SUBTITLE

Bachelor Thesis

R&D Expenditure and Financial Performance in the Pharmaceutical Industry:

A Case Study of Pfizer

Submitted:

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Abstract

This dissertation investigates the impact of R&D expenditure on Pfizer's financial performance. The study examines the relationship between R&D investment and key financial indicators identified which are revenues and profitability. The analysis reveals a strong and positive correlation between R&D spending and revenue growth which highlights the necessity of sustained investment in innovation in order to protect the competitive edge. On the other hand, the link between R&D and profitability is weaker, which reflects the high costs associated with pharmaceutical R&D. the findings are consistent with industry trends including long development cycles and regulatory compliance impacting short term profitability. The literature review from various industries including banking and aviation highlight the role of strategic investment in improving financial outcomes. Nevertheless, these studies often fail to account for the unique feature of the pharmaceutical industry. This gap emphasizes the need for tailored approaches to evaluating the financial impact of R&D in the pharmaceutical sector. The dissertation recommends several strategies for Pfizer to enhance the financial impact of its R&D expenditures. These include streamlining R&D processes and leveraging advanced technologies such as artificial intelligence .These measures can help Pfizer align its R&D investments with both revenue growth and profitability goals.

Key words

- Research and Development (R&D)
- Financial Performance
- Pharmaceutical Industry
- Pfizer
- Blockbuster Drugs
- Generic Drugs
- Innovation
- Revenues
- Profits
- Competitive Advantage

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1. Introduction

1.1. Introduction

As a concept research and development is concerned with product development, creativity, finding new products, and creating solutions for consumers and for the market in the aim of making disruptive innovation that would tackle and undermine the competition as well as improve their market share and revenue streams. But investment in R&D has not been solely controlled and implemented in the technology industry such as communications, internet, transportation and other but it is also a hallmark of the pharmaceuticals industry. The graph below shows the extent of spending in research and development in the pharmaceuticals industry.

Research shows that for example, in the UK spending on research and development in the pharmaceuticals industry represents half of the total spending – the total spending in the UK is around £16 billion where the spending on R&D in the pharmaceuticals industry is approximately £8 billion (Vina, 2016). “Two big pharmaceutical companies, GlaxoSmithKline and AstraZeneca, are behind almost all of the sector’s investment — £7.5bn of the £7.9bn spent. The industry accounts for 48 per cent of all corporate R&D in the UK, according to PwC’s analysis of 1,000 big companies” (Vina, 2016). But the trends in spending in the pharmaceutical industry are changing and that is because the industry itself is changing, from a strategic business perspective. The industry has been famous in concentrating on what the industry calls the blockbuster drug and these are drugs that are equivalent to cures to specific illnesses. These drugs are decreasing in value and they are decreasing in appearance in the market – moreover, market regulation is driving the competition in areas where it makes investment in blockbuster drugs to be ineffective.” t might take a handful of such drugs before a company finally finds one that works, a single blockbuster that can hopefully make up for all that investment. But the cost of new drug development is rising, and the number of big wins is declining–with the number of common illnesses in need of interventions dwindling–so it is getting increasingly difficult to bring enough blockbusters to market to make up for all those drugs that go bust” (Ubel, 2016)

1.2. Overview of Pfizer

Before analyzing the issues relating to the research topic and the research subject it is important to analyse the company case study which is chosen and that is Pfizer. Pfizer is an American multinational corporation which specializes in producing medicines, vaccines and drugs (Pfizer Annual Report, 2022). Pfizer is known for its research capabilities in the field of pharmaceutical drugs and vaccines and it has world renowned research facilities in that field. The areas of expertise of Pfizer are in the fields of immunology, oncology, cardiology and neurology.

1.3. Research Motivation & Problem Statement

The research motivation is directly related to the pharmaceutical industry. The pharmaceutical industry is based on two fundamental pipelines:

The generic drugs: these are the basic drugs (medicines) which are for the diseases which are common. These are basically linked to the 10 years patent period. That means that when a company produces a drug with a patent –after ten years the producer must share the ingredients of the drug and it becomes legal for competitors to produce these drugs (Hensley and Winslow, 2017).

The blockbusters: these are drugs that are basically cures for diseases. These drugs are rare and cannot be easily defined. The research and development aspect is highly related to this issue. In other words, the link between increasing the possibility of coming up with blockbusters is interlinked with how much the company is spending on research and development (Hensley and Winslow, 2017).

The research problem is represented by the industry reports by CBO (2016): "total spending on health-related research and development by the drug industry and the federal government has tripled since 1990 in real terms. However, the number of innovative new drugs approved by the Food and Drug Administration each year has not shown a comparable upward trend. NME approvals shot up for a few years in the mid-1990s and then fell again; on the whole, such approvals have consistently ranged between about 20 and 30 per year. Measured by the number of drugs approved per dollar of R&D, the innovative performance of the drug industry appears to have declined." Therefore, the research problem is that the spending on research and development

has declined due to the believe that innovation in drugs has declined and has become unnecessary due to the strategic approach to concentrate on generic strategies rather than blockbuster strategies:

"Pfizer has expanded its R&D pipeline to 13 projects, up from eight in 2020, including those from its acquisitions of the biotechnology companies Arixa Pharmaceuticals and Amplyx Pharmaceuticals. These moves added innovative antibacterial and antifungal projects to its pipeline. Of the companies evaluated, Pfizer has the most late-stage projects that are already covered by plans for ensuring access, including registration commitments and equitable pricing strategies, as well as measures to strengthen supply and ensure stewardship" (ATMF, 2021).

Therefore, it is unknown whether companies in the pharmaceutical industry is concentrating on generic strategies (which concentrate on lower R&D investment) or on blockbusters? Thus the trend is currently unknown. But it is important to understand the trend that Pfizer is taking at the moment. "It was no surprise that the company was thrilled by these results. After all, Lipitor was becoming the biggest selling drug of all time with sales eventually peaking at $12.9 billion. Internal projections for a pill that combined Lipitor with torcetrapib were on the order of $20 billion" (LaMattina, 2017).

