Pharmaceutical Industry in Basel, Switzerland – Cluster Analysis

Course
Industry Cluster & Firm Competitiveness – Prof. Örjan Sölvell

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Executive Summary

- Switzerland is the most competitive economy in the world and highly export oriented; within the country’s borders several clusters have gained worldwide recognition.
- Among them, the Basel Pharma Cluster represents one of the most important economic areas in Switzerland; in fact a substantial part of the country’s export strength is rooted in the pharma industry.
- The origin of the cluster dates back to the late 19th century, when chemical companies decided to produce synthetic medicines; at that time the world-famous big pharma company Roche emerged.
- Growing strongly until the early 21st century the cluster is now standing on a cross road that will decide about revival or decline as current industry trends and increasing competition from other clusters represent opportunities, as well as threats.
- Due to the clusters importance throughout the history a highly dynamic environment has evolved, with specialized cluster participants that reduce transaction costs and foster innovativeness.
- However, in absolute comparison with the leading pharma clusters in San Francisco & Boston the Basel cluster performs weak in terms of innovation, mainly due to its size.
- Innovativeness is the key success-driver in the knowledge intensive pharma industry, where the ability to leverage future trends such as digital healthcare and increasingly sophisticated demand in emerging markets decides about success or failure.
- Not only does the connection to the broader Life Science cluster - spanning parts of Germany, France and Switzerland - need to be further enhanced through collaboration with the BioValley Cluster Organization in order to keep up with demand trends, but a new cluster organization also needs to be established.
- The recommended DigiValley cluster organization aims to connect the Basel Pharma Cluster with the ICT clusters in Bern & Zürich in order to make the Basel cluster one of the outstanding areas for digital healthcare.
- An increasing connection to the LS and tech clusters in combination with a stronger start-up footprint will increase cluster dynamism, the flow of knowledge, mobility of employees and, finally, also the innovativeness; an emerging start-up scene in the field of digital healthcare benefits large companies that seek innovative healthcare solutions and will make Basel the leading pharma cluster in Europe.
Nation Level: Swiss History since 19th century
Scarcity of resources and political neutrality created an export & import oriented economy

<table>
<thead>
<tr>
<th>Swiss Industrialization&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Political Neutrality in the World Wars&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Geographical Position</th>
</tr>
</thead>
</table>
| - Swiss industrialization started in the textile industry, where first machines were manufactured 1801; by 1814 the entire textile production was mechanical  
- At the same time, watchmaking flourished in the areas of Geneva and Neuchatel  
- The pace of industrialization increased when in 1948 Switzerland formally became independent  
- A dense railway system was established and more supporting industries such as the chemical industry and further machinery suppliers emerged  
- The industrialization of the economy required large amounts of capital, leading to the emergence of the banking sector in the 19<sup>th</sup> century<sup>2</sup>  
- By the end of the 19<sup>th</sup> century, the pharmaceutical industry emerged from the chemical industry  
- After the turbulences of two World Wars, the economy shifted towards services  
- A policy of free trade was adapted in the late 20<sup>th</sup> century<sup>3</sup> | - During both World Wars Switzerland adopted a policy of neutrality  
- The relatively small size of the country, high population density and low resource endowment imposed harsh economic consequences as the country’s economy depended on imports of agricultural products and raw materials to function  
- For a long time in the 2<sup>nd</sup> World War Swiss imports were under control of Germany and its Allies, leading to strong rationing and efforts towards independence in the agricultural production  
- However, Switzerland engaged in financial dealings with the Third Reich and exported weapons to all major war participants  
- Sharp criticism arose since 1957 about Switzerland’s involvement in the 2<sup>nd</sup> World War despite its neutrality status and led to international isolation<sup>4</sup>  
- It took the country until 2002 to abandon political isolationism by becoming member of the UN<sup>5</sup> | - Located in the center of Europe Switzerland bridges the northern parts of Central Europe (Germany, Netherlands, Belgium) with the Mediterranean area (Italy & Southern France)  
- The country is bordering Germany, France, Italy, Liechtenstein and Austria  
- Switzerland has no direct access to the ocean, but ships have access to the Northern sea via the Rhine |
Until today, Switzerland has excelled in offering favorable conditions for doing business.

### Political
- Switzerland is a federal, directorial republic consisting of 26 cantons.
- Direct democracy is a pillar of Swiss governance. Citizens are called to vote on legislation several times per year.
- Switzerland embraces a policy of neutrality. For this, it is the seat of many international organizations and NGOs.
- In 2016 Switzerland has withdrawn its entry application to the EU.

### Technological
- 2.97% of the GDP is spent on R&D, which is higher than the OECD average of 2.38%.
- 4,481 out of 1,000,000 Swiss people work in R&D; it is the 13th highest number worldwide.
- 88 out of 100 persons in Switzerland are active Internet users.

### Economic
- Small economy, heavily relying on imports & export.
- GDP amounts for US$ 664.0bn (#20 worldwide) with a GDP per capita of US$ 80,603 (#4 worldwide).
- The largest shares of exported goods are chemicals (40.2%), tools, watches and clock, jewelry (22.5%), machinery and electronics (16.6%).
- The EU is the main trading partner (56% of exports, 75% of imports).
- Free trade agreements with 39 partners.
- Most competitive economy since 2009 in a row.

### Social
- Switzerland has 4 official languages: French, German, Italian, Romansh.
- 23.8% of the 8.35 million Swiss residents are foreign (mainly from Germany, Italy, Portugal).
- The population growth rate is 1.16%.
- Switzerland was ranked 3rd in the 2015 Human Development Index Report.
- Almost 50% of the Swiss population in the 25-34 age group has attained tertiary education.

### Legal
- Switzerland enjoys the status of a tax haven; however, the tax system is currently changing.
- Similar to most central European countries, Switzerland has a civil law system in place.
- The country ranks 7th on the Corruption Perception Index, indicating low corruption levels.
- It is ranked 5th on the International Property Rights Index.
- The FDI Regulatory Restrictiveness Index of 0.08 is slightly above OECD average (0.07).

### Environmental
- The topography is an obstacle to agriculture, but the Alps attract millions of tourists.
- 6% of Europe’s water reserves are in Switzerland; 56% of Swiss electricity comes from water power.
- For its unique position, the country has become a bridge between Northern and Southern Europe.
- A strong impact of climate change on Swiss alps and Alpine climate is predicted for the future.

Political neutrality and stability are favorable conditions for businesses. Economically, Switzerland is highly trade oriented and therefore dependent on the EU that accounts for 56% of exports. The Swiss society is highly advanced and culturally diverse. From a technological perspective Switzerland ranks among the most innovative countries. The country has also a strong legal framework. Overall, macroeconomic conditions in Switzerland are favorable for conducting business.
Nation Level: The Swiss Economy
Pharma clusters are increasingly gaining importance in the Swiss economy.

**Facts & Figures**

| Population: | 8'287m |
| GDP: | $664.0bn |
| GDP/capita: | $80'603 |
| GDP growth: | -0.2% |
| Exports as % of GDP: | 63.5% |
| CPI: | -0.01% |
| Unemployment: | 4.5% |
| PPP (Swiss vs. OECD): | 148% |

**Top 10 competitive nations**

1. Switzerland
2. Singapore
3. United States
4. Germany
5. Netherlands
6. Japan
7. Hong Kong SAR
8. Finland
9. Sweden
10. United Kingdom

**Gross Domestic Product Over Time**

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP in bn US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>580.6</td>
</tr>
<tr>
<td>2011</td>
<td>665.4</td>
</tr>
<tr>
<td>2012</td>
<td>685.2</td>
</tr>
<tr>
<td>2013</td>
<td>701.2</td>
</tr>
<tr>
<td>2014</td>
<td>664.0</td>
</tr>
<tr>
<td>2015</td>
<td>662.5</td>
</tr>
<tr>
<td>2016E</td>
<td>684.4</td>
</tr>
<tr>
<td>2017E</td>
<td>702.2</td>
</tr>
<tr>
<td>2018E</td>
<td>722.3</td>
</tr>
<tr>
<td>2019E</td>
<td>744.8</td>
</tr>
</tbody>
</table>

**Top 10 Industries (% of GDP)**

<table>
<thead>
<tr>
<th>Industry</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Wholesale</td>
<td>9.4%</td>
</tr>
<tr>
<td>2) Financial Services</td>
<td>8.4%</td>
</tr>
<tr>
<td>3) Healthcare</td>
<td>6.4%</td>
</tr>
<tr>
<td>4) Construction</td>
<td>5.1%</td>
</tr>
<tr>
<td>5) Pharma</td>
<td>3.9%</td>
</tr>
<tr>
<td>6) Consulting</td>
<td>3.0%</td>
</tr>
<tr>
<td>7) Architecture</td>
<td>2.2%</td>
</tr>
<tr>
<td>8) Education</td>
<td>2.1%</td>
</tr>
<tr>
<td>9) ICT</td>
<td>2.0%</td>
</tr>
<tr>
<td>10) Food Industry</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

**Swiss Exports in 2000 and 2014**

- **2000**: 18% Pharma exports, 82% Rest
- **2014**: 18% Pharma exports, 82% Rest

(1) Basel, (2) Lake Geneva area & (3) Zürich-Zug-Lucerne generate roughly 75% of gross value added in Swiss pharma industry.
The Swiss economic situation is characterized by a strong tertiary industry sector, which reflects the high education and salary levels. Pharmaceuticals is one of the main Swiss industries with clusters in Basel and Geneva. There are several pharma-relevant clusters within commuting distance of Basel. Most noteworthy from a supply chain perspective are the close chemicals and medtech clusters in Basel, Bern and the Geneva area.

