The Digital Adoption and Technological Innovation in the Pharmaceutical industry--A case study of Pfizer

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Abstract. With the emergence of the information age and the Covid-19 pandemic, digital transformation has become a mainstream trend among various industries. The study elaborates on the current market situation in the pharmaceutical industry and focuses on the investigation of the digital adoption and technological innovation in the pharmaceutical industry and puts forward several strategies pharmaceutical companies, Pfizer in particular, can adopt. The research adopts literature research and a case study as research methodologies. The case study carefully evaluates Pfizer, one of the leading companies in the pharmaceutical industry, and the evaluation includes Porter's five forces, SWOT analysis, TOWS analysis, and DuPont Analysis.

Keywords: Digital Adoption, Technological Innovation, Artificial intelligence, Pharmaceutical industry, Pfizer

1. Introduction

With the double addition of the information age and the post-pandemic era, the tendency of digital adoption has become a hot topic in the pharmaceutical industry, which focuses on research and development, production and marketing of pharmaceuticals. With the continuous development and popularization of Internet technology, enterprises with online business transformation have gradually increased their influence in the pharmaceutical field. As companies transforming their businesses online are more focused on innovation and responding quickly to market demands, traditional pharmaceutical companies' production and sales models are relatively slow and conservative. In addition, enterprises with online business transformation can better manage and optimize production processes, improve efficiency and reduce costs through digital technology adoption, and enhance their competitiveness by gaining more market share. The peculiarities of the current period have created new opportunities for the adoption of digital technology and technological advancements in the pharmaceutical industry. The healthcare industry is likely to undergo significant changes and innovation as a result of the rapid advancement of technology.[1] Therefore, previous studies will be unable to comprehensively evaluate the situation the industry is facing and the corresponding strategies it can adopt. This study aims to investigate the digital adoption and technological innovation of the pharmaceutical industry. The research is worthy of study since it provides unique insights for the improvements that companies may take to promote their development. The study adopts literature research and a case study of Pfizer as research methodologies. The case study carefully evaluates Pfizer, one of the leading companies in the pharmaceutical industry, and the evaluation includes Porter's five forces, SWOT analysis, TOWS analysis, and DuPont Analysis.

2. Literature Review

Selected literature is reviewed in the context of two key areas, including Digital Adoption and Technological Innovation in the pharmaceutical industry.

2.1. Digital Adoption

The biomedicine industry has the characteristics of high technology, high investment, long cycle, high risk, and high return. The use of digital technology to promote enterprises in the field of biomedicine and medical devices to improve quality, reduce cost and increase efficiency, shorten the

research and development cycle, and obtain different degrees of optimization in both production and sales, will become the inevitable choice for biomedicine enterprises, enabling them to gain competitive advantages in domestic and international markets.[2] However, compared with information, communications technology, media, professional services, and other sectors, pharmaceuticals have limited digital capabilities with less digital spending, business processes, and interactions.[3] Therefore, pharmaceutical companies need to pay more attention to digital transformation, appropriately increase digital spending when conditions permit, and benefit from it.

The pharmaceutical industry is currently facing challenges in maintaining its drug development programs due to increased R&D costs and reduced efficiency, but experts firmly believe that artificial intelligence is going to permanently change the pharmaceutical sector and the way medications are discovered.[4] Understanding the interactions between humans and drugs and leveraging available data and technology will foster collaboration and improve efficiency, and the current spate of pharmaceutical sector consolidations is not a problem, but rather an opportunity.[5] From those studies, it is concluded that there is a need for companies in the pharmaceutical to consider both the positive and negative effects of utilizing Al techniques and adopt the strategies according to their financial and risk-taking ability in the face of uncertainty.

The experience of using AI in various pharmaceutical companies can occasionally be transferred to other circumstances and adapted to new realities, and the implementation of emerging technologies in the pharmaceutical industry may be beneficial to the company's strategy if the integration goals are readily recognized.[6] The pharmaceutical companies, Pfizer in specific, can refer to the digital adoption experience of its competitors, adapt and refine it according to its own integration goals, and adopt unique digital transformation strategies.

