“Market versus technology drive in R&D internationalization: four different patterns of managing research and development”

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As relates to:

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List of Abbreviations

HQ - Headquarters
M&A – Mergers and Acquisitions
MNC – Multi-national Corporation
NIH Syndrome – Not-Invented-Here Syndrome
NYSE – New York Stock Exchange
R&D – Research and Development
RTC – Research Technology Centre
TM – Trade Mark
Introduction

Large multi-national corporations (MNC’s) have seen dramatic changes in the past decade regarding their search for the best allocation of resources in a globally hypercompetitive environment. Is it better to do R&D activities in Japan or in South Korea? Silicon Valley or Germany? Research and development (R&D) activities require heavy investments, sometimes without a clear or defined objective and with the added ambiguity of trying to assess the net-present value of the investment. The choice of where to invest these large sums of money is a decision that cannot be taken lightly and there are many factors which determine the final destination for the new R&D site.

“Location, location, location.” This phrase is usually associated with the choice of the retail point of contact with customers, but is also very important when choosing the site for a new R&D facility. Actually, the decision might be even harder because it is a global choice. These facilities may or may not contribute to the development of products in the MNC’s home market, but this will be covered in more detail further on. Location-specific innovation advantages are what a company will try to exploit when investing in a new site, whether it be for research or development.

Some challenges for the selection of new research or development sites are the following:

**Physical Distance** (from both the R&D sites and corporate headquarters): This is important for the transfer of knowledge and discoveries. It also affects the communication, in both quality and frequency. Transaction costs must also be considered because the greater the distance, the higher the costs associated. Frequent travel can also put large amounts of stress on project managers.

**Coordination and control**: The larger the network of R&D sites, the harder it is to coordinate activities and manage the different activities of each site. This may lead to negating potential synergies created by the location of the facility.

**Not-invented-here (NIH) syndrome**: This has been defined as the following: “a term used to describe a persistent sociological, corporate or institutional culture that avoids using already existing products, research or knowledge because of its different origins.” Also “…is manifested as an unwillingness to adopt an idea or product because it originates from another culture, a form of nationalism.” This could become a big problem if the new technology must be diffused into a new culture that does not accept it. Site selection must try and minimize or eliminate this kind of problem.

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1 As defined by Wikipedia
Once these factors have been taken into consideration, along with the decisions derived from location specific advantages, corporate strategic goals and all associated costs, the new site will be established. Section 1 of this paper focuses on trends of geographic selection in the internationalization of R&D activities by defining and analyzing four frameworks and emerging patterns.

Section 2 of this paper will focus on Pfizer Inc. There will be a breakdown of their organizational activities with a focus on their R&D activities worldwide plus their classification into the frameworks described in section 1.

Section 1

1 Trends in R&D Internationalization

Currently, it is hard to ignore the importance of internationalizing research and development activities. In a global business environment, it is important to locate your development facilities close to where the products will be used. With research labs, it’s important to be close to centers of excellence in your field, universities with strong research bases and in critical competitive environments to spur creativity and advancements. The potential benefits from the internationalization of R&D activities are often too significant to ignore. Studies have since broken down the determinants and drivers in the decentralization of R&D activities, notably location factors and overseas determinants. These will be discussed later on in the paper.

The combined term “R&D” often fails to recognize the different aspects of the two activities that it comprises: Research and Development. Research is considered the scientific process of invention and creating something new while development is the continual engineering or improvement of newly discovered methods or products. This means that they require different ways of managing the separate divisions as well as different selection procedures when internationalizing. Managing the knowledge transfer between units is becoming increasingly important and external R&D sites must take this into account. There are inherent differences between research and development when dealing with location selection and different work cultures, which both create different regional concentrations.

The main goal of the article and section one of this paper is the following:

“we propose a model of R&D internationalization that focuses on external sources of knowledge as well as the exploitation of home-based-generated but locally implemented forms of knowledge.”

This model was based on the study of 81 companies representing 1021 research and development sites (see exhibit 1 for full list). 13 of the 81 companies studied are among
the top 20 companies in the world by market capitalization. The model also identifies four archetypes for international R&D dispersion: National Treasure, Market-Driven, Technology-Driven and Global. Using the four archetypes they identify four trends in internationalizing activities. It also highlights the two principle forces in driving R&D international: access to local science and technology, and access to local markets and customers. Finally, they argue that there are significant gains from geographical and functional separation.

1.1 Main Research and Development Centers of the World

There seems to be a growing trend of creating world-renowned centers of excellence, where either research or development activities of many companies concentrate, forming synergies among the different activities being conducted. R&D is becoming concentrated in 3 regions: Europe, the US and Japan. There are also emerging regional centers in South Korea, Singapore and other developing countries along the Pacific Rim (see exhibit 2 for map of R&D sites).

Development is not as concentrated as research, where 73.2% of all research sites are located in 5 regions: northeast US, California, the UK, western continental Europe (mostly in Germany), and the Far East (Japan, South Korea). If only foreign research sites are considered, research is even more heavily concentrated with 87.4% of operations in the Triad (Europe, US, Japan).

Development, to a large extent, follows the same pattern as regional research sites but with a more even distribution among EU countries and the northeast US.

It should also be noted that research and development sites are not necessarily located in the same place. The reasons for this will be covered in the four strategies.

2 Article Methodology

The methodology that was used can be briefly explained in 3 parts. First, the authors determined the extent to which each company was internationalizing research and development, treating each activity separate. Second, patterns were studied in the international structure of R&D activities due to emerging trends over time. Third, these patterns were confirmed via follow-up interviews with senior R&D personnel.

Different data types were used. Geographical locations of each companies R&D sites were compiled to determine how internationalized they were. Many management interviews were conducted to try to clarify ambiguous information and to better determine internationalization goals and strategies. The information concluded from these meetings was then sent back to the company for another round of clarification to make sure there were not erroneous conclusions being drawn.