1.4.Research Aim , Objectives & Questions

Research aim

The aim of this research is to assess the impact of spending on R&D on the financial performance of Pfizer. The importance of this research is that it will shed light on the trend of the industry at the moment from the relationship between these two variables. But in general this research is created to assess that relationship between spending on R&D and financial performance of Pfizer.

Research objectives

- To assess the environment of research and development in the pharmaceutical industry
- To assess the financial performance of companies in the pharmaceutical industry
- To investigate the relationship between R&D and financial performance
- To provide recommendations for Pfizer

Research questions

- What is the relationship between research and development on revenues of Pfizer?
- What is the correlation between research and development on profits of Pfizer?

Hypothesis 1

H_0 (Null Hypothesis): There is no significant relationship between Pfizer's R&D expenditure and its revenues.

H_1 (Alternative Hypothesis): There is a significant positive relationship between Pfizer's R&D expenditure and its revenues.

Hypothesis 2

H_0 (Null Hypothesis): There is no significant relationship between Pfizer's R&D expenditure and its profits.

H_1 (Alternative Hypothesis): There is a significant positive relationship between Pfizer's R&D expenditure and its profits.

1.5. Research Scope & Significance

The research scope is focused on examining the relationship between expenditure on research and development and the financial performance of Pfizer. Pfizer is a major global player in the pharmaceutical industry. The study will investigate how R&D expenditure impacts major financial metrics such as revenues and operating income. Moreover, the impact on industry trends will also be discussed based on the financial performance. The research will also delve deeper in the strategic approach of Pfizer to R&D, highlighting the internal focus and significant expenditure over a decade, spanning 2016-2022. This exploration is grounded in the highly competitive pharmaceutical industry. Innovation and regulatory pressures play a crucial role in allocating resources and development of blockbuster drugs versus generic alternatives.

The research investigates particularly interesting period 2016-2022, during which major shifts and transformations occurred, especially with the outbreak of Covid-19. Emergent factors including shifting consumer preferences and industry dynamics played a major role in making

Pfizer a relevant subject in terms of assessing the effectiveness of R&D strategies in achieving financial success and driving competition. Through leveraging secondary data, mainly from Pfizer's annual reports, the report will apply a quantitative method including correlation and regression analysis to establish the relationship between R&D investments and the financial performance.

2. Literature Review

2.1.Concept and Importance of Research and Development (R&D)

Before delving into the core of the literature review of this research, it is essential to define what R&D is, and where does the link between the R&D and the overall revenue and profits. Research and development could be defined as the collective efforts, work and thinking towards a new, creative, and innovative product/service, or the improvement of an existing product/service in such a way that it becomes more advanced and superior to its competitor product/service, or to improve the overall efficiency of production (Investing Answers, 2017). T

The graph below shows the percent of income spent on R&D out of revenue in different sectors, and we can see that more than 36% of total income of pharmaceuticals is spent on R&D, which is only second to consumer electronics and by a narrow margin. This confirms the fact that the pharmaceutical industry is dependent on R&D up to a great extent.

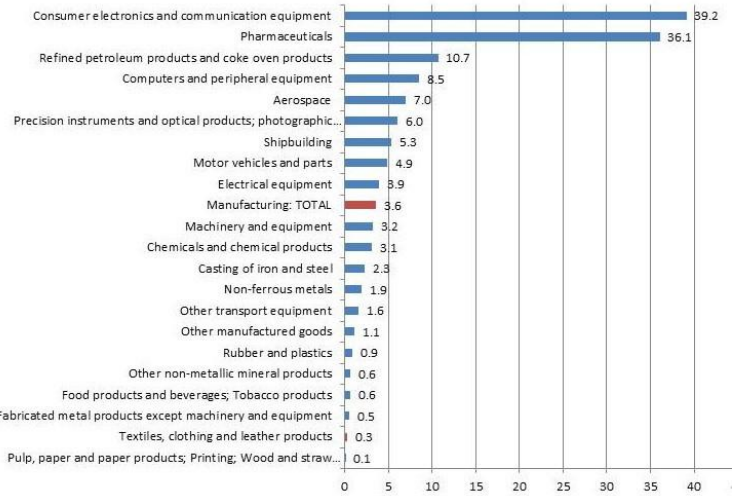

Figure 1-R&D in different sectors

Since this research focuses on the case of Pfizer, it is also necessary to take a closer look at the American pharmaceutical industry. The American pharmaceutical market is the largest market in the world, and represents around 45% of the global pharmaceutical market; the market share of the US was estimated at around $446 billion back in 2016. American pharmaceutical corporations dominate the global pharmaceutical industry, with 6 corporations out of the top 10 being American and the largest being Pfizer. The American pharmaceutical corporations spend the most on R&D as the figure below shows, with Pfizer being the highest spender on R&D.

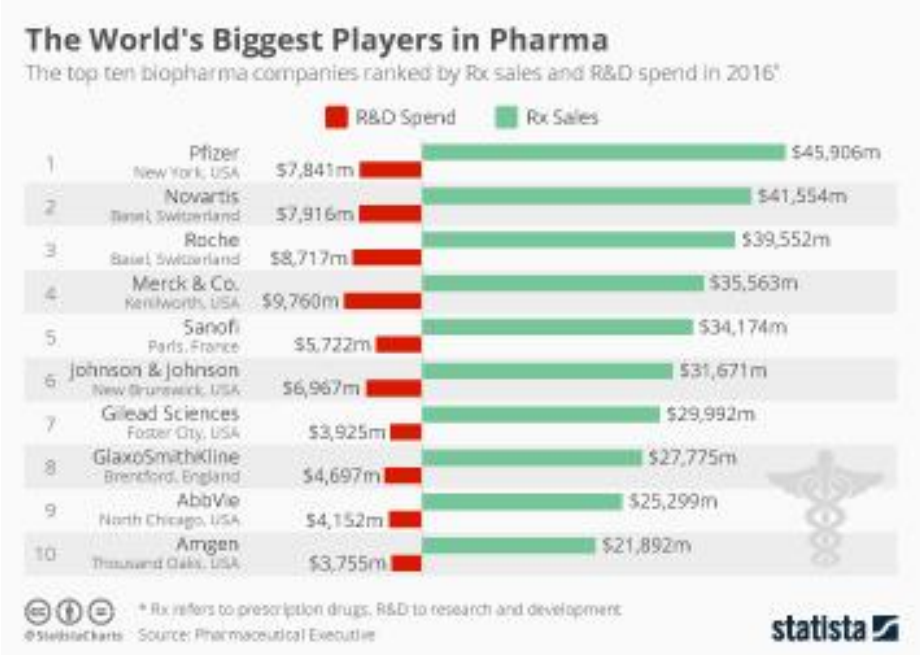

Figure 2-R&D expenditure from top 10 Pharma Companies (Statista, 2022)