2.2. Technological Innovation

The COVID-19 pandemic has expedited the digital transformation of the pharmaceutical industry and the medical affairs segment has the opportunity to lead and innovate, and medical affairs will need to show innovative technological abilities in leading various collaborations and partnerships across the healthcare ecosystem to achieve future fitness.[7] The technological innovation efficiency of the pharmaceutical manufacturing industry plays an important role in promoting the growth and development of the pharmaceutical industry in this region, and the synergies between regions are more obvious.[8] The fierce competition promotes the continuous development and growth of enterprises and improves competitiveness. Consequently, to promote this virtuous cycle, pharmaceutical companies should strengthen communication and cooperation between enterprises, promote talent exchange and interaction, and technological innovation, and better achieve collaborative development.

Other measures can be used to facilitate technological Innovation in the pharmaceutical industry. Research has shown that there is a significant positive correlation between R&D capital investment intensity and technical personnel investment intensity and industry growth. The industry technology environment and industry policy environment play a positive regulating effect, but the market power of enterprises will weaken the above positive relationship.[9] Pfizer, as a leading enterprise, should strengthen R&D capital investment and technical personnel investment to lead the development of the pharmaceutical technology environment and promote the continuous growth of the industry if it wants to have a huge market share. Moreover, the positive effect of government subsidies on innovation input is constantly verified and has become a consensus, and tax incentives promote enterprises' R&D innovation input as a whole.[10] The government can appropriately increase subsidies and tax incentives for pharmaceutical companies to encourage innovation.

3. Case Study

3.1. Profile

Pfizer was founded in 1849 and has a history of more than 170 years. It is a multinational pharmaceutical and biotechnology corporation in the United state that develops and produces drugs and vaccines for various medical disciplines. Its products cover a wide range of potential therapeutic and health fields, including chemical drugs, biological agents, vaccines, and health drugs. With total revenue of more than $100 billion in 2022, Pfizer is among the top five most valuable pharmaceutical and biotechnology companies with a market capitalization of more than $240 billion, occupying the market leader position.[11]

3.2. Porter's Five Forces

Porter's Five Forces model was proposed by Michael Porter. He believes that the five forces affect the attractiveness of the industry and the competitive strategy decisions of existing enterprises. The five forces are rivalry among existing competitors, the threat of new entrants, the threat of substitute products, and bargaining power of buyers and bargaining power of suppliers (Table 1).

Table 1. Porter’s 5-forces for the pharmaceutical industry

Porter’s 5-forces for the pharmaceutical industry	
Rivalry among existing competitors	High. Pfizer's main competitors are Johnson& Johnson, Roche, Eli Lilly, AbbVie, Merck, Novartis, and so on. These enterprises continue to introduce new products, open up new markets, reduce costs, and other aspects of competition, fierce competition for market share.
Threat of new entrants	Low. The pharmaceutical industry has high barriers to entry. It has a strong moat, including strict legal protection from the government administration, the huge amount of funds under the premise of monopoly’s economic of scale, and the advantage of product differentiation among the industry (brand advantage).
Threat of substitute products	High. There are alternative therapies or drugs for many diseases. The existence of a generic drug that has similar characteristics to the original drug and charges at a lower price may act as a substitute product and increase the competition in the industry.
Bargaining power of buyers	Moderately high. The degree of concentration of buyers is high, and they are generally bought in bulk, so they occupy a bargaining position. These buyers can negotiate for lower prices on drugs and may switch to cheaper generic drugs or substitute therapies, leading to a strong ability to argue. Also, the price of pharmaceutical products is relatively high, which may lead to higher price sensitivity of customers.
Bargaining power of suppliers	Low. There are many suppliers in the market, so the competition between them will reduce the bargaining power of each supplier. Also, pharmaceutical companies tend to maintain a long-term cooperation relationship with suppliers by establishing contracts with them. Therefore, suppliers are willing to make compromises in negotiating prices to maintain good relations with the company.

3.3. SWOT Analysis

SWOT analysis is a situational analysis based on internal and external competitive environments and competitive conditions, including internal strengths, weaknesses, and external opportunities and threats.

3.3.1 Strengths

Pfizer has economies of scale and market leadership with a history of more than 170 years, it established unique brand advantages. Pfizer aims at "bringing life-changing breakthroughs to patients" and focuses on R&D investment. Its strong sales line ensures the market impact of its products. It also has strong research and development ability and marketing ability and produces high-quality products with a good reputation. Pfizer is actively engaged in digital transformation, and its overall benefits are reflected in improved product yield and quality, minimized capacity losses, generally reduced energy costs, and improved asset utilization.[2]

3.3.2 Weaknesses

Pfizer also faces several weaknesses, including the expiration of patents, and the limitations of manufacturers' products may lead to a decrease in revenue. Its R&D efficiency is low because of the high failure rate & lengthy regulatory approval process while producing medicines and vaccines. 90% of clinical drug developments have failed during clinical phases within the past few decades because of the lack of clinical efficacy, commercial demand, and strategic planning.[12] A huge investment may not reach the initial design level of the drug, resulting in the early investment in research and development costs will be wasted.