International sales were also graphed in relation to total sales (see exhibit 3) to compare the relative importance of international R&D activities among global firms. Almost all of the firms had greater international sales than R&D activities. Where international sales are well above R&D activities, it can largely be due to a small domestic market (i.e. Belgium) where a firm must conduct sales abroad.
3 The Four Archetypes of R&D Internationalization

Upper management makes the decision of where to locate the new international site for research or development. There are many factors that are involved in the decision process. For examples, the quality of inputs at the new site (i.e. local talent, local scientific cooperation), the quality of potential outputs (i.e. local receptiveness, market proximity), and the efficiency of operations (i.e. communications, cost) of the new location. There are also deciding factors outside the realm of the R&D activity itself (i.e. taxation issues, stability and reliability of local governments, image).

There are two main drivers for R&D internationalization that the article identifies: the quest for external science and technology, and the quest for new markets and new products. These two drivers form the framework for the four archetypes of R&D internationalization (see exhibit 4):

1. National Treasure R&D: domestic research and domestic development
2. Technology-Driven R&D: dispersed research and domestic development
3. Market-Driven R&D: domestic research and dispersed development
4. Global R&D: dispersed research and dispersed development

Almost all of the 81 companies could be clearly defined inside one of these archetypes. There were 10 companies in ‘national treasure’, 7 in ‘technology-driven’, 42 in ‘market-driven’ and 19 that were considered ‘global’. The ones that couldn’t be classified seemed to follow a combination of a few strategies.

3.1 National Treasure R&D

In this framework, all the R&D activities are done at home, either because core technologies are easier to control or that critical mass is too important. Companies that use this organization are usually in a strong dominant design position in their core technologies or their main sales market is domestic. The product requires very little or no adaptation to foreign markets. The company might also have little foreign exports. This organizational structure is only positive if the firm can maintain a dominant position.

An example of a company that supports this framework is Kubota. They are a large producer of machinery. They located all of their research and development facilities in or around the Osaka-Kyoto area of central Japan while depending on global production sites for feedback and further development of foreign needs (see exhibit 5). This was a management decision to ensure that all of the R&D facilities could work together. They had (as of 1999) no international research or development sites and 83% of sales (1999) were domestic.

3.2 Technology-driven R&D
This model of R&D internationalization follows the framework of internationalizing research while containing development at home. This is an attempt to capitalize on international centers-of-excellence. Also, it is a strategy to follow when there is a lack of scientists in your field, or in general, at home. Development remains centralized in the home country for various reasons. It could be because of economies of scale at home (i.e. the existence of technology platforms or access to specific specialized testing equipment), the relative proximity of central planning offices, the protection of commercial results in development or synergy effects.

Xerox is an example of a company that follows this strategy in R&D internationalization activities. They have 5 research centers worldwide (1999) and each site has a specific reason for being situated in that location, via leveraging local competencies. Development remains centralized (see exhibit 6). After technologies have been developed, they are then sent to new business groups for production.

3.3 Market-Driven R&D

In order to adapt new products to different foreign markets, companies will follow an internationalization of R&D as follows; internationalize development while maintaining research at home. Business development is dominated by customer demand and not necessarily by new and improved scientific advancement. Research is generally of a lower significance in product development so research activities are kept at home in an attempt to create a critical mass. The benefit of keeping research at home has come under criticism while research is under greater pressure to add value.

A leader in elevators and escalators, Schindler (a Swiss company) follows this pattern of R&D activities. In the elevator and escalator industry, codes, standards and passenger behavior vary widely; so local development for local needs is essential. They have 3 levels of R&D activities (see exhibit 7): corporate R&D, manufacturing R&D and field engineering. The corporate R&D was located in 4 major centers for real research and new technology advancement. Following the new advancements, manufacturing R&D was responsible for incremental improvements in manufacturing the new developments. Finally, field engineering, located in over 100 countries, customized the products to meet local specifications. As you can see, product development happened at different stages of production and becomes increasingly global.

3.4 Global R&D

These are the true internationalized corporations, with both research and development located worldwide. Research sites are located in centers with a high quality scientific base. Development locations are located to adapt products to local standards and demands. With this structure comes an added cost, but the added value of business creation and market advantages offset the costs. Information management and diffusion are extremely important in this type of framework. It is critical that new science can be quickly diffused to other parts of the world for local adaptations, while development sites
must be capable of launching a product globally. This is the typical framework in the pharmaceutical industry because of its highly competitive nature and increasing size of main global players.

A pharmaceutical company based in the UK, Glaxo-Wellcome had 4.72% of the global pharmaceutical industry, then valued at USD$ 275 billion. In 1998, it had seven of its products in the world’s top fifty. A merger formed Glaxo-Wellcome, so that alone created a global R&D network. With principle R&D sites in the UK, two in the US, plus Japan, Italy, France, Spain and Canada, they truly have a global research base (see exhibit 8).

4 Principle Forces and Trends in Internationalizing R&D

Following the four archetypes for R&D structuring, there can be drawn two principle conclusions for internationalization: access to local markets and customers, and access to local science and technology. Access to local markets and customers is a demand-pull economic theory, forcing the multi-national to meet and serve differences in local demand through the adaptation of its products locally. The access to local science and technology is the opposite, or a supply-push. It is essential to create innovations, so locating the research and development activities in innovation-friendly environments is the force, funneling information back for development. This then leads to the 4 trends in internationalization (see exhibit 9): internationalization of research, of development, development follows research, research follows development.

4.1 Internationalization of Research

This is the primary evolution of a company’s growth in R&D activities if there are none or a lack of scientific resources at home, but have strong local engineering. The company internationalizes research in an attempt to avoid being constricted to the scientific constraints at home. They usually position research centers towards centers-of-innovation, or to foreign talent pools.

4.2 Internationalization of Development

This is the opposite of the internationalization of research. The company possess’ a strong domestic research pool, without the necessary resources to fully develop the products (i.e. lack of good engineering personnel). It is also a trend when a company needs to develop the product to meet foreign needs or local specialization because of regulations. This could also be the result of foreign markets becoming more important than domestic markets.