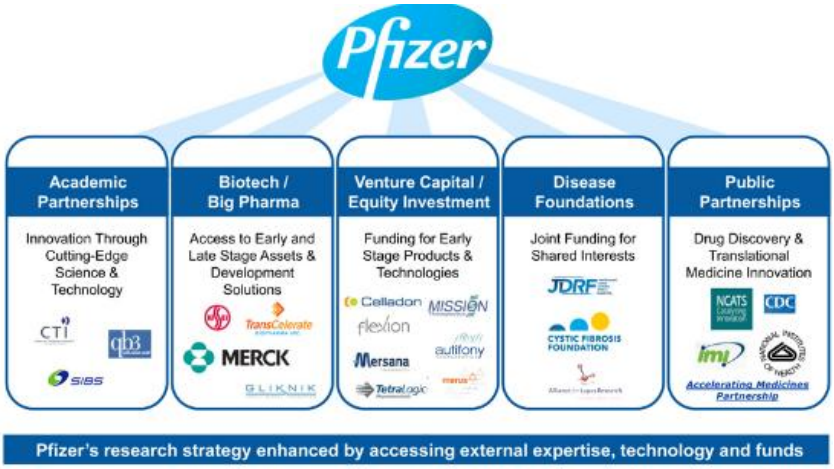

Figure 3-R&D and Pharmaceutical Products (Daiichi Sankyo, 2017)

2.2.The relationship between spending on R&D and financial performance

The research done on this relationship is vast; there are many researchers who attempted to understand and this relationship. The researcher wants to point out the fact that researcher which will be discussed does not really have to be about a specific industry or a specific company. That is actually the research gap that is discussed in this paper. That means that because the research in the literature review does not consider a specific industry or a specific company and therefore the value of this research paper.

Zhu and Huang (2012) made a research on the relationship between the exact proposed variables (R&D spending and financial performance but in the IT industry of China. The researchers chose the linear regression as a tool for analyzing the relationship as well as statistical inference and found out that there is a positive relationship. Zhua and Huang (2012) concluded "that firms with an intensive investment strategy in R&D will have significantly larger financial performances in the following year" (Zhu and Huang, 2012: 32).

Beld (2014) also adopted a similar research methodology to the one adopted by Zhu and Huang (2012) in addition to the methodology adopted by the researcher; but there is a difference in the researcher strategy. That's because this research paper adopts the case study research but Beld (2014) adopted the archival research that's because Beld (2014) assessed the relationship in various listed companies in different countries such as Luxemburg, Netherlands and Belgium – with a specific concentration on manufacturing companies rather than non-manufacturing companies. Beld (2014) found a great conclusion for this paper: "we assume a positive impact of R&D on the corporate value, using a new variable that includes both decision and outcome features." That means that the U-shaped graphical representation of this relationships as that R&D is effective to a certain point and then it because a negative relationship.

Furthermore, VanderPal (2013) found that there is "a positive impact of R&D on the corporate value, using a new variable that includes both decision and outcome features." Again, the methodology adopted by Vanderpal (2013) was also similar and there is nothing new in that area; in other words, all of the research papers were quantitative and some used different statistical tools. Therefore the ability to assess the relationship based on differences in methodologies is difficult because the methodologies are basically similar but the countries and industries are

different. Liang and Yan (2006) on the other hand, found a different relationship where the p-value was insignificant. Meaning that the relationship is not linear and that means that the changes in spending on research and development does not really impact the financial performance of the company. Here the argument can be following the discussion that the difference in the time period is the reason why in 2006 the relationship was insignificant but in 2014 it was positive. Note that Liang and Yan (2006) was also done in China and in its IT industry. Some arguments for example in these differences are that in 2006 the industry was not competitive enough like today argues Lee et al., (2009).

Anagnostopoulou (2008) is another paper that covered Greece in 2008 and that was during the financial crisis. The relationship was insignificant but that was the only research paper where the researcher used qualitative methodology. "The paper provides a comprehensive assessment of the literature findings on a variation of valuation topics useful for internal and external users of financial statements of firms intensive in R&D investments. It sheds light on certain literature limitations and thus guides the users of financial statements regarding to which issues they should pay attention when analyzing the financial statements of firms intensive in R&D."

Furthermore, there are other papers as well that discussed this relationship in the previous period. For instance, Ayaydin & Karaaslan (2014) also mentioned this issue in his paper and argued that it I possible that due to time horizon differences between papers that the research results can differ. That's because Ayaydin & Karaaslan (2014) argues that pervious research papers coming from the 1990s shows a powerful correlation between spending on R&D and financial performance; yet in his research paper the correlation was insignificant. That indicates that t effectiveness of research and development as a strategy changes as a function of time. That tis also linked to the major idea in this research paper that argues that due to the time horizon in 2917 there might be changes in the industry spectrum of the pharmaceutical industry that might prompt an investigation in this area in order to understand if the industry dynamics changed. It seems like there is actually a change in the industry and there seems to be a new need for research and development as a source of competitive advantage. This has been highlighted by research from Zhu and Huang (2015). Bell (2005) confirms this situation an integral paper called "Clusters, networks, and firm innovativeness" where Bell (2005) argues that research and development is a

concept that is linked to the industry – sometimes the industry becomes saturated and in order to break the cycle, companies must invest in disruptive innovation to crack new markets.