### Nation Level: Pharma-related Swiss clusters

A success driver of the Swiss economy is the proximity of knowledge intensive clusters.

#### Relevant pharma-related clusters in Switzerland

<table>
<thead>
<tr>
<th>#</th>
<th>Region</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basel Area</td>
<td>Chemicals – Basel’s chemicals cluster originated in the 19th century and, nowadays, is closely connected as a supplier to the local life science hub. Chemical giants like BASF are part of this cluster. Life Science – The Basel area boasts one of the largest life science clusters in Europe. Pharma and biotech combined add about 24% to the local GDP.</td>
</tr>
<tr>
<td>2</td>
<td>Bern Area</td>
<td>ICT – More than 10,000 employees work within the ICT cluster in Bern. This cluster is strongly dynamic due to the strong involvement of the local cluster organizations. Medtech – The medtech cluster in Bern is the largest Swiss medtech cluster with more than 7,000 employees. However, it is dwarfed by the strong medtech clusters of Germany and northern Italy.</td>
</tr>
<tr>
<td>3</td>
<td>Zürich Area</td>
<td>ICT – Like Bern, Zürich boasts an ICT cluster of over 10,000 employees and is supported by the cantonal government and other bridge-building organizations. Financial Services – Both banking and insurance have a rich history in Zürich. Nowadays, the cluster represents one of the financial centers of Europe and accounts for 27.1% of regional GDP. Life Science – Contrary to the Basel cluster, the Zürich life science cluster is focused on biotech. This is a young, emerging cluster.</td>
</tr>
<tr>
<td>4</td>
<td>Geneva Area</td>
<td>Chemicals – The area around Lake Geneva is the largest chemicals cluster in Switzerland. International chemicals giants like Dupont are part of this cluster. Life Science – This life science cluster, branded as BioAlps, boasts both pharma and biotech companies, and a multitude of bridge builders. Financial Services – Focused on private banking and asset management, this Financial services cluster is a valuable source of capital for pharma start-ups.</td>
</tr>
<tr>
<td>5</td>
<td>Eastern &amp; Southern Switzerland</td>
<td>There are no strong pharma-related clusters in Eastern &amp; Southern Switzerland. Many strong industries in these areas are related to agriculture or tourism, due to Alpine landscape.</td>
</tr>
</tbody>
</table>

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*The Swiss economic situation is characterized by a strong tertiary industry sector, which reflects the high education and salary levels. Pharmaceuticals is one of the main Swiss industries with clusters in Basel and Geneva. There are several pharma-relevant clusters within commuting distance of Basel. Most noteworthy from a supply chain perspective are the close chemicals and medtech clusters in Basel, Bern and the Geneva area.*
Nation Level: National Diamond
Knowledge intensive industries such as pharma are fostered by favorable conditions

**Factor Conditions**
- Ranked 4th in GCI in terms of higher education
- Ranked 2nd most attractive country to work in
- 5th highest FDI net inflow worldwide
- Availability of capital through established banking industry
- Low resource endowment as force towards service industry
- Among leading countries in GCI in terms of infrastructure

**Context for Firm Strategy, Structure and Rivalry**
- Country size forces export orientation, which is promoted by FTAs
- Businesses protected by stable law system; IPR protection exceptionally good in international comparison
- Contracting of foreign European talent eased by bilateral agreements with the EU/EFTA; quotas for non-EU/EFTA citizens and increasing difficulty to obtain Swiss work permit

**Demand Conditions**
- High sophistication of demand; ranked 3rd in Human Development Index
- Relatively small country and consequently small home demand
- Geographical location in central Europa and FTAs with EU create large single market
- Cultural diversity of Switzerland and EU; market adjustments of products might be required

**Related and Supporting Industries**
- Historical importance of chemical industry in Switzerland
- Pharmaceuticals and Biotechnology emerged from chemical industry
- Strong transportation industry due to central location in Europe; bridge between the large European economies Germany and Italy
- Proximity to three country spanning BioValley Life Science cluster
- Emerging ICT sector in Zürich and Bern

**Government**
- Long history of FTAs strengthen export business and counteract low resource endowment

**Chance**
- High dependence on EU; current nationalistic trends might impose negative economic effects
Switzerland’s business-friendly environment is favorable for innovation-focused pharma

Strengths
- Stable political system
- Sophisticated industries based on innovation
- Highly-developed infrastructure
- High productivity in workforce
- Efficient capital market
- Highly-educated workforce following strong national education system
- Strong geopolitical positioning in Europe

Opportunities
- Aging populations favoring key Swiss industries (robotics & pharmaceuticals)
- Sophisticated cluster landscape have potential for worldwide recognition (e.g. financial clusters in Geneva and Zürich) – Potential Hollywood
- Transformation towards green energy

Weaknesses
- Little international influence due to size
- High wage and price levels
- Limited labor market
- Land-locked country

Threats
- High dependence on European Union in terms of imports and exports
- Uncertainty of EU’s future
- High energy dependency
- Slowdown of growth in Western markets
- Currency fluctuations
- Closing labor market towards non-EU countries

Switzerland’s business-friendly environment combined with high price and wage levels are favorable for innovation-focused and technology-based companies. However, the dependence on Europe and its uncertain future imposes a large threat on the Swiss economy that is hard to hedge against. Additionally, nationalistic and protectionist trends despite Switzerland’s long open and free trade history can be observed.
The concentration of pharma clusters focusing on innovative medicines is high in Western Europe. The leading pharma clusters are currently located within the major global pharmaceuticals markets. The two US clusters (Boston & SF Bay Area), and the European clusters (e.g. Basel) are world-leading clusters in the fields of innovative drugs, and research and development. During the last century clusters in emerging markets have gained size as well. One example of this is the pharmaceutical cluster in Maharashtra in India. Maharashtra emerged as one of the world’s largest producers of bulk drugs, stressing the demand for cheaper generic drugs in emerging nations.
The industry structure is multidomestic with certain players pursuing global strategies

### Global Market Matrix

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>EU</th>
<th>CN</th>
<th>JP</th>
<th>LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gilead Science</td>
<td>Novartis</td>
<td>Pfizer</td>
<td>Takeda</td>
<td>Sanofi</td>
</tr>
<tr>
<td>2</td>
<td>Johnson &amp; Johnson</td>
<td>Sanofi</td>
<td>Astra Zeneca</td>
<td>Astellas Pharma</td>
<td>EMS</td>
</tr>
<tr>
<td>3</td>
<td>Roche</td>
<td>Pfizer</td>
<td>Bayer</td>
<td>Pfizer</td>
<td>Novartis</td>
</tr>
<tr>
<td>4</td>
<td>Pfizer</td>
<td>Roche</td>
<td>Sanofi</td>
<td>Daachi Sankyo</td>
<td>Pfizer</td>
</tr>
<tr>
<td>5</td>
<td>Novartis</td>
<td>Merck</td>
<td>Roche</td>
<td>Roche</td>
<td>Bayer</td>
</tr>
</tbody>
</table>

### Firm Strategy Matrix

<table>
<thead>
<tr>
<th>National</th>
<th>Multidomestic</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer</td>
<td>Novartis</td>
<td>Roche</td>
</tr>
<tr>
<td>Merck &amp; Co</td>
<td>Sanofi</td>
<td>Pfizer</td>
</tr>
</tbody>
</table>

### Evaluation

When mapping the 5 companies with the highest market share for the 5 largest regions worldwide a total of 13 different players that dominate the industry can be identified. This makes the pharmaceutical industry a multidomestic one. But while only a handful of companies pursue a multidomestic strategy, the majority pursues national strategies.