4.3 Development Follows Research

Primarily in technology intensive industries, product development is gained through scientific advancement. Development sites are often located close to research
centers to rapidly develop new technologies or innovations.

4.4 Research Follows Development

Within quickly developing industries, research centers are often placed in close proximity to development centers to try and advance new developments.

4.5 Summary of Trends

In order to follow any of these four strategies, companies must have a large amount of resources to spend on R&D activities. Only the largest companies with substantial resources can afford to globalize both research and development at the same time.

Following the internationalization via one of these trends, there must be a reorganization of the R&D structure, particularly after mergers and acquisitions (M&A). M&A trends may seem the reversal of some of these trends, while the MNC may try to consolidate some of the redundant activities. The activity of M&A is usually the result of an attempt to create new synergies or cost savings. Consolidation of R&D activities can also be an effort to consolidate ‘jungle growth’ where companies have grown too quickly and must be streamlined for both cost savings and increased efficiencies.

5 Differences in Strategy

The internationalization of R&D strategies might also be the result of a difference in cultural origin, and may also be different when classed by industry.

5.1 Differences by Cultural Origin

There seems to be a slight different in the internationalization of R&D activities whether the company is of American, Japanese or European origin.

European companies seem to be the most aggressive in the internationalization of R&D activities. They sometimes don’t just set up a new outlet abroad, but purchase entire foreign companies. Often, European companies are located in the ‘market-driven’ category of foreign expansion. This could be attributed to their small geographical home markets, so going international only seems logical. They establish outpost in other European countries, and if these outpost were not taken into account of their internationalization activities, only about half of the originally calculated R&D sites would still be considered global.

On the other hand, Japanese companies tend to depend on home development, while opening up ‘listening posts’ to acquire technology instead of setting up whole research sites overseas. Because of their relatively large domestic markets, Japanese MNC’s often fall into the ‘national treasure’ category. Few Japanese companies have
succeeded in establish international research and development sites.

Again, American companies, due to their large domestic market, usually fall into the ‘national treasure’ category. However, recently American companies have started to be classed as ‘market-driven’ because they are continually setting up foreign R&D units staffed with American personnel. They are recognizing the importance of international markets and seem to be adapting accordingly.

5.2 Differences by Industry

Breaking down the trends in internationalization by industry is a good way to negate such factors as culture and company-specific factors. It seems that, from the research, the most intensive R&D industries (i.e. pharmaceuticals and IT/electrical) pursue the most truly global strategy. This may be due to the fact of global centers-of-excellence and location advantages. Also, the pharmaceutical industry seems to be the most global in terms of research alone.

‘Market-driven’ would be the most widely adopted, while MNC’s try to adapt global products locally. Development internationalization seems to happen much sooner than research, proving the ‘market-driven’ model to be the most used. Foreign R&D investment is two times more likely to be development in oil, machinery, automotive, chemicals, telecom and food industries. Only the pharmaceutical industry seems to have a one-to-one ratio of foreign research to foreign development.

6 Conclusion on the Article

Throughout the article, there is the theme of the internationalization of R&D activities and the different strategies a firm might pursue. The four archetypes have been defined as ‘national treasure’, ‘technology-driven’, ‘market-driven’ and truly ‘global’. Following the four archetypes are the four emerging trends in an attempt to move from one of the archetypes to another. The four trends are the internationalization of research, internationalization of development, research follows development and development follows research. There are different reasons a firm might choose one strategy over another, including cultural differences or industry differences. Once the appropriate strategy has been chosen, an R&D manager must choose how to proceed with the management of the main difficulties of internationalization, which are the physical distance, coordination and control, and the NIH syndrome.

The authors conducted a very good survey, covering many industries and a large number of companies. Their methodology was very sound, especially with their follow-up process to insure the accuracy of all findings and conclusions.

While not every company could be classified 100% into one of the four archetypes, the model suggested is very relevant and a useful tool for managers to assess
their current situation and to determine where they want to be in the future. Managers are also then provided with the necessary framework to make decisions on how to achieve their goals.
Section 2 Pfizer Inc.

1 Introduction to Pfizer Incorporated

“Pfizer is the world's largest research-based biomedical and pharmaceutical company.”

Pfizer Incorporated (Pfizer for the purpose of this paper) is the world’s largest pharmaceutical company as ranked by sales. It is based in New York City, USA, traded on the NYSE (New York Stock Exchange) under the stock symbol PFE, and is currently included in the Dow Jones Industrial Average (a stock market indicator). It had revenues in excess of $48 billion in 2007 with a net income of over $8 billion. Currently, Pfizer employs over 100,000 people worldwide. With an annual advertising budget of over $3 billion, Pfizer had the 4th largest marketing budget in the US (as of 2004). They also spent over $8 billion in R&D last year. For full financial information, see exhibit 13.

1.1 Products

Pfizer is currently active in the production of pharmaceutical medications worldwide. The product categories that Pfizer competes in can be broken down into 9 categories, and each category contains multiple products. The categories are as follows: allergies, cancer, cardiovascular diseases, central nervous system, diseases of the eye, hormonal system, infections, mycosis or fungal diseases, rheumatism and pain, and finally urinary passages and sex organs. Most of these categories would require different R&D sites and process. Following all of their activities in human therapeutics, they also have a wide range of medications for animals. Their most important and well-known products are:

- Lipitor: a medicine that lowers cholesterol, and 2006 sales of $12.9 billion, making it the #1 drug in the world
- Diflucan or Trican (both TM of Pfizer): an oral anti-fungal medicine
- Viagra: for male erectile deficiency with sales well over $1 billion since 1999
- Zoloft (for depression and anxiety): sales of $3.5 billion (2005), representing more than 6% of total revenues

Other commonly known Pfizer Trade Marks (TM) include Sudafed and Sudafed PE, Xanax, Benadryl, Nicotrol NS and Nicotrol Inhaler. Their list of products is over 150 items long, with some products having more than one version.