3.3.3 Opportunities

Pfizer embraces promising opportunities since there is more attention paid to intellectual property rights, and countries have increased the protection of patented medicines. There is also increased demand for medical services because of the aging population. The adoption of digital health technologies also creates more online business opportunities for Pfizer. Finally, Pfizer's emphasis on Environmental, Social, and Governance also plays an important role in boosting its long-term sustainable development. Pfizer has adopted a series of energy-saving, environmental protection, and green building measures to respond to the global carbon peak carbon neutrality policy. They also made an "Environmental Sustainable Commitment", aiming to use their global presence aid scale to make a difference in local communities and the world around them since they have unique resources to do more for people.[13, 14]

3.3.4 Threats

However, external threats exist, and Pfizer must be aware of them to maintain its market leader position. First, it faces fierce market competition with both existing competitors and new entrants. Second, Pfizer was frequently involved in scandals due to exaggerations and misinterpretations of facts by the media. The public questioned Pfizer constantly, and the enterprise was plunged into a crisis of trust. As can be seen in the sector charts, the vaccine segment accounts for more than half of Pfizer's revenue, which could fall in the wake of the pandemic due to a drop in demand. Once the Pfizer vaccine data is falsified, the experimenters are not standardized, and the vaccine side effects are confirmed, Pfizer will face a crisis of trust(Figure 1).

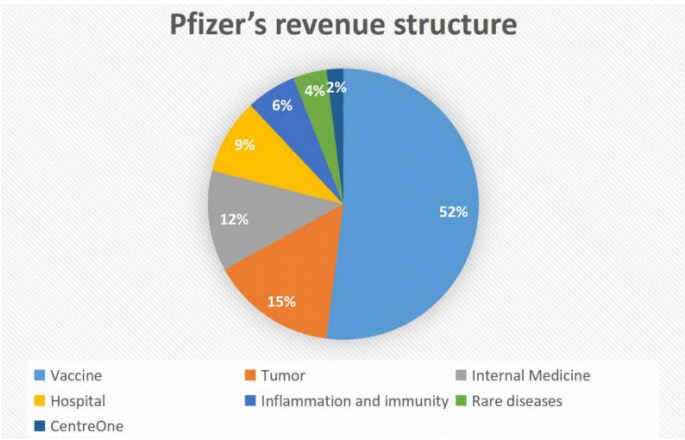


Figure 1. Pfizer's revenue structure [15]

3.4. TOWS Analysis

Based on the SWOT analysis, the TOWS analysis was presented for the strategic analysis of Pfizer, aiming to obtain the optimal combination of strategies. By leveraging their strengths, companies can take advantage of opportunities and address threats, while also overcoming weaknesses to pursue opportunities and avoid threats.

3.4.1 Strengths & Opportunities strategies

Under the favorable policy and the aging social phenomenon, Pfizer can increase the R&D of patents, especially focusing on the development of healthcare products for the elderly. Furthermore, it can expand online business by establishing a consumer interactive communication platform. Pfizer can realize the shortcomings of its products and improve them by allowing consumers to exchange product experiences with each other. Finally, Pfizer can increase the publicity of its efforts in Environmental, Social, and Governance. For example, it can send promotional advertisements to consumers in the form of emails, or post related tweets and videos on the official website and social media, so that consumers are aware of Pfizer's actions for the construction of a friendly environment, establishing a good brand image and strengthening the brand effect.

3.4.2 Strengths & Threats strategies

Pfizer should integrate more technical resources, ensure drug quality by improving drug testing standards, and develop products that better meet public expectations, thus reducing scandals. It should use high-quality research and development and honest management to regulate behavior and win the trust of the public and maintain the existing leading position in the industry by properly handling the crisis of public trust. In addition, Pfizer appropriately reduced R&D investment in coronavirus-related drugs and vaccines and devoted more resources to developing products in new areas, such as elderly care products, anti-tumor drugs, inflammatory drugs, rare disease drugs, etc., to develop products for the post-epidemic era.