Certain industry characteristics distort the analysis. Most notably, the industry is highly fragmented and competitive with the Top 10 world market players ranging between 3.1% and 5.8% market share only (see Figure 1). The position in the Top 5 per region is also highly dependent on the innovation pipeline and yearly performance of companies. The composition of the Top 5 changes every year. Gilead Science for example jumped from place 16 in 2013 to place 1 in the U.S. due to the market introduction of one specific drug (Sovaldi – a hepatitis C treatment) that was acquired with the incorporation of Pharmasset for $11.2bn in 2013. One can note that almost all major players pursue at least multidomestic strategies, while in certain regions (e.g. Japan) national strategies seem to work best.

![Figure 1. Top 10 pharmaceutical companies worldwide based on prescription drug market share](image)
Cluster Level: Products & Customer Structure
The main product focus of the Western pharma clusters is patent-protected innovative drugs

<table>
<thead>
<tr>
<th>Products</th>
<th>Customers</th>
<th>Export Markets of Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>By nature, pharmaceuticals are very diverse in what they treat and which effect they have on the patient. Major product groups include for example cancer drugs, antiviral drugs and antibiotics. However, from the perspective of pharmaceutical companies drugs can generally be divided into either patent-protected innovative drugs or generic drugs.</td>
<td>Due to the nature of pharmaceutical products and to patent protections, the final customer (i.e. the patient) often faces a monopoly and has little choice in which drug to acquire. This extends along the supply chain towards pharmacies and hospitals who buy the drugs either directly from the pharmaceutical company or through a wholesaler. Depending on the country, a part of the costs is borne by public or private health insurance.</td>
<td>The Basel cluster exports about a quarter of their products to countries other than Europe, USA or Japan. This is an increase of 9 percentage points in comparison to ten years ago. While the share of pharmaceuticals exported towards those emerging markets is on the rise, the maturing Western markets remain the main export targets of Basel pharma due to their sizes. The dominance of the European market can be attributed to geographical proximity. Drugs targeted towards the US or Japanese market are in many cases produced closer to those markets.</td>
</tr>
</tbody>
</table>

**Patent-protected innovative drugs**
- Chartered by ownership of a patent giving the pharmaceutical company the exclusive rights to produce & sell the drug
- Implies the creation of a temporary monopoly for a certain drug and, by extension, higher prices than in a competitive market

**Generic drugs**
- When the patent protection expires, generic drugs can enter the market which leads to lower prices
- Since no additional R&D is required and companies compete over the price of the products, an efficient production process is crucial

**Pharmacies & Hospitals**
- Act as the main port towards consumer. Both innovative medicines as well as generics are either sold, or directly administered to the consumer
- Can acquire the drugs either directly from a pharmaceutical company or from a wholesaler

**Wholesaler**
- Act as middlemen between pharmaceutical companies and pharmacies or hospitals
- Generally characterized by the large quantities it buys and its warehouse facilities. From a pharmaceutical company’s perspective, dealing with a wholesaler has the advantage of being able to sell in bulk

<table>
<thead>
<tr>
<th>2005</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>54%</td>
</tr>
<tr>
<td>USA</td>
<td>67%</td>
</tr>
<tr>
<td>Japan</td>
<td>11%</td>
</tr>
<tr>
<td>BRIC</td>
<td>7%</td>
</tr>
<tr>
<td>Rest</td>
<td>5%</td>
</tr>
</tbody>
</table>

- The Basel cluster exports about a quarter of their products to countries other than Europe, USA or Japan. This is an increase of 9 percentage points in comparison to ten years ago.
- While the share of pharmaceuticals exported towards those emerging markets is on the rise, the maturing Western markets remain the main export targets of Basel pharma due to their sizes.
- The dominance of the European market can be attributed to geographical proximity. Drugs targeted towards the US or Japanese market are in many cases produced closer to those markets.
Cluster Level: Industry Dynamics

Threat of generics and a lack of innovation have caused sluggish industry growth

### 5 Forces

<table>
<thead>
<tr>
<th>Supplier Power</th>
<th>Raw materials are commodity chemicals, available from numerous sources. Same for research &amp; manufacturing supplies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyer Power</td>
<td>Medical patient lacks power. Insurance company with power towards distributor. Pharmacy and hospital little power if patented.</td>
</tr>
<tr>
<td>Rivalry:</td>
<td>High competition for high-level workers &amp; researchers. Firms merging and big firms buying smaller firms.</td>
</tr>
<tr>
<td>Substitutes</td>
<td>Mainly generics in case of patent run-out; currently weak innovation pipeline. Problem of counterfeit drugs that destroy reputation.</td>
</tr>
<tr>
<td>New Entrants</td>
<td>Many new smaller companies with good ideas and venture capital funding. But: Goal of startup is a sell-out to big Pharma companies.</td>
</tr>
</tbody>
</table>

### Value Chain

<table>
<thead>
<tr>
<th>Drug Discovery</th>
<th>Trials</th>
<th>New Drug Approval</th>
<th>Manufacturing</th>
<th>Marketing</th>
<th>Distribution &amp; Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research &amp; Development Phase</strong></td>
<td><strong>Production Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Can be divided into the R&amp;D phase and the production phase. Pharma companies who focus on innovative drugs usually invest heavily into the R&amp;D phase. This in turn creates competition for highly-skilled researchers. Pharma companies specialized in generic drugs focus on making the production phase more efficient to gain cost-advantages.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Due to continuous product development, pharma's portfolio is changing constantly. Current fields of research involve nanotechnology and tissue re-engineering.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

### Global Market Size

- In 2011 the global pharma market reached the mark of **$1 trillion in sales**. Deloitte expects the market to reach the size of **$1.4 trillion** by 2019. The two largest markets are the North American market with 36% of global pharmaceutical sales and Europe with 28%, but a large share is forecast to come from the emerging markets.
- Relative to other industries, the pharma industry has performed poorly over the last decade (average share price development of pharma companies on par with STOXX Europe 600 Index, but trailing up to 50% behind other industries like utilities or FMCG).

The position of pharmaceutical companies towards suppliers and buyers is, in general, favorable. Threat from new entrants is low as these rather function as a supplier of new product ideas and licenses than as competitors. However, threat from generic products and especially counterfeit products makes the industry unattractive. The high degree of competition from a number of multinational companies continues to decrease profit margins in the industry. Additionally, when looking at the global market size, it stands out that the last years have been characterized by sluggish growth. The threat of the patent cliff and generics, and a decline in pharma innovations have led to this decline in growth (2011-2015: ~5.5% CAGR vs. 2001-2010: ~8% CAGR).
Cluster Level: Regional & Cluster History

The Basel pharma cluster stands at a crossroad that decides about revival or decline.

### 19th century
- 1844: First railway-train reaches Basel
- 1859: Start of syntactic dyes production in Basel; foundation of CIBA
- 1880s: Foundation of Kern & Sandoz by former CIBA employees
- 1885: Start of production of synthetic medicines
- 1896: Foundation of Hoffman-La Roche

### 20th century
- 1904: Beginning of the navigation on the Rhine up to Basel
- 1946: Inauguration of Basel-Mulhouse airport
- 1963: Foundation of Regio Basiliensis
- 1970: Merger of CIBA and Geigy into Ciba-Geigy
- 1993: Foundation of Swiss pharma interest group Interpharma
- 1996: Emergence of Novartis through Ciba-Geigy and Sandoz merger
- 1997: Foundation of Actelion
- 2005: Bayer joins Basel Cluster
- 2010: Emergence of more and more LS start-ups

### 21st century

#### Dynamic:
- Due to the limited size of the local market, a lack of natural resources, and high labor costs, the Basel pharma cluster had to focus on exporting high-value-added specialty pharmaceuticals from an early stage.
- Especially during the second half of the 20th century the Basel pharma cluster witnessed various mergers which created the pharma giant Novartis as a counterpart to Roche. In the 21st century the number of employees of the 10 largest Swiss pharma companies has increased by 80%.

The Basel pharmaceuticals cluster started with the foundation of chemicals companies in the 1850s and 1860s. Only in 1885 synthetic medicines started being produced in Basel. Two main drivers of the emergence of the Basel pharma cluster have been Switzerland’s non-restrictive patent legislation and their location by the Rhine river close to France and Germany. The first Basel chemicals companies (CIBA and Geigy) were established by French chemists who wanted to escape the restrictive French patent system.