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3 Pfizer.com – About Pfizer, Corporate Overview
2 History and background

Charles Pfizer, a chemist born in Germany, and his cousin, Charles Erhart, a confectioner, founded the Chas. Pfizer and Company Inc. in 1849 based in Brooklyn, New York. Then in 1968 the company was moved from Brooklyn to the Wall St. area of New York. The initial product that kept them in business was an anti-parasitic called santonin. By the turn of the century, their main product had become citric acid, which had many industrial applications. It was also used to add flavor in the food industry as well as medicines.

By 1910, sales had reach 3 million. It wasn’t until 1917 that the process of making citric acid from fermenting sugar was discovered, one of their great successes. Following this discovery, Pfizer became a specialist in fermentation processes and developed new ways for the fermentation process that cut costs, increased volume of production and also overall quality by the mid 30’s.

At the beginning of the Second World War, there was an urgent need to discover and produce an infection fighting medicine for the troops. Penicillin had been discovered in London in 1928 but there was a lack of capability in mass production. Pfizer was one of the American companies commissioned to help find a solution, which it did, and this then became the ‘wonder drug’ of WW2. The same year that they could successfully produce large amounts of penicillin, 1942, the company went public.

By 1945, Pfizer had become the world’s largest producer of penicillin. They then became curious in finding other biological organisms to fight diseases. Following 20 million tests and 135,000 soil samples from all over the world, Pfizer licensed a new antibiotic Terramycin in 1959. This was the first discovery by Pfizer’s systematic research.

Pfizer was established in Belgium, Brazil, Canada, Cuba, Iran, Mexico, Panama, Puerto Rico, Turkey, and the United Kingdom by the end of the 50’s. They also moved their international headquarters to Manhattan, New York in 1959 where they remain today. In the early 60’s, Pfizer became the main producer of an anti-polio vaccine, which helped North America quell fears of an outbreak by the vaccination of nearly 60 million people. The company name was then changed to Pfizer Inc. and continually developed new medicines throughout the 70’s and 80’s.

Their latest growth was spurred by their innovative medical solutions and then by a number of acquisitions including Warner-Lambert in 2000 and Pharmacia in 2003 (these will be discussed in the next section).

It is important to note the activities of Pfizer since 1996, referring to the ongoing situation that is Nigeria. In 1996, there was a meningitis outbreak in Nigeria, where Pfizer was commissioned to administer drugs. It used mainly proven medications, but also tested new products, Trovan and ceftriaxone. 200 hundred children were given the new drugs, of which the majority suffered “either/or muteness, deafness, blindness, and/or other physical impairments”. 11 children died. “Nigerian authorities allege that

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4 Confectioner: somebody who makes or sells candies
5 Wikipedia. Pfizer – Nigeria.
Pfizer lied to them about the unapproved drugs used in the tests”. Since this incident, the federal government of Nigeria and the state of Kano (where the tests took place) have been seeking a lawsuit for a combined $9.25 billion. The issue has only been postponed numerous times by Pfizer, and there have been no settlements to date.

Currently, Pfizer is going through some tough times, with the intention to lay-off approximately 10,000 employees, or 10% of its workforce. The current CEO, Jeffery Kindler, has admitted that Pfizer seems to have hit a wall and that its business model is slowly falling apart. Their business model focused on producing “Blockbusters”, or drugs that could generate sales of over $1 billion a year, and now this is not considered an appropriate strategy. They are in the midst of huge restructuring, starting with the closure of research facilities worldwide.

2.1 Acquisitions

It was through the acquisition of Pfizer’s main competitor, Pharmacia, which made Pfizer the world’s largest pharmaceutical company. Each acquisition by Pfizer has had the goal of obtaining a product, not necessarily a research base. This is evident through the acquisition of Warner-Lambert (who previously acquired Parke-Davis). After this acquisition, Pfizer plans to close the Parke-Davis research facility in Michigan, along with the sale of their former headquarters (HQ). They also closed some of SUGEN’s labs in an effort to consolidate research activities. The reasons for each acquisition are as follows:

- **Agouron**: to gain Nelfinavir, used for the treatment of HIV
- **SUGEN**: compound SU11248 and SU14813 to treat cancer
- **Pharmacia**: to eliminate competition
- **Warner-Lambert**: to gain Lipitor, which lowers cholesterol

For an illustrated chart of the M&A activities of Pfizer and its acquisitions, see exhibit 10.

3 R&D Activities

Pfizer currently spends the most out of any pharmaceutical company in the world on R&D: in excess of $8 billion in 2007. This is the world largest pharmaceutical R&D organization, called Pfizer Global Research and Development. This gives Pfizer an R&D intensity of approximately 16%.

This may be the only strong point in recent years in Pfizer’s R&D activities. It recently had major troubles in the development of what many thought to be its next ‘blockbuster’, torcetrapib. This was a drug that was supposed to increase what is called in the industry, ‘good cholesterol’. This drug was cancelled in the testing and trials phase on December 2nd, 2006. This was because the clinical trials, involving more than 15,000 patients, experienced more deaths than expected. They observe more than a 60% increase

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6 Ashman, Alexis. “Pfizer faces fresh $6.5bn lawsuit over Nigerian tests”.

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in deaths as a direct result of patients taking this medicine combined with Lipitor. Patients taking Lipitor alone showed no significant increase of complications. Following the cancellation of the development of torcetrapib, Pfizer lost more than $1 billion in investments. Also following the cancellation, Pfizer’s stock price fell and the overall value of the company also suffered as investors lost confidence.

Another recent loss (October, 2007) has been the cancellation of Exubera, an inhaler form of insulin. This write-off will cost Pfizer roughly $2.8 billion.

This has not been the only woe to R&D in Pfizer. Pfizer has yet to develop a blockbuster since Viagra (in 1999). Instead of relying on their own extensive R&D activities, in recent years the only thing that has produced results for them has been their M&A activities (as previously described), which allowed them to acquire new and innovative drugs for production and marketing.