The above literature review considers studies and researches which implemented similar methodologies to this dissertation, however, these cited researches addressed a large set of companies and institutions in their study. On the other hand, this dissertation is rather concerned with a single case study, which is Pfizer. Therefore, it is critical to focus on similar literature testing the impact of different variables on the financial performance of a single case study company. The following literature review introduces and analyzes several studies focusing on single case studies in order to enrich the literature review and contextualize it more effectively in the dissertation.

Due to its significant impact on financial performance and competitive advantage, R&D spending has been a key focus for academic and corporate researchers. A compilation of studies is included in this review which ascertain the findings of such studies that look into the impact of R&D and related variables like marketing and acquisitions on business success. The primary focus of this dissertation is on the impact of R&D investment on Pfizer's financial performance, however, the findings from related studies give a core understanding of how strategic expenditures build business value.

The first investigation done by Baidya and Basu (2008) investigated the impact of several marketing strategies on the success of the Navratna brand. The study separated components such as advertising, sales promotion, and salesforce operations and calculated their respective Return on Investment (ROI). Among them, salesforce efforts yielded the highest ROI, highlighting the fact that aligning spending with high-impact activities is necessary. This technique can help Pfizer allocate its R&D spending to certain high-return programs like focused medicine development or cutting-edge biotechnology research.

According to Hall et al.,(2010), R&D investments help maintain a competitive advantage by producing innovative drugs and creating long term revenue streams, unlike the marketing and operation expenditure which are associated with a higher level of uncertainty in terms of potential project failure or the impact of external factors.

The development costs in the pharmaceutical industry are particularly high, and this is a defining element of the industry. According to Dimasi et al., (2016), the average cost of bringing a new drug to market exceeds $2 billion. This is a staggering amount and included covering a rigorous process such as funding clinical trial periods which can take years and having to navigate a highly complex regulatory landscape to achieve approval. This helps explain why short term impact of R&D investments cannot be realized, rather it is a more long term impact.

Moreover, R&D intensity also plays a role in the impact, which is a factor measures in R&D expenditure relative to sales. According to Cockburn and Henderson (2001), firms with higher R&D intensity in pharmaceuticals benefit from the "cumulative innovation". This relates to the knowledge spillovers and experience in the scientific domains which contribute to growth over extended periods of time. As a result, this helps firms further protect their products through representing a barrier to entry and strengthens the probability of a successful drug development. Moreover, Lantz and Sagut (2005) also found that the R&D intensity is positively correlated with the valuation of a firm, especially in biotechnology and pharmaceutical industries.

Moreover, the perceived strategic importance of R&D expenditure is also reflected by the financial market response. According to Eberhart et al., 2004), increases in R&D expenditure are associated with long term positive stock returns. Thus, increased R&D expenditure is seen as a value creating process by investors. This perception is also aligned with the arguments of Lev and Sougiannis (1996) who suggested that accounting systems often understate the value of R&D because they treat it as an expense, rather than an investment. Thus, for a pharmaceutical firm such as Pfizer, R&D spending can have an impact on profitability on the short term, however, it enhances the firm value through its long term value creation and investor confidence.

2.3.Comparative Insights from Other Industries

Together, the examined papers demonstrate how strategic investments can significantly improve firm performance in a variety of industries. The studies include examples of the usage of marketing and acquisitions to explain the benefits reaped, but this remains relevant to Pfizer's study since the essential idea is invariant. Focused and consistent investments provide both short-term and long-term financial gains.

Mehir Kumar Baidya and Partha Basu (2008) carried out a thorough case study to investigate how well marketing investments worked for the Navratna brand. The purpose of the study was to calculate the return on investment (ROI) for each type of marketing activity, including pricing, distribution, advertising, sales promotion and sales force operations. The approach provided a comprehensive assessment of marketing effectiveness by computing modified ROIs based on customer happiness and sales success metrics.

The study's main conclusions showed the success of the majority of marketing campaigns in significantly increasing sales and customer satisfaction. It is noteworthy to mention that the greatest adjusted return on investment efforts were found to be the most influential element in the study. On the other hand, it was also highlighted that pricing tactics had an insignificant impact on consumer satisfaction and sales performance. Moreover, the study emphasizes how important it is to match marketing expenditures with initiatives that optimize profits. The research offers actionable insights for maximizing budget allocation within businesses through the separation of the effects of various marketing components.

Moreover, the relationship between advertising spending and business value in the Indian fast-moving consumer goods (FMCG) industry was the central aspect of Mandeep Mahendru and Karamjeet Singh's (2014) study. The study sought to find relationships between advertising expenditure and financial performance indicators like market valuation and shareholder wealth. The study found a positive and significant correlation between business value and advertising spending. Furthermore, the study showed that higher advertising expenditures increase shareholder wealth and this indicates that marketing campaigns are essential for maintain and strengthening competitive advantage.

The study expands the influence of marketing by concentrating on business value rather than just sales, which provides a more thorough understanding of its advantages. The determination of sustainable financial performance is explained by R&D, marketing and acquisitions alike in the literature. This uniformity can be utilized to realize the insights brought upon by R&D investment and therefore to evaluate Pfizer’s R&D expenditures.

This conclusion is supported by the study's figures. For instance, after implementing a more aggressive advertising and promotional plan, Trade Kings claimed a 15% increase in annual revenue. The survey also showed a 12% increase in market share, which translates into a quantifiable boost in profitability. In line with findings from earlier studies, these results highlight the crucial role that marketing strategies, in particular, branding and advertising, play in influencing financial success (Madden et al., 2006; Grullon et al., 2006). Therefore, to achieve long-term financial success, Kamau's (2018) research emphasizes how crucial it is to match marketing initiatives with overarching corporate goals.

3. Methodology

The methodology section aims at putting the formulated hypotheses and questions regarding the topic under discussion to testing, it reveals the framework and approach with which the researcher plans to proceed to uncover the answers. The methodology section could be described as a comprehensive tool used to carry out an investigation of a certain field of interest. In order to reach solid conclusions which could be used as a foundation for further analysis and interpretations, the research must contain a credibility assurance, and that is the essence of the methodology, it gives the conclusions credibility. The framework of the methodology has been effectively described through the famous research onion (figure 5), where the different layers of the methodology sections are elaborated and explained (Saunders et. al, 2009).