From a railway model perspective the consolidation of five large multinationals as main anchors of the cluster combined with the stagnation of growth in the pharma industry have led the Basel pharma cluster to a „train station“.

The strategic decisions made today determine the success or failure of tomorrow. Based on current trends, the right train has to be boarded to continue a track of growth.
Today, a dense network of players and bridge builders explains the success of the cluster.
Cluster Level: Cluster Diamond

The majority of cluster conditions is very positive; Current demand trends impose challenges

**Factor Conditions**
- World class education system with strong Life Science focus
- High level of knowledge creation with high R&D spending and patent activity
- Presence of major European and Swiss chemical companies
- Growing Venture Capital Scene providing start-up funding
- Establishment of state-of-the-art science and technology parks
- High labor costs, but also high levels of productivity

**Firm Strategy, Structure and Rivalry**
- High degree of competition from leading pharmaceutical companies
- Pharmaceutical lobby located in Basel with short communication ways
- War for talents leads to companies competing for the brightest talents from throughout the world; HR strategically important for innovation
- Limited degree of cooperation among large firms
- Start-up sector emerging, but not comparable to Boston or SF Bay Area

**Demand Conditions**
- Highest health care expenditure per capita in the world
- High sophistication of Swiss healthcare system and medical tourism sector
- Aging population in almost all industrialized countries
- Relatively small home market; however, free trade agreements with EU
- Decline in healthcare spending on pharmaceuticals and vaccines

**Related and Supporting Industries**
- Chemical cluster provides production input and allows for SC innovation
- High concentration of Contract Research Organizations for outsourcing
- Emerging biotechnology cluster; blurring borders to pharma companies
- Strong cooperation between research institutes and pharma companies
- Transportation hub due to strategic location in border area

**Government**
- Change in tax system with uncertain effects on companies

**Chance**
- Shift of business model possible
- Shift in industry towards generic pharmaceuticals

- Unfavorable
- Favorable
Cluster Level: Cluster Diamond – Factor Conditions

Input of knowledge by universities and research constitutes main factor conditions

<table>
<thead>
<tr>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human Capital</strong></td>
<td>World class university education provides human for research intensive pharma companies. It also serves as an innovation engine through research findings and start-up spin-offs. However, Basel is behind SF (72) &amp; Boston (68) in the ranking.</td>
</tr>
<tr>
<td>Basel shows an abundance of quality higher education institutions with a strong focus on Life Science. The University of Basel and the ETH Zürich contribute to a high ranking in the Shanghai index (52), only slightly behind London (53).</td>
<td>Favorable</td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
<td>Innovation is a success driver in the industry. Basel seems to outperform other clusters in terms of innovativeness. However, the numbers provided do not account for the concentration of research intensive industries in Basel and their share of GDP.</td>
</tr>
<tr>
<td>Basel shows an exceptional amount of R&amp;D expenditure of 14.1% of the regional GDP, thus clearly outperforming Boston (5.8%) and SF (4.3%). Patent activity is also much higher with 170 Pharma patents compared to 91 and 68 respectively.</td>
<td>Favorable</td>
</tr>
<tr>
<td><strong>Material Supply</strong></td>
<td>The presence of local suppliers such as BASF and Brenntag Schweizerhall allow for close cooperation, the design of more efficient supply chains, knowledge sharing and can be key to innovations on process and product dimensions.</td>
</tr>
<tr>
<td>As part of the BioValley, Basel is in close proximity to suppliers of medical technology equipment and chemical products. Especially the latter is abundant in the area due to the historical development of the chemical industry in Switzerland.</td>
<td>Favorable</td>
</tr>
<tr>
<td><strong>Venture Capital</strong></td>
<td>A vital start-up scene increases dynamism in clusters. Thus, the support for start-ups is important to promote the incentive to start ventures locally. Large firms benefit from the flow of new ideas or by acquiring start-ups and their respective innovations.</td>
</tr>
<tr>
<td>In recent years, more and more venture capital firms have established operations in Basel to fund local start-ups or provide training, facilities and the-like. Additionally, large players such as Novartis and Roche have set up own venture funds.</td>
<td>Favorable</td>
</tr>
<tr>
<td><strong>Infrastructure</strong></td>
<td>Functioning infrastructure is important to secure operations. This can include logistics, electricity supply and international schools for children of employees. Science parks aim to promote innovation by researchers coming together and sharing ideas.</td>
</tr>
<tr>
<td>The infrastructure in Switzerland is ranked among the best in the world. The history of pharma in Basel has lead to the specialization of local infrastructure to its specific needs. In recent years, 7 science parks have opened in the Basel area.</td>
<td>Favorable</td>
</tr>
<tr>
<td><strong>Labor Costs</strong></td>
<td>Labor costs impose immediate financial burdens for large and medium sized companies, but high productivity levels of labor can largely compensate for it in the long-run. However, the high labor cost still represent strong obstacles for founding start-ups.</td>
</tr>
<tr>
<td>Switzerland has the second highest hourly labor cost in Europe. At the same time, Swiss LS employees show the highest level of productivity worldwide with 286,000 US$ p.a compared to 275,000 US$ in Boston &amp; 265,000 US$ in Oresund.</td>
<td>Unfavorable</td>
</tr>
</tbody>
</table>

Factor conditions in the Basel cluster are largely positive and contribute to high dynamism. However, the Basel cluster also has potential for improvement, which is needed to keep track of more innovative clusters such as Boston and SF. Further progress has to be made in the areas R&D and in the start-up sector.
Cluster Level: Cluster Diamond – Demand Conditions

Demand conditions have been favorable, but a decline in spending poses a major threat.

<table>
<thead>
<tr>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health Care Expenditure</strong></td>
<td>This leading position signals high demand and makes the country attractive for companies. It increases competition and the necessity to reinvest profits to stay ahead of competitors in order to fulfill sophisticated demand in western economies.</td>
</tr>
<tr>
<td>Demand conditions have been favorable, but a decline in spending poses a major threat</td>
<td></td>
</tr>
<tr>
<td><strong>Sophistication of Health Care System</strong></td>
<td>Sophistication forces companies to innovate in order to quickly meet emerging demand. In order to remain attractive for medical tourism newest medical care has to be provided, increasing the demand and incentive for innovative products.</td>
</tr>
<tr>
<td>The Swiss health care system was assigned high quality, high patient satisfaction and one of the longest life expectancies in the world. Furthermore, it is attractive for medical tourism; it is the 2nd largest health &amp; wellness tourism market in Europe.</td>
<td></td>
</tr>
<tr>
<td><strong>Demography</strong></td>
<td>Demographic trends increase the demand for pharmaceutical products and increase attractiveness and competition in the market segment for elderly healthcare. However, these trends are not limited to the Basel cluster.</td>
</tr>
<tr>
<td>The LS sector is expected to grow in the future, especially due to aging populations in western economies as the main long-term growth driver; the growth rates in population over 65 years from 2014 to 2019 in Western Europe is expected to be 21%.</td>
<td></td>
</tr>
<tr>
<td><strong>Size of Home Market</strong></td>
<td>However, due to its strategic location in central Europe and a bilateral free trade agreement with the European Union from 1972 the ‘home market’ currently has a population of over 500 million, forcing Swiss companies to compete internationally.</td>
</tr>
<tr>
<td>Despite active medicine tourism and a highly sophisticated medical sector the Swiss home market is relatively small with a population of 8.3 million, comparable to Denmark (5.7 million), Austria (8.5 million) and Sweden (9.8 million).</td>
<td></td>
</tr>
<tr>
<td><strong>Health Care Spending Trends</strong></td>
<td>The rise of generics represents a threat for Swiss companies. The long R&amp;D process of drugs forces companies to get innovations from outside-in. However, innovation from start-ups and research institutes is comparably scarce in the Basel cluster.</td>
</tr>
<tr>
<td>Health care spending on pharmaceuticals and vaccines declined in the past years in many OECD countries. This can be largely attributed to budget cuts in the health care sector, the run-out of patents and the resulting rise of generic products.</td>
<td></td>
</tr>
</tbody>
</table>

Demand conditions have a slightly positive tendency; especially, trends in the demography and the consideration of Europe as a ‘home market’ are favorable. Nevertheless, current trends pose a risk to the Basel cluster. The rise of generics, decreasing profit margins and the long development time of drugs harm the competitiveness of Swiss pharma companies, which currently lack strong innovation pipelines. As the ability to spin-in innovation in the Basel cluster is rather limited compared to other pharma clusters with higher research and startup activity, the innovativeness of the cluster is in danger.
## Cluster Level: Cluster Diamond – Firm Strategy, Structure & Rivalry