Another potential problem for Pfizer and their R&D activities, as well as their business in general, is the fact that a large number of their branded drugs either lost their patent protection or will soon. The problem is that they do not have any suitable replacements for the revenue that will soon be lost due to the emergence of generic drugs following a branded drugs loss of patent protection. Their main source of revenue, Lipitor (sales of $13 billion last year), will lose its patent protection in 2010.

In an attempt to increase R&D productivity, Pfizer has recently (Oct 2007) acquired 2 new chief scientists. This is following the admission by the new CEO that the once acclaimed research pipeline at Pfizer is now one of its main weakness’. Dr. Briggs Morrison, who was once the senior vice president of research at one of their main competitors, Merck, is now the chief of clinical development at Pfizer, their number 2 spot in the research division.

3.1 Research Locations

**Groton, Connecticut:**

This is the largest research facility of its kind in the world, with a 160 acres site and 2.7 million square-feet of state of the art facilities. It is also the HQ (combined with the New England, Connecticut campus) for Global Research and Development. There are currently more than 4,000 scientists and technicians employed here. Some main focuses of this site are discovery, pharmaceutical science, animal health and drug effectiveness coupled with safety evaluations. This site also stores a large amount of pharmaceutical compounds. It is one of two sites worldwide that is responsible for production, acceptance and processing of compounds.

**St. Louis, Missouri:**

This used to be a research site from Pharmacia, but then came under the control of Pfizer following their acquisition of Pharmacia in 2003. Here, there are four campuses that comprise 200 acres of land and 1.2 million square feet of laboratories, but this is not all. With a tentative completion date of late 2008, there is the current expansion of a $200 million facility, with 330,000 square feet of operational space that is supposed to consolidate the St. Louis locations. The focus of this campus is pure discovery. There are
over 1,100 scientists working here.

_San Francisco, California:_
A research facility obtained through the acquisition of the company Rinat in 2006, they focus on neuroscience and biotherapeutic discoveries.

_Cambridge, Massachusetts:_
This is Pfizer’s small Research Technology Center (RTC). It is located in the heart of scientific innovation near many other research labs, both commercial and academic. The lab focuses on innovation in science, both in process and discovery. By allowing the scientists here greater scientific flexibility, Pfizer hopes this strategic unit will produce results with the advantage of finances from the world’s largest pharmaceutical behind them.

3.2 Development Locations

_New England, Connecticut_\(^7\):
The HQ for Global Research and Development at Pfizer, (combined with the Groton site), the New England site boasts 780,000 square feet on 29 acres. It also employs 2,000 people from their Global Development Team. They are responsible for the creation of appropriate dosages for new therapeutics.

_Paris, France_\(^8\):
The main focus in Paris is clinical development.

3.3 Combined R&D Locations

As many pharmaceuticals have chosen to locate research facilities in close proximity to development facilities, so has Pfizer.

_Sandwich, England:_
This is their largest research and development site located outside of the US and also their European HQ, with 390 acres and 2.2 million square feet of R&D space. At this site, they employ 2,700 researchers and more than 900 manufacturing staff. Their main objectives are discovery, development and safety analysis.

_La Jolla, California:_
A staff here of 1,000 scientists and support staff focus on both research and development along with safety evaluations. They use their 33.5 acres and 1 million square feet of state of the art facilities to obtain these goals. Pfizer has spent more than $522 million over the past few years to make this a totally integrated site for both

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\(^7\) This site is in combination with the Groton site, but seems to have the development focus while Groton does research. This is why it was not considered in the ‘Combined R&D Location’ heading.

\(^8\) Little information could be found regarding this location.
research and development. By combining disciplines, this site has made notable discoveries in the treatment of HIV and cancer. It has also partnered with other research facilities and academic facilities in the area in an attempt to create increased synergies.

3.4 Streamlining and Consolidations of R&D

During the past few years, Pfizer has come upon hard times. The new CEO at Pfizer has put some R&D sites under scrutiny because of their duplication of processes, or just what is termed in the article as ‘jungle growth’. In 2003, Pfizer had over 90 production facilities world-wide, and at the end of 2007, there remained only 60. In an attempt to streamline and improve the company’s financials, by the end of 2008 there will be the closure of the following sites:

- Amboise, France
- 2 locations in Ann Arbor, Michigan (acquired from Warner-Lambert and Esperion)
- Kalamazoo, Michigan
- Nagoya, Japan

Along with the elimination of jobs at these facilities, there are 10,000 job cuts in total, all across the world. There were 420 jobs lost at the Sandwich, UK site after Pfizer stopped all production at this facility in 2007. This is all in an effort to gain $2 billion in savings.

3.5 Production and Product Testing

For a short note on the internationalization of Pfizer, but not included in their R&D activities, is production and testing. 1 in 6 Pfizer employees are in the production department. This is their largest activity and by far the most internationalized. Pfizer produces in over 32 countries, with 60 production facilities. These locations cover all the corners of the globe: North and South America, Europe, Asia, Africa, and the Middle East. Belgium has a stage 1 testing facility (see exhibit 12 for different phases) located at ULB, Erasme. (For more info on Pfizer in Belgium, see exhibit 11)

4 Pfizer’s Internationalization Archetype

(For the analysis and comparison of Pfizer to the article, production facilities are not included; only research sites and development sites)

It is difficult to categorize Pfizer into one of the specific positions as defined by Zedtwitz and Gassmann. This is largely due to the fact that it was difficult in assessing the global activities of Pfizer. Each international website seemed to have the same information as their main site, presented in the domestic language with a different layout.
It was also difficult to differentiate between research and development sites because of
the vagueness of the information regarding this issue. This is essential in categorizing
Pfizer into one of the frameworks. If there are more research sites worldwide than
development sites, this puts Pfizer in a different category than if the situation were
reversed.

What makes it difficult is that in the pharmaceutical industry, it’s hard to
distinguish what is actual development. If product testing were considered a development
process, then they would be considered in the ‘market-driven’ framework, having
international development and domestic research. For the purpose of classification,
product testing is not considered a development activity, because the development comes
before it is tested.

Therefore, following analysis of Pfizer’s global position and internationalization
activities, there could be one of 3 conclusions, which will be discussed as to why they
would work for Pfizer.