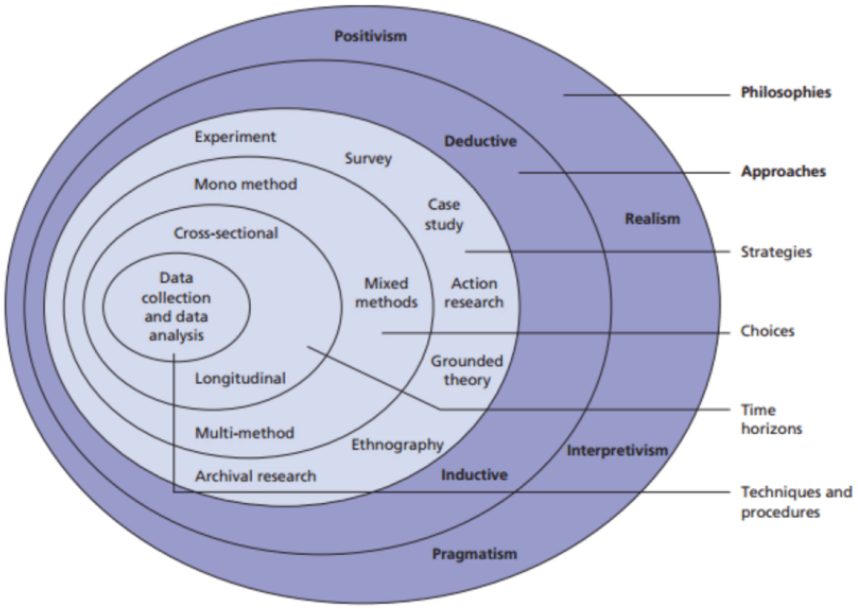

Figure 5-Research Onion (Saunders et.al, 2009)

3.1.Research Philosophy

The research philosophy is an abstract section of the research. There are majorly 3 research philosophies implemented in researches, and they are Positivism, Realism and Interpretivism. The 3 different philosophies have their own characteristics and their own approach to the topic in question; however they differ notably in their interpretation of the data available for research (Howell, 2012). The Positivism philosophy is concerned with the data that is scientifically proven or logically/mathematically accepted, in addition, the positivism philosophy does not analyze data from the researcher's point of view, and that is why the positivism philosophy is considered the most objective philosophy amongst the other philosophies.

The Positivism philosophy is associated with quantitative and numerical data and a more deductive framework, confirming the previously mentioned fact about not interfering with the analysis of the available data, rather the researcher merely presents it (Teddlie and Tashakkori, 2009). The Realism philosophy is somehow a combination of the positivism and interpretivism; it bases the research on empirical data and is used mostly when a social science is being researched. A realist researcher would be required to make observations and perceptions on the topic in question and consider social factors in play as well. The interpretivism philosophy opposes that of

Positivism and focuses on the qualitative approach rather than the quantitative; therefore it mostly deals with social sciences. Other aspects of the research philosophy are the ontology and the axiology. The ontology which deals mostly with the nature of reality through defining the basic principles. The ontology is divided into 2 branches which are the subjectivism, which suggests that the reality is influenced by perceptions and social factors and the objectivism which opposes the subjectivism and suggests that the reality is independent of these social factors and perceptions and is not affected by them (Dybjer et.al, 2012).

The chosen philosophy for this research is the positivist philosophy and this is due to the quantitative aspect of the research along with the deductive nature of the overall analysis. The philosophy of a research is often implied and not explicit, nonetheless the positivist philosophy is most commonly associated with the use of numerical figures, statistics and correlations, therefore the most suitable philosophy for this research would be the positivist philosophy.

3.2.Research Approach

A crucial aspect of the research is finding the hypotheses, which sometimes requires additional researches to reveal these hypotheses. A hypothesis might be extracted from the literature itself, and sometimes the literature does not give rise to any hypothesis, and this usually occurs when the researcher is new to the subject being researched, and therefore the researcher must conduct a deeper research in order to find the adequate hypothesis. The two main research approaches regarding the hypotheses are the Deductive and the Inductive research methods. The Deductive method begins when the researcher comes up with a hypothesis, form the literature review of the research. The researcher moves on to data collecting and testing of the hypothesis formulated, and then the hypothesis is either verified or nullified, in short, the deductive method works down from the general to the specific. The Inductive method works in the other way around as the researcher moves from a specific case and makes generalizations, through formulating tentative hypotheses after realizing a pattern, and then this all leads to a general rule.

3.3.Research design

The research design is basically the research choices and that is concentrated on the idea regarding the difference between quantitative and qualitative research or mixed one. In other rods, there are two different research choices and they are the qualitative or quantitative research – there

is also the mixed research design but that is not a very popular research method. The difference between these two choices is that the quantitative research is numerical in nature while the qualitative research is ordinal in nature. The difference is in the nature of the data and the approach that the research will come to the data (Saunders, 2009). For instance, in a research where the numerical data will be used the researcher is using the quantitative research. While if the research uses ordinal data such as the worded information from the assessments or interviews for example can lead to a different results than a quantitative (numerical) data. For example, in this paper the researcher will collect data regarding the spending on research and development as well as the financial performance; these variables are numerical in nature. For instance, spending, money-wise, on research and development, can be collected in the form of numerical value (Bryman and Bell, 2015). This is also provided for the financial performance. On the other hand, the qualitative data is a data set that is collected by, for example, observing a group of people where the researcher takes notes on the behaviour (Saunders, 2009). In that kind of research, the researcher is collecting qualitative data where the researcher is collecting data based on his personal observation and the observation is collected via descripting by words and not numbers.

In this paper the quantitative research will be adopted that's because the quantitative research, which uses the numerical data, will be applied in this paper. the justification for tis usage is that in in this paper, just like the papers which were cited in the literature review collected data form the annual reports if Pfizer in the form of numerical data. For that reason, this assessment is basically quantitative in nature and therefore it is only logical to choose the quantitative design because it is also the basis for further decision made in this paper.