A major drawback of the cluster is the lack of a sophisticated start-up culture

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>The headquarters, manufacturing and/or R&amp;D facilities of leading European and global pharmaceutical companies are located in the Basel region. This includes for example Novartis, Roche, Boehringer Ingelheim, Bayer and Actelion.</td>
<td>High comparability of core activities and agglomeration of companies that operate in similar markets – especially Novartis and Roche – leads to high degrees of competition and thus high pressure to be innovative.</td>
</tr>
<tr>
<td>Switzerland ranks among the countries with the highest labor costs worldwide. However, this also signals the quality of the job market. Currently Switzerland is ranked after the U.S. as the 2nd most attractive country to work in.</td>
<td>The war for talents in Basel contributes to further increasing the attractiveness of the Swiss job market. Apart from attracting talent from high ranked local universities, Switzerland will also remain attractive for foreigners.</td>
</tr>
<tr>
<td>The interest/lobbying organization Interpharma is located in Basel. Interpharma handles PR issues, lobbies for strengthening IPRs and decreasing trade barriers. It also aims to strengthen the research and pharmaceutical site Switzerland.</td>
<td>Lobbying efforts were quite successful in the past, including the relocation of the systems biology department of ETH Zürich to Basel. Especially the strong focus on research might be beneficial in increasing the cluster innovativeness in the future.</td>
</tr>
<tr>
<td>Due to the nature of the industry with firms competing for innovation and establishing a patent protected monopoly, cooperation among the pharmaceutical companies is limited to areas such safety, environmental protection and lobbying.</td>
<td>Nevertheless, large pharmaceuticals cooperate with other players in the cluster such as local suppliers, research institutes, biotech companies and start-ups. There are also indirect knowledge spillovers through employee mobility.</td>
</tr>
<tr>
<td>The majority of startups in the region operates in the LS sector. Just recently PIQUR, a local pharmaceutical startup, was awarded as the best startup in Switzerland. The startup sector is promoted by VCs and funds of large pharmaceuticals.</td>
<td>A rich vital startup scene that builds around innovation can be valuable for large companies through collaboration or spin-ins. However, the Basel region’s start-up environment still lags behind other LS clusters such as Boston or SF.</td>
</tr>
</tbody>
</table>

The high concentration of large pharmaceutical companies increases competition and forces the players to constantly innovate. However, innovation tends to emerge more and more from SMEs and startups in the pharmaceutical industry. In specific, the radical innovations from small, new ventures are limited in the cluster, the innovativeness of the region is low. This problem is further intensified by a lack of product related competition of big pharma companies.
Cluster Level: Cluster Diamond – Relating and Supporting Industries

Due to the history of the cluster a dense network of related industries has developed

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Cluster</strong></td>
<td>Close vicinity enables players in the cluster to better coordinate operations along the supply chain and work together on process and product related innovations. However, many chemical companies started to relocate towards Asia.</td>
</tr>
<tr>
<td>Chemical commodities are the main manufacturing input for pharmaceutical companies. The region contains numerous potential suppliers, ranging from producing multinationals such as BASF to chemical distributors such as Brenntag Schweizerhall.</td>
<td>The cluster shows the highest number of CROs in Switzerland with more than 50 CROs (out of 186) in commuting distance. This infrastructure allows to outsource clinical research to specialized providers that are faster and offer higher quality.</td>
</tr>
<tr>
<td><strong>CROs</strong></td>
<td>The biotechnology cluster in Basel competes with clusters in the U.S., the UK, Germany and Scandinavia. As the use of biotechnology in pharmaceutical R&amp;D increases, the cluster can serve as an important source of innovation.</td>
</tr>
<tr>
<td>Global trends in the pharmaceutical industry include the fragmentation of value chain activities and outsourcing of prior insourced activities to specialized providers. Research and clinical trials for example are often outsourced to CROs.</td>
<td>University research provides new insights and findings that might be outside immediate commercial use, but still valuable in the sector. However, in R&amp;D spending in absolute terms is clearly not comparable to the competing clusters.</td>
</tr>
<tr>
<td><strong>Biotechnology Cluster</strong></td>
<td>In 2011 the cluster initiative Logistikcluster Region Basel was founded to promote Basel as a transportation hub. Local companies benefit from the dense network, reaching customers in all over Europe and many parts of the world.</td>
</tr>
<tr>
<td>The border of the biotechnology industry to the pharma industry, where the use of biotechnological processes for manufacturing becomes more and more common (e.g. use of E. coli to produce human insulin) are currently blurring.</td>
<td>In terms of supporting industries, the Basel pharmaceutical cluster can benefit from the emerging biotechnology cluster; these two areas tend to merge more and more, allowing for collaboration and innovation spillovers used in both industries. As mentioned before, innovation is a vital point in every pharmaceutical cluster. While relative numbers indicate the strength of the Basel region, absolute numbers indicate a lack of innovativeness compared to SF and Boston.</td>
</tr>
<tr>
<td><strong>Research Institutes</strong></td>
<td></td>
</tr>
<tr>
<td>Private research by companies contributes the lion share of R&amp;D (93%). The remaining 7% are investments by university research institutes. The investment accounts for 1% of the regional GDP (compared to 1.2% in Boston and 0.3% in SF).</td>
<td></td>
</tr>
<tr>
<td><strong>Logistic Cluster</strong></td>
<td></td>
</tr>
<tr>
<td>Basel is often referred to as the “gate to Switzerland” in terms of passenger transportation and cargo with a strategic position in central Europe and connections through motorways, railways and the EuroAirport Basel-Mulhouse-Freiburg.</td>
<td></td>
</tr>
</tbody>
</table>
Cluster Level: Cluster Diamond – Government & Chance

The rise of generics is the largest threat for the cluster, pushing it towards decline.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Taxation</strong></td>
<td>For a long time the low corporate tax rates of Switzerland were one of the main reasons for businesses to go there. 68% of respondents in a KPMG study stated that the low tax rate was one of the reasons for them to go to Switzerland. 63.</td>
</tr>
<tr>
<td><strong>Business Model Innovation</strong></td>
<td>Strong pressure for cost reduction due to increasing regulations, spending control of governments and the rise of generics force pharma companies that base success on patent-protected monopolies to change their business models.</td>
</tr>
<tr>
<td><strong>Trend towards Generics</strong></td>
<td>The industry currently shows high pressure from declining governmental spending on drugs, introduction of spending control measures in emerging markets and tightened regulatory requirements that all increase effort and costs of pharmaceutical companies. At the same time the industry pipeline does not hold sufficient innovation in order to compensate for these developments. 64.</td>
</tr>
</tbody>
</table>

The underlying changes in the tax system might decrease the attractiveness of Switzerland for corporations. But industry trends such as decreasing profit margins and the shift towards generics are more threatening to the cluster. It imposes high pressure on the companies that almost have to shift their business models to enhance competitiveness by either finding a market niche (e.g., personalized or digital medicine) or being a first mover in effective value chain fragmentation.
Cluster Level: 7 Cluster Gap Model

The disconnection with ICT clusters is the main obstacle towards a revival of the cluster.

**Firm-to-Firm**
- “Anchors” Roche & Novartis interact mainly through competition on innovations or HR
- SME’s and start-ups show no gap in interactions, mostly due to the establishment of joint networks and the efforts of bridge builders like the cluster initiative
- Additionally, the “anchors” support start-ups with venture capital

**Firm-to-Capital**
- The connection between firms and capital providers is strong
- Anchor players are part of the Swiss Market Index (SMI)
- Basel pharma start-ups have a number of possible sources for venture capital; „Anchors“, as well as the cantonal banks and private venture capitalists close the gap between cluster firms and capital.

