

Future of the Global Pharmaceutical Industry

Torreya finds the global pharmaceutical industry is larger, innovating more rapidly, and likely to experience higher growth than previously thought.

Key Findings

- At approximately \$5.4 trillion today, the pharma industry is around 30% larger than previously thought and is one of top five in the global economy by total value.¹
- Despite widespread concerns about the slowing of innovation and continued cost controls in pharmaceuticals, we predict that the pharmaceutical industry will grow substantially in the decades ahead.
- We estimate that the total revenue of the pharmaceutical industry will triple in real terms between 2017 and 2060.
 - Short-term growth driven by rare disease drugs and biologics
 - Longer-term growth driven by nucleic acids and implantables
- Major innovations will continue to drive the size and growth of the sector with positive implications for the health of the global population.

Near-Term Growth Will be Driven by Rare Disease Drugs and Biologics

- The rare disease sector is an important growth driver in the pharmaceutical industry. The pure-play rare disease sector is now more than 17% of the value of the big pharma sector, larger than the entire biotech sector and larger than either the entire Japan pharma sector or Chinese pharma sector.
- The last decade has seen substantial accretion in industry valuations from adoption of biologics for the control of diabetes, inflammation, and cancer.
- We expect to see continued growth in the biologics field, fueled by growth in new biologics such as Novartis' Canakinumab (anti-IL1-beta monoclonal antibody) and by improvements in the manufacturability of peptides.

Long-Term Pharma Industry Growth Will be Driven by Nucleic Acids and Implantables

- Longer-term, we expect substantial growth in nucleic acid drugs built through approaches that include microRNA, RNAi, direct mRNA, gene therapy, and gene editing.
- The ability to regulate gene transcription and correct genetic mutations with therapeutic constructs has profound positive implications for human health and may ultimately reduce society's reliance upon chronic therapies.

¹ Based on Torreya econometric model relating OECD estimates of future GDP growth to growth estimates for the pharmaceutical sector.

- Several other important areas of innovation are likely to shape the future of the pharmaceutical sector; these include cell therapy, NGS-driven medications, and innovations in digital health.

Silicon Valley Likely to Make Its Presence Known in Pharmaceuticals

- The pharmaceutical industry has been relatively immune to the digital innovation disrupting other industries. We believe this will change in the next decade. We are already starting to see the adoption of closed-loop systems driven by technology for improved pharmaceutical delivery (Medtronic's recent insulin delivery system is a good example).
- We believe that very small implantables will likely be an important area for innovation in the future; companies such as GSK, Google, and Neuralink (Elon Musk) have recently made meaningful investments in this area.
- The low cost of silicon and the miniaturization made possible in implantables means that radical changes in the entire model of drug delivery will become possible in the not-too-distant future.
- We envision a future where medical monitoring and use of therapeutics is more continuous, more automated, and more effective.

Pace of Innovation and Approvals in the Pharmaceutical Sector Is Increasing

- The pace of innovation in drug discovery, manufacturing, and delivery has been rapidly accelerating.
- The chemical synthesis revolution took nearly a century to play out. In contrast, Biologic therapeutics (i.e., antibodies and peptides) has been a "revolution" about 35 years in the making since the first one was produced by Genentech in the late 1970s (though we believe it could take 100 years for revenues from this drug modality to peak).
- In nucleic acids, 25 years have elapsed between the first approval of an antisense drug by Isis in 1992 to multiple approvals today, and we expect many approvals will occur over the next several decades.
- It also appears likely that the fields of cell therapy and regenerative medicine will see numerous approvals in the decades ahead.
- The field of implantables and bioelectronics is very new and, yet, the first approval took place in 2016 (Medtronic's artificial pancreas). We expect numerous additional approvals in the next decade in this area driven by the ease of applying the technology and speed in which silicon-based digital technologies can be adapted for therapeutic applications.

On the Paradox of Cost Controls Amidst Rapid Industry Growth

- We are forecasting meaningful market growth at the same time that we note the increasing use of pharmaceutical cost controls around the world. This may seem paradoxical, but market growth and pharmaceutical cost controls have gone together for decades.
- Innovation in new products has outpaced society's ability to pay for them, creating the need for cost containment.
- At the same time, access to pharmaceuticals has improved markedly. The poor and middle classes in many parts of the world have obtained widespread access to pharmaceuticals for the first time in the last two decades. The consequent increase in volume has been important in creating pressure for cost controls.
- Because of the scale of the new-drug pipeline in upcoming decades, we expect cost-containment policies to continue and strengthen.

Overall, We See a Future of Strong Growth in the Global Pharmaceutical Industry

- On the whole, the industry's future is bright. Medical innovation accompanied by economic growth will increase the size of the industry and the need for cost-containment policies. A major benefit of these policies will be improved access to drugs for much of the world's population that cannot afford them today.
- The pharmaceutical sector of the future will be very different than today's market which is led by small molecule oral solid dose pills. The future sector will feature co-existence of chemical drugs, advanced biologics, nucleic acid therapeutics, cell therapies, and implantables.

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