3.4.Research strategy

Research strategy is the decision that the researcher has to make which is related to the strategy for collecting data. Data collection is a specific process which his discussed separately but it is based on the strategy of the research. Research methodology proposes various research strategies to pick from such as the experiment, survey, document review, case study and ethnography (Saunders, 2009). Experiments for instance are used in papers where the research cannot proceed without testing a certain relationship via observing and collecting data from an experiment – for example such as in physics or chemistry. Scientists record data from the tools they are using on the experiment and thus assess the relationship between the aspects they are

trying to consider. In business research the survey method is more popular as a tool for assessing relationships between variables as well as gauging specific reactions of consumers (Bryman and Bell, 2013). A survey research is defined as "A method of sociological investigation that uses question based or statistical surveys to collect information about how people think and act. Furthermore, the research strategies are considered when making a business research and they are dependent on the availability of the data.

For example, the case study strategy is used when the research wants to explain the behavior of variables in specific setting – such as this paper where the assessment of Pfizer is needed. The research strategy of this paper is the case study. That's because in the literature view it has been realized that many papers considered the relationship between spending on R&D and financial performance in general and that brought up many conclusions and a lack of consensus. In other words, having a general assessment for many industries and many companies does not provide insight about these variables. Therefore, it becomes apparent that it is more effective to assess the relationship for a specific company in a specific industry. The research will be concerned with the impact of R&D on financial performance in the pharmaceutical industry for Pfizer as a company.

3.5.Time horizon

When research is made it is often done in light of a time period, the element of time is necessary when conducting research. Some research methodology is based on the concept of research repetition and that means that the time element is important for the success of the research. In other words, there are research questions which require constant repetition after period of time in order to answer the question (Zikmund et al., 2013). For example, if the researcher wants to know the impact of child growth under the supervision of bilingual parents, then the researcher must check this growth semi-annually or even yearly. In other words, the research itself needs time passage to be done. On the other hand, there are other researches that do not require such differences in time horizon.

There are two types of time horizon: longitudinal and cross sectional. The cross sectional research is the one that does not require time repetition and the time factor is not very important. While the longitudinal research is applied to the child growth research given as an example before. the time horizon chosen for this paper is the cross sectional because the researcher will analyse the

research at one time in order to assess the relationship between the variables only at one time for the past ten years. The time horizon is cross sectional and will be form the time period between 2016 – 2022.

3.6.Data analysis tool

The tool for data analysis in this research paper is linear regression as well as inferential statistics. These are the tools which will be used in the assessment of the data to be collected by the researcher. But before discussing linear regression and inferential statistics it seems necessary to understand the nature of the data which will be collected.

The data collected in this paper is secondary in nature. That means the data exists and published data that the researcher found. Moreover, the secondary data is important and helpful for researchers because it has easier access and not expensive to collect. Furthermore, the data will be collected form the financial reports of Pfizer which are published annually (Pfizer Annual Report, 2022).

The two variables which will be discussed in this paper are:

- Spending on Research and development (independent variables) - this will be valued by US Dollars
- Financial performance (dependent variables) which will be via revenues and profits and they will also be collected via US Dollars

4. Results

4.1.Data Overview

Year	Revenue	R&D expense	SGA Expense	Net Acquisitions
2016	52.8	7.9	14.844	-18.368
2017	52.5	7.7	14.804	-1
2018	53.6	8	12.612	0
2019	51.8	8.7	12.726	-10.861
2020	41.7	8.9	11.597	0
2021	81.3	10.5	12.703	0
2022	100.3	11.4	13.677	-22.997

Table 1. Annual Data collected by researcher (Pfizer Annual Reports)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.96484
R Square	0.930916
Adjusted R Square	0.861831
Standard Error	7.739195
Observations	7

y= -172.99+15.15R&D + 7.51SGA + 0.18Netacquisition

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	2421.275	807.0915	13.47507	0.030179
Residual	3	179.6854	59.89514		
Total	6	2600.96			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-172.992	59.67827	-2.89874	0.062566	-362.915	16.93126	-362.915	16.93126
R&Dexpense	15.15675	2.770343	5.471074	0.012004	6.340282	23.97322	6.340282	23.97322
SGAeExpense	7.51393	3.408829	2.204255	0.114715	-3.33449	18.36235	-3.33449	18.36235
NetAcquisitions	0.187254	0.435463	0.430012	0.696205	-1.19858	1.573091	-1.19858	1.573091

Table 2. Regression Analysis Outputs – Revenues model

4.2.Correlation between R&D & Revenues

1. What is the correlation between research and development on revenues of Pfizer?

The first research question is concerned with testing the relationship between research and development spending and the revenues of Pfizer. This analysis will provide insight about this relationship. Note that the majority of the research papers analyzed in the literature review showed a positive relationship between these variables. For instance Liu et al., (2012) found a positive relationship between these variables; while research papers which covered this relationship in the 2000 period actually found an insignificant correlation. In other words, the time period plays a

powerful role in defining the impact of research development on financial performance because that is directly linked to the nature of the competitiveness in the market in that a period. But before analyzing the data, it is beneficial to discuss the results of the correlation and then discuss their meanings and interpretations in the market.

The correlation coefficient between research and development spending and the revenues of Pfizer is 0.93, indicating a very strong positive association. The R^2 value of 0.93 means that approximately 93% of the variation in Pfizer's revenues can be statistically explained by changes in R&D expenditure. However, this does not imply direct causation but rather a strong linear association. The p-value obtained for the regression model is 0.012, which is below the conventional 0.05 threshold. Therefore, the null hypothesis (that there is no significant relationship between R&D and revenue) can be rejected, indicating that the relationship is statistically significant at the 5% level.

To determine whether a correlation or relationship between two variables is statistically significant, the p-value must be less than 0.05 (5%). When $p < 0.05$, the probability that the observed relationship occurred by random chance is low, and the null hypothesis can therefore be rejected. Conversely, when $p > 0.05$, the relationship is not statistically significant and the null hypothesis is retained.