**Firm-to-Global-Markets**
- Switzerland is closely integrated into the world economy; its economic structure is characterized by its pronounced outward orientation
- Consequently, the constant improvement of access to foreign markets represents a core objective of Swiss foreign economic policy
- This is represented by their 39 FTAs, and increasing exports of the Basel cluster into the world markets

**Firm-to-Research**
- As research is core to the pharma industry, a significant part of research happens within firms
- Co-operation with University of Basel, ETH Zürich, and FHNW facilitate a high level of innovativeness within the cluster
- Innovativeness gets amplified by the Basel start-up incubator, the technology park Basel, and the Swiss innovation park, supported cluster participants

**Firm-to-Education**
- Firm-to-education-gap is minimal
- Co-operations, common research projects, and guest lectures with University of Basel, ETH Zürich, and FHNW are indicators of a largely closed gap
- These strong ties can be explained by the positive incentives both sides have to collaborate: Pharma firms gain access to highly-skilled HR, while universities gain, among other things, financing

**Firm-to-Public**
- No gap between the firms of the Basel cluster and the cantonal or federal government authorities
- On the contrary, many governmental bodies (chamber of commerce or canton) actively support the cluster in its development
- They establish the necessary innovation infrastructure, engage in lobbying and create initiatives for better cross-firm communication

**Firm-to-Cluster**
- Strong ties towards the connected clusters relevant for the pharma supply chain (i.e. chemicals and medtech) in Basel, Bern and Zürich.
- Additionally, organizations like BioValley connect Basel’s pharma cluster internationally to the LS clusters in southern Germany and eastern France
- There is a significant gap towards the Swiss ICT clusters (lack of forums and research projects

Basel’s pharma cluster is very well-connected. Due to positive incentives to collaborate, the gaps between the cluster firms and research, education, public authorities and capital providers are especially well-bridged. Additionally, Switzerland’s dependency on the global market drives a constant governmental effort to bridge any gap between Basel and the global markets. Due to the nature of Novartis’ and Roche’s relationship as competitors, interaction between them mainly takes the form of competition. However, their interactions with the start-ups reach the extent of investing in them. Due to common platforms start-ups interact frequently with each other. One large gap is between Basel’s pharma firms and the ICT clusters in Bern and Zürich. Unlike, the SF cluster, that has Silicon Valley in front of their doorstep, Basel currently does not utilize close ICT clusters as a source of technical innovations.
Cluster Level: Performance
Basel’s growth is stagnating in spite of strong innovativeness, due to industry trends

**Gross value added over time**

- Similarly to the cluster dynamism, the cluster performance measured in nominal gross value added (NGVA) has started to stagnate over the last decade.
- While the NGVA has tripled over the past 19 years, the largest fraction of this growth occurred in the period between 1997 and 2007 after the merger of Ciba-Geigy and Sandoz into Novartis, and the foundation of rare diseases drug specialist Actelion.
- The overall slowdown of cluster performance growth is comparable to the overall development of the global pharmaceuticals industry (i.e. a decrease of growth towards ~4% p.a.)

**Static advantages**

- In terms of competitiveness, Basel’s advantageous access to a highly-educated workforce stands out. Within commuting distance, Basel’s pharma cluster can access a multitude of universities and research facilities in the Basel, Bern and Zürich areas.
- The country’s stable environment in combination with a business-friendly tax system increases Basel’s competitiveness. This is reflected in the competitiveness report of the World Economic Forum where Basel scores in the top 11 of all basic requirements.
- Switzerland’s relatively high labour costs and small domestic demand negatively impact the Basel cluster’s competitiveness from a static perspective.

**Dynamic advantages**

- In terms of innovativeness, on the other hand, Basel’s pharma cluster benefits from the relatively high labour cost, since it attracts highly-skilled researchers from other areas and forces pharma companies to be efficient in their use of human resources (signified by the highest relative productivity for any life science cluster with $282,000).
- Basel’s small Swiss home market forces them to be successful across borders leading to partnerships in Europe, the US and emerging markets.
- Another long-term positive driver leading towards more innovativeness is the Swiss focus on tertiary industries and more specifically research. This is reflected in the global competitiveness ranking of the World Economic Forum where Switzerland is consistently ranked first in terms of business sophistication and innovation.

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Cluster performance in nominal gross value added (NGVA) over time.
### Cluster Level: Cluster benchmark – An overview

Basel is the most important European cluster, but boasts fewer large players than US clusters.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Market position</th>
<th>Approximate # of employees</th>
<th>Main players</th>
<th>Cluster focus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boston</strong></td>
<td>Globally leading cluster</td>
<td>74'000</td>
<td>Novartis, Merck, Takeda, Pfizer, Bayer, Roche, Johnson &amp; Johnson, Sanofi, Boston Scientific</td>
<td>Mainly innovative medicines, but also generic drugs. Additionally, massive biotech cluster.</td>
</tr>
<tr>
<td><strong>Basel</strong></td>
<td>European leading cluster</td>
<td>25'000</td>
<td>Novartis, Roche, Actelion, Bayer, Boehringer Ingelheim, Basilea, Vifor Pharma, Johnson &amp; Johnson</td>
<td>Mainly innovative medicines, but also generic drugs. No general product focus due to size of cluster</td>
</tr>
<tr>
<td><strong>Øresund</strong></td>
<td>European leading cluster</td>
<td>22'000</td>
<td>Novo Nordisk, LEO Pharma, Baxter Gambro, Lundbeck, AstraZeneca</td>
<td>Focus on oncology, nervous system and immunology for drug compound development</td>
</tr>
<tr>
<td><strong>Flanders</strong></td>
<td>European leading cluster</td>
<td>52'000</td>
<td>Pfizer, Novartis, Roche, Boehringer Ingelheim, Bayer, Merck, Actelion, Boston Scientific, Google</td>
<td>Mainly innovative medicines, but also generic drugs. Especially biopharma</td>
</tr>
<tr>
<td><strong>Cambridge</strong></td>
<td>Smaller European cluster</td>
<td>5'000</td>
<td>AstraZeneca, Pfizer</td>
<td>Numerous local SME’s (93% of cluster participants have less than 250 employees. Additionally, boasts Europe’s largest hospital network</td>
</tr>
</tbody>
</table>

### Evaluation

The analysis makes it obvious that there is no central European pharma cluster. In Europe, Basel is currently the leading pharma cluster. A major strength includes the location of Roche’s and Novartis’ headquarters in Basel. The main competing European clusters are Øresund and Flanders. Øresund is home to the major growing Nordic pharma companies while Flanders is popular with many of the globally operating MNCs (e.g. J&J, Bayer, Novartis). Cambridge, on the other hand, is the main cluster for AstraZeneca and many local SME-like research labs, fueled by their location close to major universities. The American clusters outsacle the Basel pharma cluster by a wide margin and host all global MNCs including Novartis and Roche.
Cluster Level: Cluster benchmark

Basel is innovative in relative terms but lacks behind the US clusters by absolute numbers

<table>
<thead>
<tr>
<th>Basel Area</th>
<th>Boston Area</th>
<th>SF Bay Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered pharma patents per million inhabitants</td>
<td>170</td>
<td>91</td>
</tr>
<tr>
<td>Total number of registered pharma patents</td>
<td>82</td>
<td>431</td>
</tr>
<tr>
<td>Productivity of Life Science Industry (Nominal GVA per employee in $t PPP, 2012)</td>
<td>282</td>
<td>275</td>
</tr>
<tr>
<td>Total Productivity of Life Science Industry (Nominal GVA in $bn PPP, 2012)</td>
<td>7.1</td>
<td>20.4</td>
</tr>
</tbody>
</table>

The fact that Novartis and Roche have their headquarters in Basel combined with the relatively small population of the Basel area (i.e. ~480,000) leads to an extremely high density of pharma-related patents and innovation within this part of Switzerland. However, when we multiply the number of patents per million inhabitants with the respective populations (Boston area: ~4,730,000, SF Bay Area ~7,650,000) the differences between the large US clusters and the smaller Basel cluster become apparent. The Basel area’s productivity is also comparatively high in relative terms. It could be argued that, due to the higher labor costs in Switzerland, this cluster was forced to use their human resources more efficiently which in turn results in a higher productivity. However, the GVA lacks behind the larger US clusters in absolute terms.
Cluster Level: Industry Trends
Cluster trends stress the need for more innovation & connection between pharma and tech

New Cluster Participants
In the last two decades two new major players (both multi-billion dollar companies) have entered the cluster in Actelion and Bayer. While Bayer entered the cluster through the acquisition of the consumer care division of Roche, the rare diseases drug specialist Actelion grew organically within the cluster. Additionally, university-based start-ups have been adding to the growth and potential of the cluster. A disproportionate share of Basel start-ups are focusing on Life Sciences (50%)74.

Digitalization of Pharma
The digitalization of pharma gives the industry the opportunity of more intensive research and technological innovations77. For the Basel cluster, this trend also stresses the need for a connection to local ICT clusters in Bern and Zürich with the pharma cluster in Basel. While other clusters like SF Bay Area are well-connected with their tech counterparts in Silicon Valley, Basel lags behind in that regard. Not following the trend of increased interconnectedness of pharma and technology imposes the threat of being a late follower and having competitive disadvantages in the future.