4.1 Conclusion 1: Pfizer sticks to the ‘National Treasure’ framework

Because the majority of both research and development is done at home, they
would seem to fit into this category. The main research hub is located in Groton,
Connecticut. This is logical because it is the largest facility of its kind. All of the foreign
research is funneled back to this center, which constitutes the ‘national-treasure’ because
further development is also done in the US.

4.2 Conclusion 2: Truly ‘Global’

Again, because there are international locations for both research and
development, one could conclude that Pfizer is pursuing a truly global framework. Being
the largest pharmaceutical company in the world, one would expect them to follow the
truly global structure. But, because of the characteristics described above, this isn’t 100%
true because their activities are dominated in one market. They have printed on their
website that they have dozens of small R&D labs worldwide, but it is impossible to get a
complete list of these locations.

4.3 Conclusion 3: Unclassifiable

The ambiguity surrounding their actual research and development activities could
cause them to be in this classification. As in the study performed in the article, not every
company could be classified into one of the frameworks because they seem to pursue a
combination of strategies. This could also be said for Pfizer.

5 Internationalization Trend of Pfizer in R&D

When trying to classify Pfizer into a specific internationalization trend as
described by Zedtwitz and Gassmann, it is again fairly difficult. Section 4.5 of Part 1 of
this paper refers to M&A activities from a MNC making it almost impossible to classify their internationalization trend. This would seem to be the case of Pfizer. In the past decade, Pfizer has made many acquisitions, following previous mergers of companies below them in the pharmaceutical food chain. Following these acquisitions, Pfizer is currently shutting down redundant activities and has already planned future plant closures and cutbacks.

Currently, Pfizer is experiencing operational difficulties and may in the near future come under hard times financially, making it difficult to define their internationalization strategy. Their stock price has seen consistent decline since February 2004 (see exhibit 14). They have not made any significant discoveries recently, which are not helping their business. As a combination of these 2 factors, their internationalization strategy might be non-existent, as they are in the middle of restructuring internationally. This means that right now they are consolidating. Consolidation of R&D activities was only briefly discussed in the article as it pertains mostly to the largest MNC’s with a history of M&A activity. Welcome to Pfizer.

6 Overall Conclusions

When classifying a MNC into one of the frameworks developed by Zedtwitz and Gassmann, there are factors that must be taken into consideration. It is the physical locations of research sites and development sites that determine where a company will fit into the framework developed. It is essential to analyze the company and observe if they keep both R&D activities in their home market, internationalize research activities, internationalize development activities or both. To do this, there must be a clear difference in focus at each of the sites analyzed, which proved very difficult to do with regards to Pfizer.

Following the analysis of international locations, one can observe which trend of internationalization that the MNC is pursuing, depending on the sequence of events of their internationalization history. The ‘market-driven’ trend seems to be the most widely applied, where development follows home based research to adapt new products to foreign markets.

In the case of Pfizer Inc., it was very difficult to identify the category that fits them best and their strategy. They are in the midst of consolidating, which is one trend that was discussed by the authors regarding large companies involved in a lot of M&A activities. This is certainly the case of Pfizer. Along with the difficulties created by their consolidation, it is difficult to classify them because Pfizer might simply be too global. Following this, one would assume they are global and place them into the ‘global’ archetype. The shortcomings of this conclusion have been discussed, which is mainly their concentration in the US.

Perhaps the timing of this analysis is the true shortcoming of the classification of Pfizer into an archetype or an internationalization trend. They are coming into hard times in the financial market, with a lot of pressure coming from shareholders to increase value. This pressure has resulted in a negative growth strategy or consolidation, which was not sufficiently discussed by Zedtwitz and Gassmann. A better time to analyze their strategy
might be in five years when the consolidation efforts have been completed and Pfizer should be concentrating on economic growth.

For the purpose of evaluating a company in a specific archetype and internationalization strategy, Pfizer was a good company to choose because of the many challenges they presented. It really makes one question their activities and distinguish which activities are research oriented, which are development, which are mostly done in their domestic market (the US) and which are mainly done abroad. Studying a company that is not as global as Pfizer might have made the analysis a little simpler, but not as interesting and thought provoking.

The larger the company in question, the larger the problems with internationalization, like physical distance, management and control, and NIH syndrome which seem to be tackled quite efficiently and effectively by Pfizer. Their consolidation is a result of these issues and shareholders are waiting anxiously for Pfizer to turn operations around. When they are done their reorganization, a further investigation into their internationalization might lead to a much more clear conclusion. Until then, Pfizer needs to concentrate on finding a new ‘blockbuster’ drug, or face an even greater challenge than being classified into an archetype.
List of Exhibits

Exhibit 1

List of 81 industrial companies considered in this study, sorted by location and industry groups

<table>
<thead>
<tr>
<th>Company based in</th>
<th>Pharmaceuticals, chemicals, food</th>
<th>Electrical, information and software technology</th>
<th>Machinery, petro, automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>AstraZeneca, BASF, Bayer, Boehringer Ingelheim, Ciba Spez, GlaxoSmithKline, Hoechst, ICI, Nestle, Novartis, Novo Nordisk, Hoffmann-LaRoche, Schering, Unilever</td>
<td>Bosch, Continental, DaimlerChrysler, Elnka, Nokia, Siemens, Philips, SAP</td>
<td>ABB, BMW, Continental, DaimlerChrysler, Elnka, Agitaine, Hilti, Mahe, Messer Toledo, Royal Dutch/Shell, Schindler, Schneider, Salzer</td>
</tr>
<tr>
<td>USA</td>
<td>3M, American Home Products, BP-Amoco, Bristol-Myers-Squibb, Chevron, Dow, Eli Lilly, W.R. Grace</td>
<td>AT&amp;T, Computer Sciences, Electric, Hewlett-Packard, IBM, Intel, Lucent, Microsoft, Motorola, National Semiconductor, Texas Instruments, Unisys, United Technologies, Xerox</td>
<td>Exxon, Ford, General Motors, Honeywell</td>
</tr>
<tr>
<td>Japan, East Asia</td>
<td>Eisai, Kao, LG, Yamanouchi</td>
<td>Canon, Daewoo, Hitachi, Kobe Electric, Samsung, NEC, Sharp, Sony, Toshiba</td>
<td>Fujitsu, Haier, Honda, Hyundai, Mitsubishi, Toyota</td>
</tr>
</tbody>
</table>

Exhibit 2


Fig. 3. Concentration of R&D in Europe, Japan, and US.
Exhibit 3


![Graph showing the internationalization of R&D and sales for various companies.]