4.3.Correlation between R&D & Profits

2. What is the correlation between research and development on profits of Pfizer?

Year	R&D expense	SGA Expense	Net Acquisitions	Net Income
2016	7.9	14.844	-18.368	7.2
2017	7.7	14.804	-1	21.3
2018	8	12.612	0	11.2
2019	8.7	12.726	-10.861	16
2020	8.9	11.597	0	9.2
2021	10.5	12.703	0	22
2022	11.4	13.677	-22.997	31.4

Table 3. Annual Data collected by researcher (Pfizer Annual Reports)

As to the second correlation it will deal with the profits of Pfizer. It is important first to realize the difference between the impact on revenues and the impact on profits form the perceptive of the researcher. The first research question dealt with the revenues; the revenues of Pfizer are linked to its selling capability. In other words, the first correlation sheds light on the relationship between the impacts that spending on research and development has on the selling capability of Pfizer. That means is the spending on research and development being able to produce products (new products or developed products) which can be competitive enough to increase the sales of the company? The answer for this question was yes; the positive correlation shows that there was a strong positive increase in revenues when there was an increase in the research and development. Yet the relationship with profits is different – the relationship with profits sheds light on how effective was the investment in research and development strategy on churning out profits. In other words, a company can increase the spending on research and development but that can be so high that it increases the revenues but it can be so expensive that it damages the profits. This has been discussed and proven by Beld (2014) who argued that that the relationship is a U-shaped and that means that it the investment in R&D increases initially but it reaches a maximum point which then decreases if it exceeds that number.

4.4.Regression Analysis Outputs

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.876176
R Square	0.767684
Adjusted R Square	0.535369
Standard Error	5.852441
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	339.5468	113.1823	3.304489	0.176239
Residual	3	102.7532	34.25106		
Total	6	442.3			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-93.6251	45.12918	-2.0746	0.12967	-237.246	49.99613	-237.246	49.99613
R&Dexpense	6.195239	2.094955	2.957218	0.059677	-0.47184	12.86232	-0.47184	12.86232
SGAeExpense	4.291866	2.577784	1.664944	0.194513	-3.91179	12.49552	-3.91179	12.49552
Net Acquisitions	0.304904	0.3293	0.925914	0.422785	-0.74308	1.352885	-0.74308	1.352885

Table 4. Regression Analysis Outputs – Net Income model.

The R-square value is 0.768, which indicates that 76.8% of the variations in profits can be explained by the R&D expenditure. This suggests that there is a moderate relationship. Regarding the significance of the model, the F value is 0.176, which is the P-Value, and in this case the value is greater than 0.05, which means that the model is not statistically significant. This means that there isn't a strong evidence which would suggest that R&D expenditure has a linear impact relationship with profits.

The analysis indicates that while there is a positive relationship between R&D expenditure and profits, there is a lack of statistical significance. This indicates that R&D many not be a strong predictor in terms of profitability. In terms of the strategic implications for Pfizer, the results show that even though the relationship is not statistically significantly, the existence of a positive coefficient indicates that R&D investment can contribute to profitability over time. This is also further confirmed by the existence of a lagging effect, especially in the context of studying the impact of R&D in the pharmaceutical industry.

The inclusion of SG&A expenses and net acquisitions as control variables helps to clarify the unique role of R&D in Pfizer's financial performance. While both controls showed positive coefficients, neither reached statistical significance, suggesting that their influence on revenues and profits is weaker and less consistent than that of R&D. This is logical in the pharmaceutical context, where SG&A supports operations but does not directly generate innovation, and acquisitions typically take years before contributing meaningfully to revenues or profits. The

results therefore reinforce the finding that R&D expenditure is the primary internal driver of Pfizer's financial outcomes, while SG&A and M&A activity play more supportive or long-term roles.

The regression results corroborate the first hypothesis which suggested the existence of a significant positive relationship between R&D spending and revenues. The strong association is confirmed through the correlation coefficient which turned out to be 0.93. In addition, the R^2 value of 0.93 suggests that nearly 93% of the variation in revenues can be explained by changes in R&D expenditure. The results also support rejection of the null hypothesis, since the p-value is 0.012, being less than the 0.05 threshold. This confirms that Pfizer's R&D investments during 2016–2022 significantly contributed to revenue growth. Moreover, the second hypothesis proposed that the R&D has a significant positive relationship with profits. In this case, the results were not as strong, in the sense that the correlation coefficient was 0.7, which indicates a moderately positive relationship, however the p-value in this case is 0.176, which exceeds the 0.05 threshold, and highlights that the null hypothesis cannot be rejected. This suggests that despite the potential role R&D spending plays in profitability of Pfizer, it cannot be said that the immediate effect on profits is certain and could be simply due to other external factors.

5. Discussion

5.1. Interpretation of Findings

The findings of the statistical analyses above provide valuable insights into addressing the main research questions of this dissertation regarding understanding the underlying relationship between R&D expenditures and financial performance of Pfizer. The results highlight a strong and positive relationship between R&D expenditure of Pfizer and its revenues. These results can also be cross references with industry dynamics, as the pharmaceutical industry is known for its high R&D investments, as pharma companies seek to develop superior drugs to boost revenues. Companies which succeed in developing blockbuster drugs are only capable of doing so after years of research and development which are supported by substantial financial commitments.

However, despite the existence of a strong and positive correlation between R&D and revenues, there is a need to understand these results in the context of industry dynamics and

characteristics. The pharmaceutical industry is characterized by a lagging effect, which relates to the long term impact of R&D investments, rather than immediate results translated into revenue growth. The initial R&D investment is often very high, and the potential drugs which can be commercialized later on as a result fo such investment would only generate revenues and profits in the long run. Moreover, there are also other associated risks which must be highlighted. Some of these risks include failure of clinical trials and regulatory hurdles. These can further impede the process and delay potential revenue generation.

In order to effectively address the research questions and better understand the results, the findings of the statistical regression must be contextualized. As mentioned above, there other factors and risks which must be integrated into the conclusions, and these include competitor pressures, regulatory hurdles and challenges, in addition to the patent challenges and potential governmental shifts.