Demand shift towards emerging markets
The two largest pharma markets are the North American market with 36% of global pharmaceutical sales and Europe with 28%. For the past years, the emerging markets have played an increasing role in the generation of growth. Between 2010 and 2015 ~67% of global pharma growth originated in emerging markets. This trend is expected to continue over the next years. Two reasons for this are the economic growth in the emerging markets and patent expirations in maturing markets44.

Patent Cliff
The patent cliff is especially problematic for the two largest established players in the Basel cluster. 2016, Novartis has lost the patent protection for the cancer drug Glivec which produced sales of $3.4bn during three quarters in 2015. Through product diversification Roche stayed more immune towards the patent cliff, but is facing a decrease of revenues as well78. A well-known antidote against the patent cliff is to improve the innovation pipeline and ensure a steady flow of new drugs.

The future holds a number of hurdles for the Basel pharma cluster. While the challenge of the patent cliff is becoming a headache for pharma companies, the digitalization of the healthcare industry and the growth shift towards emerging markets offers opportunities. On one hand, when mastered, both the connection of ICT and pharma, and the rising demand in emerging markets can lead to a competitive advantage of the Basel pharma cluster. On the other hand, should the challenges not be mitigated, the cluster risks falling behind. The key question is whether the Basel pharma cluster can leverage the opportunities of increasing digitalization, growth in emerging markets and new cluster participants while mastering the patent cliff and tackling the issue of maturing Western market.
### Firm Level: Novartis International AG

Basel is home to internationally successful companies such as Novartis

### General Information

- Novartis was established in 1996 through the merger of Ciba-Geigy and Sandoz\(^7^9\)
- Headquarter in Basel, Switzerland
- 2nd largest pharmaceutical company in the world in terms of revenues
- In 2014 Novartis employed over 130,000 people in different sites around the world\(^8^0\)
- From 2007 to 2011 revenues of Novartis increased with a CAGR of 8.0\(^8^1\) slightly above industry growth (CAGR of 7.3\(^8^2\))
- When growth in the industry started to slow down, Novartis’ revenues also stagnated; the drop in 2015 is attributable to the spin-off of OTC and consumer health division

### Strategy

“Our strategy is to use science-based innovations to deliver better patient outcomes”

**Products** – Following a corporate restructuring towards being a focused provider of innovative medicine, Novartis product portfolio includes **pharmaceuticals, generics and eye care**, which is reflected in the corporate structure\(^8^3\).

**Innovation** – A core pillar of Novartis’ strategy is **science-based innovation**. Novartis aims to completely fund R&D with internally generated resources and in 2013 invested 15.3\(^8^4\) of its revenues in R&D\(^8^4\), compared to 17.9\(^8^5\) industry average. However, through the company restructuring the number increased to 17.7\(^8^5\) in 2015. The ration of in-house produced to licenced drugs is approximately 70:30\(^8^6\).

**Growth Areas** – Novartis operates at a **global scale** and aims to further focus on growth areas in the health care sector. The company is currently among the Top 5 pharma companies in the U.S., Europe, Latin America and are also present in China and Japan. Novartis aims to further **strengthen presence in emerging markets** were demand becomes more sophisticated\(^8^7\).

### Corporate Structure

- Innovative medicine with high research focus and mostly innovative and patented drugs
- Sandoz is a provider of generic pharmaceuticals
- Alcon responsible for eye care\(^8^8\); acquired in 2010\(^7^9\).
Firm Level: Novartis History and Competitiveness

Novartis performs stable and ranks high in a competitive industry

Performance Evaluation

When looking at the stock price, one can observe stability from the late 1990s until 2011, indicating a good performance in a very competitive and growing industry. Even during the financial crisis the stock price did not drop significantly. Starting in 2011 the stock price of Novartis increased to its all-time peak in 2015 as increasing specialization towards pharmaceuticals, generics and eye care through the GSK deal enables more efficient R&D and therefore promises increasing profit margins.\(^{90}\) Switching from Novartis’ suffering vaccine business towards their strong performing cancer business was appreciated by investors.\(^{91}\) However, profit margins did not improve and corporate restructuring in 2016 led to a decrease in the stock price.
Novartis follows a strict strategy of business specialization towards innovative pharmaceuticals, generics and eye care and a geographical diversification trend of research & development. These strategic decisions, taken early on since the company’s foundation largely bind Novartis direction for the future as a diversification would require time and a large amount of capital. However, similar business specialization trends can be observed throughout the industry.

**R&D Approach**

While the focus on certain product categories makes sense from a business perspective, as narrowing on fewer research areas comes with more efficiency and reduced R&D expenditure / costs, the geographical dispersion of R&D activities as such is of special interest. Even though the company is headquartered in Basel, R&D centers are spread around the globe. Novartis had formed the Novartis Institutes for BioMedical Research Network (NIBR), consisting of 7 research facilities and being headquartered in another pharma cluster than Basel – Cambridge, Massachusetts, U.S.). To understand the strategy of geographical dispersion of research centers Novartis’ and its rivals’ approaches towards R&D and implications for the Basel cluster have to be analyzed more closely.

**Strategic Lock-In**

Novartis follows a strict strategy of business specialization towards innovative pharmaceuticals, generics and eye care and a geographical diversification trend of research & development. These strategic decisions, taken early on since the company’s foundation largely bind Novartis direction for the future as a diversification would require time and a large amount of capital. However, similar business specialization trends can be observed throughout the industry.

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**Business Specialization vs. Research Diversification**

**Firm Level: Novartis Strategy from a Railway Model Perspective**

Novartis focused early on innovative pharma and diversified R&D

1996

Foundation of Novartis

Business Track

1997

Spin-off of chemistry business and focus on new industries

1999

Spinoff of agro-chemicals, food & drinks

2000

Investments into Pharma, Generics & Ophthalmology

2003

Rebranding Generics into Sandoz

2004-2009

Several acquisitions with health care focus

2014

GSK deal; swap vaccine vs. cancer business

Research Track

1999

Foundation of GNF in San Diego, California, U.S.; later part of NIBR network

2002

Creation of NIBR in Cambridge, MA, U.S. & the NITD in Singapore

2006

Foundation of research center in SF Bay Area as part of NIBR network

2007

Foundation of research center in Shanghai as part of NIBR network

2015

State-of-the-art campus in Cambridge and Shanghai

2016

Relocation of research activities from Singapore to Cambridge and Basel
Firm Level: Novartis Global Operations
Research Locations spread around the globe, located in major clusters

Industry Standard
Similar to many leading players in the pharma industry, Novartis applies a global R&D strategy by forming and connecting research hubs across important Life Science clusters around the world. The reason behind globally dispersed R&D is the belief that a single company can never fully understand the complexity of human diseases and that collaboration with different stakeholder groups – that are spread across the globe – is essential to be innovative.

Conclusion
This also reveals that there can never be a single Hollywood Cluster in the Pharma industry with global importance. On the contrary, one can observe that the majority of pharma companies is present in many regions worldwide.

Implication
For the Basel cluster, this implies that competing clusters are other European clusters such as Flanders, Øresund and Cambridge (UK). SF and Cambridge (US) are rather potential allies towards a global pharma cluster of innovation.
**Firm Level: Novartis Interaction in the Cluster – 7 Gap Model**

In the Basel cluster Novartis closes main gaps, except for the one to ICT

<table>
<thead>
<tr>
<th>Firm-to-Firm</th>
<th>Firm-to-Research</th>
<th>Firm-to-Education</th>
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</table>
| • Inter firm collaboration limited to areas as health & safety, education and lobbying, due to strong competition in core product segments  
  • However, competition fosters the war for talents and employee mobility leads to knowledge spillovers between firms  
  • Cooperation with start-ups through venture fund  
  • Among suppliers are many local and national SMEs | • Historical connection to research institutes: 1970 establishment of Friedrich Miescher Institute with the aim to bring together Novartis’ and public research strength  
  • Furthermore, board members of the company are professors at local universities  
  • Novartis maintains alliances with over 300 academic institutions, locally and internationally | • Offering tailored education programs in cooperation with higher education institutions such as the University of Basel (Next Generation Scientist (NGS) program) and the Novartis International Biotechnology Leadership Camp  
  • Personal sponsoring of talents aims at professional development towards careers in the pharmaceutical industry |