Fig. 2. R&D internationalization as compared to sales internationalization of 46 technology-intensive companies.

Exhibit 4

![Diagram illustrating organizational structures of internationalized R&D.]

Fig. 4. Organizational structures of internationalized R&D.
Exhibit 5

Kubota:
- US$ 8.0bn of sales in 1996
- Work force of 15'000
- 17% international sales
- 4.5% R&D/Sales
- R&D staff about 2000

49 R&D units in 23
in the five divisions of:
1. Housing Materials & Materials
2. Environmental Control
3. Farms & Industrial Machinery
4. Materials
5. Pipe & Fluid Systems

Four central R&D labs:
1. Advanced Technology Laboratory
2. Technology Development
3. Computational Research Center
4. Electro-Technology Center

Fig. 5. Kubota’s national treasure R&D organization.

Exhibit 6

Xerox:
- US$ 18.2bn of sales in 1997
- Work force of 92'000
- 65% international sales
- 5.8% R&D/Sales
- Research staff about 1'320

R&D Organization:
- Research:
  Centrally managed but strategically located to leverage industry and academic competencies.
- Technology Development:
  Centrally managed but collocated with manufacturing sites they deliver to.
- Engineering/Product Development:
  Management is decentralized and teams are collocated with primary manufacturing sites.

Fig. 6. Xerox’s technology-oriented R&D organization.
Exhibit 7

Schindler:
- US$ 5.5bn of sales in 1998
- 76% international sales
- 30% international R&D
- Work force of 46000
- R&D staff about 930
- 3.3% R&D/Sales

Fig. 7. Schindler’s market-driven R&D organization.

Exhibit 8

Glaxo-Wellcome
- US$ 13.2bn of sales in 1997
- Work force of 54000
- 93% international sales
- 14.4% R&D/Sales
- 65% international R&D
- Research staff about 10000

R&D Organization:
- Research in:
  1 location in the UK
  9 foreign locations
- Development in:
  5 locations in the UK
  9 foreign locations

Fig. 8. Glaxo-Wellcome’s global R&D organization.
Exhibit 9

Fig. 9. Principal determinants and trends in internationalization of research and development.

Exhibit 10

Pfizer’s M&A activities
(Double-ended arrows denote merger activities)
(Single-ended arrows acquisitions)
Exhibit 11

Pfizer, Belgium/Luxemburg Operations

Founded in 1952
Number of employees in Flanders: 2,900
Pfizer Belgium/Luxemburg is operating in 8 different sites mainly situated in Flanders.
  Anderlecht: Phase I Clinical Research Unit
  Puurs: Pfizer’s largest Production Unit in Europe specialized in sterile production
  Bornem: Production of gelatin capsules for medicines
  Louvain-la-Neuve: Production of vaccines for animals
  Nossegem / Mechelen: Pfizer’s second largest Distribution Center in the world.
  Brussels: Commercial and administrative headquarters
  Luxemburg: Commercial and administrative Offices

Pfizer is performing many clinical trials in Belgium with its existing and new products. In 2004 more than 70 phase I clinical trials were conducted in our phase I unit and more than 80 clinical trials phase III and IV with more than 2,000 patients in universities and hospitals.
We have also research collaboration contracts with the University of Ghent, the KUL and are financially supporting many other R&D projects.

Exhibit 12

Testing Phases to Bring a Drug to Market

* Pre-phase: the therapeutic compound is tested in a laboratory setting.
* Phase 1: the compound is tested on healthy volunteers.
* Phase 2: the medicine is tested for its effectiveness and safety on a limited number of patients who are suffering from a particular disease or disorder. In addition, the most suitable dosage for the new medicine is sought.
* Phase 3: these are comparative studies in which the drug's safety and effectiveness is tested on large groups - specifically, on several thousand patients from several different countries. These studies are conducted in collaboration with university centers, peripheral hospitals, and/or general practitioners. In this way, we study patients who are as representative as possible of the patients who will be treated later with the new medicine.
* Phase 4: the medicine is approved and brought onto the market. And it is also closely followed. Regular evaluations are performed with regard to effectiveness, safety, and possible side effects of the product.
Exhibit 13