3.4.3 Weaknesses & Opportunities strategies

Digital adoption creates promising opportunities for pharmaceutical companies to reduce the high failure rate and improve the accuracy and effectiveness of drug development. Extraordinary breakthroughs in computer processing capability, along with innovations in artificial intelligence, have the potential to change the pharmaceutical manufacturing process.[5] AI could also dramatically reduce the cost of drug development. Experts believe that AI could halve risks in the process of developing new drugs: by 2025, the pharmaceutical industry could save about $26 billion a year.[16] The new drug discovery engine driven by AI can help pharmaceutical companies reduce research and development costs and improve the efficiency of new drug research and development in the process of new drug research and development.

3.4.4 Weaknesses & Threats strategies:

Pfizer can improve the efficiency of drug research and development through AI technology and technological innovation and enhance the competitiveness of enterprises. At the same time, Pfizer should pay attention to precision marketing, capture consumer demand, and research and development of drugs needed by the market, reducing the waste of huge investments. By partnering with other pharmaceutical companies, for example, through joint development of new products or marketing, Pfizer can share the risk and increase sales. It can also keep its products competitive by protecting its intellectual property to prevent other companies from copying them.

3.5. DuPont Analysis

DuPont Analysis is to comprehensively analyze the financial situation of an enterprise by using the relationship between several major financial ratios. It is used to evaluate the profitability of a company and the level of return on shareholder's equity and analyze the performance of the enterprise from a financial perspective.

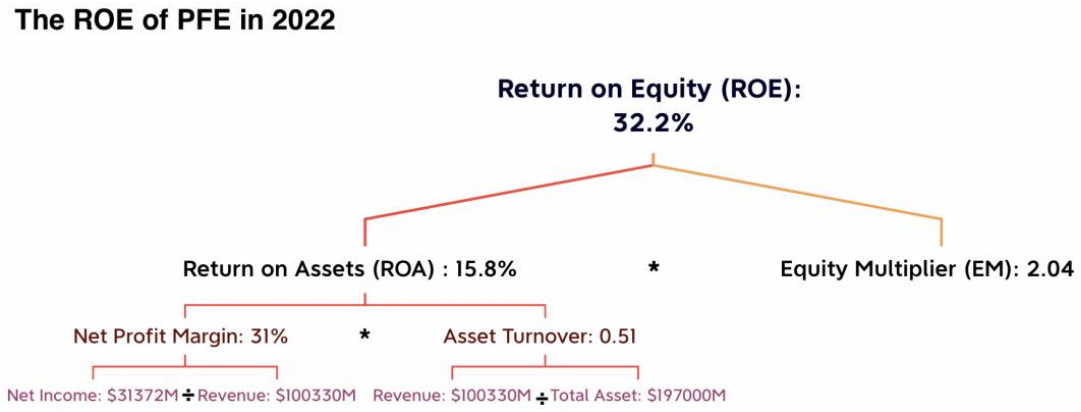


Figure 2. The ROE [17]

The ROE for the pharmaceutical industry in 2022 is around 24.54% (Figure 2). As can be seen in the graph, the ROE for PFE in 2022 is 32.2%. So, PFE has a high rate of return on net assets, strong profitability, and development advantages in the long term. Based on Pfizer's high investment efficiency and competitive advantages, it should avoid complacency and arrogance, but use its own superior conditions to increase research and development and technological innovation, continuously improve the company's core competitiveness, and build moat barriers.

4. Conclusion

This dissertation sets out to discuss the digital adoption and technological innovation in the pharmaceutical industry and puts forward several strategies pharmaceutical companies, Pfizer in particular, can adopt. As the research has demonstrated, Pfizer should utilize its strong profitability by increasing R&D spending on products that meet the needs of the post-pandemic era and actively engage in technological innovation and AI adoption. At the same time facing up to business weaknesses and take action to conquer external threats to better pursue new opportunities. Pfizer, as the leading company in the pharmaceutical industry, should take the lead and promote the growth and development of the whole industry. The findings of the study help Pfizer and other companies to understand the current situation in the pharmaceutical industry, and ways they can take to increase production efficiency, leading to higher competitiveness and reinforcing their market position.

The limitations of the investigation stemmed from a lack of recent studies in the chosen area since the selected period of this research is recent, and the specific focus on Pfizer may lead to less generalized strategies for other companies in the industry. There is a need for further work to involve the general suggestions regarding digital adoption and technological innovation for the whole industry.

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