<table>
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<tr>
<th>Firm-to-Capital</th>
<th>Firm-to-Public</th>
<th>Firm-to-Cluster</th>
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</table>
| • Listed at stock exchange  
  • Capital is provided by equity and regular debt capital from banks  
  • Novartis has a comparably high and stable credit rating at major rating agencies such as Fitch, S&P and Moody’s | • Public relations handled by local public affairs office  
  • Striving towards constructive dialogue with policy makers and trade associations; Novartis even contributes financial resources if this is allowed under local regulations  
  • Member of the pharma interest group Interpharma, located in Basel | • Globally connected to other important pharma clusters such as Cambridge (U.S.), SF and Shanghai  
  • Connection through other local clusters either via business relationships or the BioValley Cluster organization  
  • No information can be found about connections to Swiss ICT clusters, but Novartis plans to introduce a digital health strategy in 2017 |

| Firm-to-Global-Markets | | |
|------------------------| | |
| • According to the Stairway Model classified as a multidomestic company  
  • However, Novartis generates sales in almost all markets worldwide and is currently expanding global reach through emerging market strategy | | |

Novartis is well connected in the Basel cluster due to its history and the established “anchor” status, using its vast resources, reputation and best practices to keep gaps to important actors as close as possible. Novartis and other big pharma companies shape the picture of the cluster, which is why the firm-level analysis of the 7 gaps only varies slightly to the cluster-level analysis. However, through the analysis important information towards the importance of the cluster in a worldwide context can be inferred. (1) While the cluster is innovative, current stagnation endangers its ranking among major European pharmaceutical clusters. (2) Especially the future outlook is not promising when considering emerging trends in digital healthcare. (3) Thus, to remain innovative and maintain importance, gaps to local and international ICT clusters have to be closed.
Policy Recommendation: Hollywood Model

The global pharma industry has no definite Hollywood, but regionally important clusters

- No definite Hollywood in the pharma industry
- There are places where every company has to be present in order to be successful (e.g. Cambridge)
- But presence in other clusters is of vital importance for pharma companies to be competitive and successful

- Therefore, a single cluster with Hollywood will never dominate the pharma industry alone
- There will rather be competition for regional Hollywood status, e.g. in central Europe, to attract firms to include the respective cluster into the global R&D network
- An adaption of the Hollywood Model is recommended

The Bollywood Model

In a knowledge-based industry where innovation is a key success driver, it is no longer sufficient to be present in one single successful cluster. Rather than having a Hollywood Cluster, these industries have several clusters with regional importance, similar to what Bollywood is in the Film-Industry. But on the contrary to film-making firms have to diversify operations, especially R&D, across the globe by establishing research centers in different clusters, where the interconnectedness gives rise to Super Clusters of innovation99, characterized by intense knowledge sharing of locally generated ideas.

The analysis with the Bollywood Model reveals that clusters such as San Francisco, Cambridge (U.S.) and Shanghai do not compete with Basel, but represent potential allies. Basel rather competes with European Clusters such as Flanders, Øresund and Cambridge (UK) to attract companies.

In every of the European clusters, locally founded companies have headquarters or major subsidiaries therein. Furthermore, some international players settled down in the clusters. As local players are largely bound by heritage and high investment in facilities (Railway Model) attracting international players and start-ups needs to be the major goal for the Basel cluster in order to remain its competitiveness and innovativeness.
A SWOT analysis of Basel’s pharma cluster shows the need for policy intervention to address the threat of falling behind major U.S. clusters in terms of innovation and access to technology. Weaknesses like the comparatively small start-up scene and the cluster gap towards Swiss ICT clusters need to be countered in order for Basel’s pharma cluster to stay competitive in the fight for being Europe’s main pharmaceuticals cluster and to avoid irrelevancy in comparison to Boston and the SF Bay area.

### SWOT Analysis of Cluster

**Strengths**
- Business-friendly environment
- Availability of capital, suppliers, education and research within cluster
- Strong locally originated cluster participants (e.g. Novartis & Roche) with global reach and importance
- High levels of cluster innovativeness
- Very few cluster gaps

**Opportunities**
- Digitalization: Opportunity of more intense research and technological innovations that disrupt the healthcare industry
- New cluster participants: Emergence of university-based start-ups
- Demand growth and sophistication in emerging markets

**Weaknesses**
- Comparatively small cluster start-up scene
- Cluster gap towards Bern and Zürich ICT clusters
- Small cluster size in comparison to US clusters
- Low importance for non-local; only few foreign Big Pharma companies (Johnson & Johnson; Bayer)

**Threats**
- Digitalization: Threat of falling behind major US-clusters with better start-up base and better access to technology
- Stagnating demand in Western markets
- Patent cliff threatening revenues of the cluster’s big pharma companies

All cluster participants need to fulfill their tasks to ensure the cluster revival

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**Strategy**

"Leverage the digitalization of healthcare and the increasing sophistication of emerging markets, and establish Basel as Europe’s prime pharma start-up hub!"

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### Create start-up branding concept

- **What**: To increase Basel’s pharma start-up footprint, local institutions develop a branding concept that promotes Basel Europe-wide as the main pharma start-up hub boasting venture capital, incubators, and large pharma giants
- **By whom**: Cantonal Government, chamber of commerce

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### Establish Swiss Cluster organization

- **What**: To connect technology and pharma a local cluster organization, similar to the BioValley (e.g. DigiValley) needs to be established, organizing joint communications platforms, symposia and workshops for tech and pharma companies
- **By whom**: Trade associations, Basel cluster organizations

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### Launch joint university research programs

- **What**: To boost the creation of innovations in the area of digital healthcare, joint ICT/pharma workshops, seminars and research projects are launched in a collaboration of cluster organizations, big pharma and universities
- **By whom**: Universities, research institutes, Basel cluster organizations, local ICT cluster, big pharma

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### Create differentiated targeting strategies

- **What**: A strategy for developed and emerging markets respectively is developed. Thereby, the differences in demand and industry trends are taken into consideration (Developed markets: digitalization of healthcare vs. emerging markets: sophistication of demand)
- **By whom**: Big pharma

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### Ensure effective market access to EM

- **What**: To ensure that Basel’s pharma companies can access the growing emerging markets effectively, the reduction of tariffs and other trade barriers is a focus of the federal government and Interpharma
- **By whom**: Federal government, Interpharma
Policy Recommendation: Adjusting the Diamond
The Basel Cluster Strategy 2017 will improve factors on all four sides of the Diamond

**Factor Conditions**
- **Easier sourcing of innovation**: Branding Basel as the prime European pharma start-up hub leads to an influx in pharma-related start-ups being founded in the cluster. This, in turn, facilitates big pharma's sourcing of innovations through partnerships with or acquisitions of start-ups.

**Firm Strategy, Structure and Rivalry**
- **Increased competition**: Pharma start-up branding leads to more cluster dynamism in the form of an influx in pharma-related start-ups.
- **Diversified strategy**: Addressing emerging and developed markets through differentiated targeting strategies allows Basel's pharma companies to leverage the respective trends of sophistication of demand and digital healthcare early to avoid falling behind other European clusters.

**Demand Conditions**
- **Improved access to emerging markets**: The lower tariffs and decreased trade barriers enable cluster participants to increase their presence in these growing markets effectively and to leverage the trend of sophisticating emerging markets.

**Related and Supporting Industries**
- **Connected pharma and technology**: Connecting Basel's pharma cluster through symposia, workshops and joint research projects to Zurich's and Bern's technology clusters sets Basel up for successfully tackling the change towards digital healthcare. The responsible cluster organization will manage the partnership of Basel southwards in a similar fashion as BioValley to the north.
Vision 2030

By 2030, a global pharma cluster of innovation has emerged, focusing on high quality patented drugs and digital healthcare. This super cluster includes San Francisco, Cambridge (Massachusetts), Shanghai and Basel. Big Pharma companies like Pfizer, Novartis and Roche have opted to base institutes of their global research networks in all of these clusters in order to leverage promising innovations that arise from high dynamism within these clusters.

Basel has defended its position as the leading European pharma cluster by utilizing trends of higher demand sophistication in emerging markets and the beginning of digital healthcare early on. Private and public research in both fields is on par with its North American and Asian counterparts, related ICT clusters in Switzerland and other parts of Europe constantly provide innovation and firms have learned to leverage the power of clusters by collaboration and open innovation.

The foundation of the DigiValley Cluster Organization in 2017 and the connection through Europe's major Life Science cluster though BioValley created the largest Digital Pharma Cluster in the Europe, Middle East and Africa region.
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