### Financial Summary

**Pfizer Inc and Subsidiary Companies**

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenues</strong></td>
<td>$460,418</td>
<td>$448,371</td>
<td>$474,005</td>
<td>$498,888</td>
<td>$411,787</td>
</tr>
<tr>
<td>Research and development expenses</td>
<td>8,089</td>
<td>7,590</td>
<td>7,256</td>
<td>7,513</td>
<td>7,279</td>
</tr>
<tr>
<td>Other costs and expenses</td>
<td>28,234</td>
<td>25,586</td>
<td>26,341</td>
<td>25,850</td>
<td>25,652</td>
</tr>
<tr>
<td>Acquisition-related in-process research and development charges</td>
<td>283</td>
<td>835</td>
<td>1,652</td>
<td>1,071</td>
<td>5,052</td>
</tr>
<tr>
<td>Restructuring charges and acquisition-related costs</td>
<td>2,534</td>
<td>1,323</td>
<td>1,356</td>
<td>1,151</td>
<td>1,023</td>
</tr>
<tr>
<td>Income from continuing operations before provision for taxes on income, minority interests and cumulative effect of a change in accounting principles</td>
<td>9,278</td>
<td>13,028</td>
<td>10,803</td>
<td>13,403</td>
<td>2,781</td>
</tr>
<tr>
<td>Provision for taxes on income</td>
<td>(1,923)</td>
<td>(1,992)</td>
<td>(3,178)</td>
<td>(2,460)</td>
<td>(1,164)</td>
</tr>
<tr>
<td>Income from continuing operations before cumulative effect of a change in accounting principles</td>
<td>8,313</td>
<td>11,024</td>
<td>7,610</td>
<td>10,936</td>
<td>1,164</td>
</tr>
<tr>
<td>Discontinued operations—net of tax</td>
<td>(66)</td>
<td>8,313</td>
<td>408</td>
<td>425</td>
<td>2,776</td>
</tr>
<tr>
<td>Cumulative effect of a change in accounting principles—net of tax</td>
<td>—</td>
<td>—</td>
<td>(23)</td>
<td>—</td>
<td>(30)</td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
<td>8,144</td>
<td>19,337</td>
<td>11,361</td>
<td>3,364</td>
<td>9,126</td>
</tr>
<tr>
<td>Effective tax rate—continuing operations</td>
<td>11.0%</td>
<td>15.3%</td>
<td>29.4%</td>
<td>18.4%</td>
<td>58.0%</td>
</tr>
<tr>
<td>Depreciation and amortization#</td>
<td>5,203</td>
<td>5,203</td>
<td>5,576</td>
<td>5,093</td>
<td>4,025</td>
</tr>
<tr>
<td>Property, plant and equipment additions#</td>
<td>1,880</td>
<td>2,050</td>
<td>2,106</td>
<td>2,601</td>
<td>2,620</td>
</tr>
<tr>
<td>Cash dividends paid</td>
<td>7,975</td>
<td>6,919</td>
<td>5,555</td>
<td>5,082</td>
<td>4,363</td>
</tr>
<tr>
<td>Working capital#</td>
<td>25,014</td>
<td>25,559</td>
<td>18,433</td>
<td>17,582</td>
<td>6,059</td>
</tr>
<tr>
<td>Property, plant and equipment, less accumulated depreciation</td>
<td>15,734</td>
<td>16,632</td>
<td>16,233</td>
<td>17,593</td>
<td>17,573</td>
</tr>
<tr>
<td>Total assets#</td>
<td>115,638</td>
<td>115,546</td>
<td>116,970</td>
<td>125,848</td>
<td>111,131</td>
</tr>
<tr>
<td>Long-term debt</td>
<td>7,314</td>
<td>5,546</td>
<td>6,347</td>
<td>7,279</td>
<td>5,755</td>
</tr>
<tr>
<td>Long-term capital#</td>
<td>80,134</td>
<td>84,993</td>
<td>81,885</td>
<td>88,959</td>
<td>78,666</td>
</tr>
<tr>
<td>Shareholders’ equity</td>
<td>65,910</td>
<td>71,358</td>
<td>65,764</td>
<td>68,433</td>
<td>60,040</td>
</tr>
</tbody>
</table>

**Earnings per common share—basic:**

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income from continuing operations before cumulative effect of a change in accounting principles</td>
<td>1.19</td>
<td>1.52</td>
<td>1.03</td>
<td>1.45</td>
<td>0.16</td>
</tr>
<tr>
<td>Discontinued operations—net of tax</td>
<td>(0.01)</td>
<td>1.15</td>
<td>0.07</td>
<td>0.06</td>
<td>0.38</td>
</tr>
<tr>
<td>Cumulative effect of a change in accounting principles—net of tax</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>(0.07)</td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
<td>1.18</td>
<td>2.67</td>
<td>1.10</td>
<td>1.51</td>
<td>0.54</td>
</tr>
</tbody>
</table>

**Earnings per common share—diluted:**

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income from continuing operations before cumulative effect of a change in accounting principles</td>
<td>1.18</td>
<td>1.52</td>
<td>1.02</td>
<td>1.43</td>
<td>0.16</td>
</tr>
<tr>
<td>Discontinued operations—net of tax</td>
<td>(0.01)</td>
<td>1.14</td>
<td>0.07</td>
<td>0.06</td>
<td>0.38</td>
</tr>
<tr>
<td>Cumulative effect of a change in accounting principles—net of tax</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>(0.07)</td>
</tr>
<tr>
<td><strong>Net Income</strong></td>
<td>1.17</td>
<td>2.66</td>
<td>1.09</td>
<td>1.40</td>
<td>0.54</td>
</tr>
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</table>

**Market value per share (December 31):**

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<tr>
<th></th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer</td>
<td>22.73</td>
<td>25.90</td>
<td>23.32</td>
<td>26.89</td>
<td>35.33</td>
</tr>
<tr>
<td><strong>Return on shareholders’ equity:</strong></td>
<td>11.04%</td>
<td>28.20%</td>
<td>12.0%</td>
<td>17.7%</td>
<td>10.0%</td>
</tr>
<tr>
<td><strong>Cash dividends paid per common share:</strong></td>
<td>0.16</td>
<td>0.06</td>
<td>0.26</td>
<td>0.68</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Shareholders’ equity per common share:</strong></td>
<td>9.65</td>
<td>10.05</td>
<td>8.98</td>
<td>9.21</td>
<td>7.93</td>
</tr>
<tr>
<td><strong>Current ratio:</strong></td>
<td>2.151</td>
<td>2.161</td>
<td>1.651</td>
<td>1.631</td>
<td>1.261</td>
</tr>
</tbody>
</table>

**Weighted-average shares used to calculate:**

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<tr>
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<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic earnings per common share amounts</td>
<td>6,917</td>
<td>7,242</td>
<td>7,361</td>
<td>7,531</td>
<td>7,213</td>
</tr>
<tr>
<td>Diluted earnings per common share amounts</td>
<td>6,939</td>
<td>7,274</td>
<td>7,411</td>
<td>7,514</td>
<td>7,286</td>
</tr>
</tbody>
</table>
Exhibit 14

Pfizer Inc. 5 yr chart; stock price on top (USD); trading volume on bottom
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