROFIT OF TOP-15 corporations USING AI ($B)

TOTAL NET PROFIT OF TOP-15 corporations USING AI ($B), positive scenario



Main Trends of R&D Efficiency



10 Underappreciated Risks Facing Pharmaceutical Companies

RISK	IMPACT	PROBABILITY	ORIENTATION
[illegible]	High	High	External
[illegible]	High	High	External
[illegible]	Moderate	High	External
[illegible]	Moderate	Moderate	External
[illegible]	Moderate	Low	Internal
[illegible]	Moderate	Low	External
[illegible]	Low	Low	Internal
[illegible]	Low	Low	Internal
[illegible]	Low	Low	External
[illegible]	Low	Very Low	External

Sources fitchsolutions.com

Summary: Solutions

Drug Discovery

New drugs on the market

3 bottleneck

R&D is unpredictable, slow and expensive	Outdated clinical trials model	Lack of flexibility, analytical power and urgency
• [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible] • [illegible]	• [illegible] • [illegible] • [illegible]

Implications

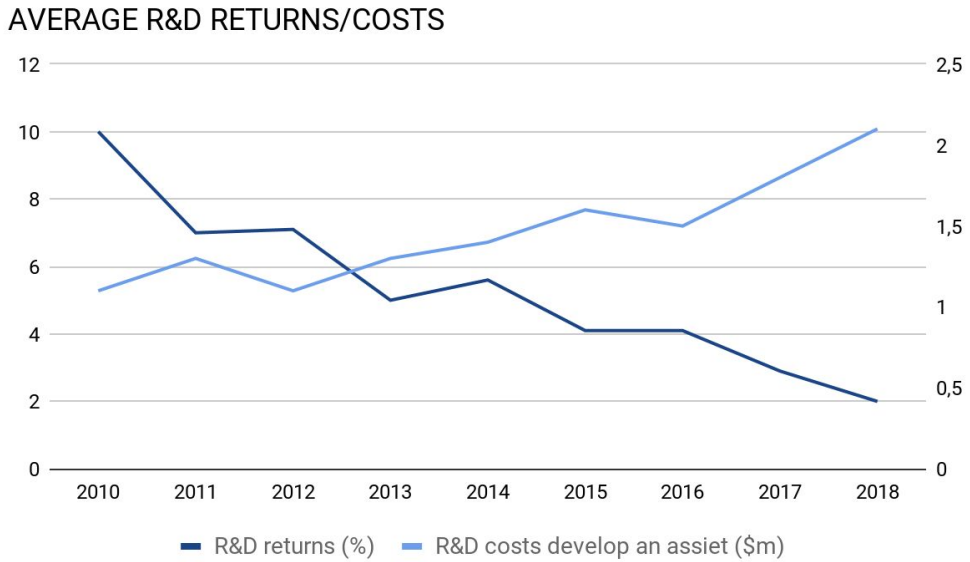
Efficiency of R&D in drug discovery of biopharma declines for many decades and this trend (known as Eroom's Law) does not stop

Solutions:

- [illegible]
- [illegible]
- [illegible]
- [illegible]

Main reasons for the growth of R&D costs:

- High failure rate leads to adequately high cumulative losses, assigned to the overall cost of R&D over a total investment period.
- An ever-increasing complexity of innovative landscape.
- FDA constantly raises the bar of requirements for new approvals.



The trend is maintained:

Pharma industry faces both a drop in R&D productivity and an increase in costs of assets development.

Basic problem:

[illegible]

Deliverables of the Report
Proposal for Cooperation

The decline of the R&D efficiency of biopharma corporations is perhaps the most crucial trend in the whole industry now. Today it is even more exacerbated due to the ever-increasing impact of this decline on financial indicators of pharma corporations and financial stagnation of the industry despite large technological progress.

The key questions regarding declining efficiency of R&D of biopharma corporations include:

- **What are the main reasons for this declining trend and what are business consequences for the corporations and other participants of the industry?**
- **How can pharma corporations find the solutions to deal with this negative trend?**
- **What are future prospects of pharma corporations regarding the evidence of R&D efficiency and how these prospects can be changed?**

This is a 70+ page report delivering practical answers to these specific questions in order to optimize the short and long-term strategies of biopharma corporations and other institutions related to the industry, with a newly updated edition being released each quarter, incrementally increasing the precision, practicality and actionability of its technological and financial analysis. Each new edition will provide a more sophisticated, comprehensive and precise understanding of the challenges and opportunities provided by the decreasing efficiency of R&D in biopharma corporations, as well as what businesses need to do in order to revert this trend, rather than stagnate. It is analyzed and assessed also how are these solutions applicable and how is it likely to implement them.

It will deliver:

- Complete assessment of the pharma industry prospects regarding declining efficiency of R&D
- Meaningful 3-5-year forecasts combined with an overview of novel biopharma tools and methods that will be market-ready by 2022-2025 and can stop or even revert the negative trend
- Practical guide for developing the best possible tools and solutions in order to success under conditions of the declining R&D efficiency
- Analysis of key market players in pharma industry for the specific understanding of how they are going to deal with the risk of declining efficiency

The parties who gain early access to this report will have deep expertise on how their strategic agendas can be optimized and stabilized in order to manage the problem of declining efficiency of R&D in pharma corporations, to surpass the challenges and to utilize the opportunities related to these biopharma trends.

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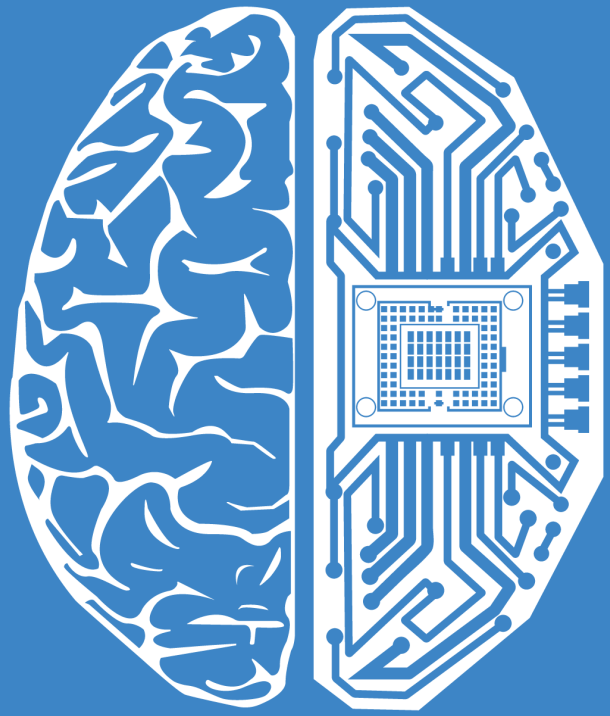

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