5.2.Implications for Pfizer

While the relationship between R&D and revenue revealed a strong correlation, the case is not same with profitability. There is a clear divergence which highlights a critical characteristics of the pharmaceutical industry. This characteristic refers to the fact the high cost and the long timelines of R&D have a dampening effect on the short-term profitability, despite the fact that there could be a sharp increase in revenues. In the context of Pfizer, profitability relies on different factors and not only the R&D initiatives. This relates to the costs on management, operational efficiency and even strategic marketing efforts. This further underscored the difficulty in isolating the impact of R&D, even in such an R&D-dependent industry. However, it must also be taken into consideration that the case study plays a role. Pfizer is one of the strongest brand names in the industry, if not the strongest, and therefore, in alignment with what has been introduced above, profitability of the brand can also be attributed to tis marketing or branding efforts. In the pharmaceutical sector, profitability is also subject to other external pressures including pricing regulation and the need for ongoing reinvestments in research and development.

Moreover, the weaker correlation between R&D and profitability in the regressions results can also be indicative of Pfizer's strategic decisions to invest in R&D projects which fit a particular category which is the High risk/ High rewards. While these investments could potentially impose

a strain on the profitability of the firm on the short term, they are however, critical for the establishment of a long term competitive advantage and protecting the robust pipeline of innovative drugs.

5.3. Industry Context and Strategic Insights

In terms of value creation, R&D investments are inherently long ventures, however the divergence between the impact of R&D on revenues and profits highlight the need for pharmaceutical companies to adopt a balanced approach which prioritize cost efficiency and innovation. Pfizer can significantly improve its revenue potential through incorporation of emergent technologies and diversifying its portfolio. Moreover, the analysis also suggest that establishing potential partnerships and alliances with academic institutions involved in biotech research can also help streamline its R&D processes and ultimately enhance efficiency.

5.4. Diagnostic Considerations

In order to ensure that the results of the statistical regression models are applicable and accurate, it is critical to implement diagnostic checks. For example, some of these checks include testing for multicollinearity and normality of the residuals. However, due to the fact that the dataset of this dissertation is relatively small, the diagnostic tests cannot be meaningfully implements (only 7 data points). Applying the tests would not yield reliable insights. Thus, it is important to highlight that potentially patterns identified could be simply reflecting randomness. Moreover, the Covid-19 period has also introduced exceptional circumstance, particularly in its direct impact on the pharmaceutical industry. This further complicates the output of the model. Thus, the results of the regression models cannot be taken as statistically rigorous, they are rather exploratory analysis which provide indicative results on the relationship between R&D expenditure and financial performance.

5.5. Limitations of the Results

The quantitative findings of this thesis are based on a very limited sample size of seven years of Pfizer's annual data. Despite the regression and correlation analyses which were applied, the

low number of observations significantly restricts the reliability and generalizability of the results. Furthermore, multiple independent variables were included in the regression despite the small dataset and this further reduces the robustness of the model. It is therefore important to stress that the results cannot prove the existence of a causal or robust statistical relationship. Instead, they should be viewed as indicative only. The analysis provides a suggestion that R&D expenditure is positively associated with revenues, and possibly profits. However, this relationship cannot be confirmed with certainty. Future research should aim to use a longer time series dataset and include diagnostic testing to strengthen the validity of the findings.

Recommendations

Enhance R&D Efficiency

Streamline R&D processes and leverage advanced technologies like AI to reduce costs and accelerate innovation.

Diversify the R&D Portfolio

Invest in emerging field in order to help balance high-risk, high-reward projects with low-risk improvements to existing products.

Strengthen Profitability Link

Optimize pricing strategies and extend the commercial lifecycle of successful drugs.

Expand Collaborations

Partner with biotech firms and academic institutions to share risks and enhance innovation capacity.

Adopt Data-Driven Decision-Making

Use predictive analytics and scenario planning to align R&D investments with financial and strategic objectives.

Conclusion

The above dissertation attempted to investigate the relationship between R&D expenditure and Pfizer's financial performance, represented by revenues and net income. The findings of the research highlight a clear and positive relationship between R&D expenditure and revenue growth, highlighting the central role of R&D in Pfizer's operations and business model altogether. This is also connected to the ability of the firm to maintain its competitive edge, as it is aligned with fundamentals of the pharmaceutical industry. Moreover, the analysis also highlighted that there exists a positive, yet weaker correlation between R&D expenditure and profitability. This result highlights the large costs associated with R&D projects, which impact profitability. The findings substantiate the dissertation's goal in understanding this relationship within the industry dynamics. The results are in line with industry fundamentals, which posit that R&D processes often incur high initial costs and only pay off on the long run in terms of profit generation.

The literature review also provided additional context in terms of providing insights into this relationship in different industries and sectors, emphasizing the role of R&D in supporting financial performance. Marketing expenditure and M&A expenditure showed positive impact on financial performance, however, these insights and results are not compatible in application to the pharmaceutical industry, as the latter is highly intertwined with R&D. Moreover, the pharmaceutical industry is also associated with other external factors such as long development cycles and regulatory hurdles. These factors demand a more tailored approach in order to test the relationship in question.

Moreover, the findings are also consistent with long term value creation through consistent R&D investments. Pfizer's ability to maintain strong revenue streams highlights effectiveness of the R&D strategy in place. However, Pfizer can consider developing and adopting other strategies in order to address the weaker link with profitability. This includes focusing on operational efficiency and streamlining the R&D process. Some emerging technologies such as AI and machine learning can be leveraged to optimize operations and consequently reduce cost.

In addition, the literature review also highlighted several research gaps, which underscores potential avenues for future research. For example, future research can focus on the role of external factors such as regulatory shifts and changes and generic drug competition. These can highly

influence R&D spending and impact. In addition, the development of a more inclusive framework in order to account for the long term impact of R&D should yield more accurate results and provide a more nuanced outlook on the value creation in the industry.

Finally, the dissertation confirms that R&D expenditure is a critical aspect of Pfizer's financial success and performance, yet the weaker correlation with profitability highlights the need for a more strategic approach to R&D expenditure. Leveraging technology and integrating efficient processes can help Pfizer continue to maximize its financial and societal impact. Ultimately, the findings also indicate that the strategic R&D investment is critical not only for Pfizer's financial performance, but also for advancing healthcare outcomes globally.

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