PERSPECTIVES_2012
THE FUTURE OF CHEMICAL AND PHARMACEUTICAL PRODUCTION IN GERMANY
CMF JUNE 19, 2012 – FACILITATED BY DR. MICHAEL REUBOLD, CHEMANAGER
A BUSINESS PERSPECTIVE.

THE FUTURE OF VALUE CREATION IN THE GERMAN CHEMICAL & PHARMACEUTICAL INDUSTRY

Dr. Udo Jung
The Boston Consulting Group
ACHEMA PERSPECTIVES 2012
The future of value creation in the German chemical and pharmaceutical industry

Frankfurt, June 19, 2012

Dr. Udo Jung
Sources of value creation of top-quartile performers in S&P 500

Change in annual TSR (%)\(^1\)

- 1 year:
  - Free cash flow: 30%
  - Multiple: 49%
  - Margin: 62%
  - Profitable revenue growth: 77%

- 3 years:
  - Free cash flow: 32%
  - Multiple: 22
  - Margin: 19
  - Profitable revenue growth: 16

1. TSR= Total return of a stock to an investor (capital gain plus dividends); TSR for top-quartile performers (S&P 500, 1992–2011)
Note: The rolling analysis covers one-, three-, five-, and 10-year time frames from 1992 through 2011. Shows the average of performers in the 75th to 100th percentile to illustrate approximate for the top quartile companies (which would be equivalent to the 88th percentile); analysis excludes financial institutions
Source: Compustat; BCG Value Science Center
However: Growth alone does not automatically create value

Low correlation of growth and TSR\(^1\)

\[(S&P\ 500,\ 1992–2011)\]

Why?

- Growth through value-eroding acquisitions
- Growth that degrades margins and ROI
- Growth that requires too much capital
- Growth that increases risk
- Growth that reduces the P/E

---

1. TSR: Total return of a stock to an investor (capital gain plus dividends)
Source: Compustat; BCG Value Science Center
We are in a two speed world: Asia expected to contribute 45% of global GDP growth until 2025

Asian economies growth compensate for OECD countries underperformance

2010–2025, GDP growth (%)

- India: 5.5%
- China: 5.2%
- Middle East: 4.6%
- Russia: 4.0%
- World: 3.9%
- Brazil: 3.7%
- USA: 3.5%
- EU-15: 3.4%
- Rest of Latam: 3.1%
- Rest of Asia: 2.8%
- Japan: 2.4%
- RoW: 2.0%

Asia (ex-Japan) accounts for 45% of overall GDP growth until 2025

2010–2025, GDP growth (Trillion US$)

- China: 4.6 trillion US$
- Rest of Asia: 7.7 trillion US$
- World: 22.9 trillion US$

Capturing profitable growth in Asia drives business model changes of German chemical and pharmaceutical companies

Note: GDP as $ in Purchasing Power Parity (PPP)
Source: EIU; BCG analysis

Copyright © 2011 by The Boston Consulting Group, Inc. All rights reserved.
More than 60% of the total global demand growth in chemicals until 2030 contributed by Asia Pacific

Source: CEFIC Fact and Figures 2011; various analyst reports; company presentations; BCG analysis
"Pharmerging": Huge growth differential vs. established markets starting from a low base

Global pharmaceuticals demand (€B)

- Pharmerging: 18% (148 billion), 28% growth contribution, 14.4% annual growth rate
- Japan: 11% (+25 billion), 11% growth contribution, 4.8% annual growth rate
- EU5: 17% (-5 billion), 13% growth contribution, -0.7% annual growth rate
- North America: 38% (+30 billion), 33% growth contribution, 1.8% annual growth rate
- Rest of World: 16% (+26 billion), 15% growth contribution, 3.6% annual growth rate

Source: IMS; analyst reports; BCG analysis

Pharmerging countries: China, India, Brazil, Russia, Mexico, Turkey, Poland, Venezuela, Argentina, Indonesia, South Africa, Thailand, Romania, Egypt, Ukraine, Pakistan and Vietnam
EU5 countries: Germany, France, Italy, Spain, UK
North America: USA, Canada

Backup

Growth contribution
- 10% Japan
- 12% Rest of World
- 13% North America
- 65% Pharmerging

Annual growth rate
- 2010: 1,080 billion, 4.8%
- 2015: 2,241 billion, 14.4%
Divergence in demographics: In mature markets 55+ segment drives consumer spending growth until 2030

**US**

**Japan**

**Germany**

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumer spending ($K)</th>
<th>Growth 2008–30</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>2.0</td>
<td>6.1</td>
<td>4.0</td>
</tr>
<tr>
<td>2008–30</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>10.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumer spending ($K)</th>
<th>Growth 2008–30</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.3</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>2008–30</td>
<td>67%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumer spending ($K)</th>
<th>Growth 2008–30</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.2</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>2008–30</td>
<td>86%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>0.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is the implication for German chemical and pharmaceutical companies?

1. Data of Japan excludes expenditure for households with a single person, due to data availability.

Note: spending power evolution forecasted based on historic correlation with GDP, not corrected with potential higher relative savings.

Source: Consumer Expenditure Survey Commissioned by AARP, 2008; Consumer Expenditure Survey, 2008; Japan Statistics Bureau & Statistics Center; Statistische Bundesamt.
5 Year value creation by industry sector

Average annual TSR, 2006-2010 (%)

Sources: Thomson Reuters Datastream; BCG analysis
Value creation of German chemical companies in the global context

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank (n=318)</td>
<td>Rank (n=269)</td>
<td>Rank (n=164)</td>
</tr>
<tr>
<td>Quintile TSR (p. a. in %)</td>
<td>Quintile TSR (p. a. in %)</td>
<td>Quintile TSR (p. a. in %)</td>
</tr>
<tr>
<td>17.9%</td>
<td>18.9%</td>
<td>14.1%</td>
</tr>
<tr>
<td>6.6%</td>
<td>8.7%</td>
<td>6.8%</td>
</tr>
<tr>
<td>-4.6%</td>
<td>2.5%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

1. TSR derived from calendar year data in local currency
Note: Worldwide industry sample based on Thomson Reuters DataStream supersector segment excluding firms not continually listed within the respective timeframe
Source: Thomson Reuters DataStream; BCG analysis

Copyright © 2011 by The Boston Consulting Group, Inc. All rights reserved.
Observations in value creation patterns in the global chemical industry in the past 5 years

Observation

1. Overall Asian chemical companies lead in value creation—especially in base chemicals

2. Agro related chemical businesses with superior value creation

3. Japan with specific challenges in value creation

4. German & European chemical companies with a good track record in diversified and specialty chemicals business models—driven by the ability to manage differentiated business models
Global energy and geopolitical trends create challenges for the European and German based chemical industry

1. Feedstock advantaged countries will continue investing in a scenario of lower gas prices vs. higher naphtha prices
   - No great expectations for cheap unconventional gas in Europe
   - Shale gas revolution in the US reduces European competitiveness in Chemicals

2. Countries will growing Chemicals demand and advantaged feedstock will increasingly drive their own economic development agenda, which includes localization of chemicals supply sources
   - Increase value added to local economies
   - Reduce imports and increase self sustainability

3. For specialty chemicals customer proximity (in emerging markets) provides competitive advantage, thus favoring new capacity in demand centers—successful European chemical companies will have to "localize" their global business models

4. Regulatory pressure on the chemical and adjacent sectors (e.g., power) will lead to increased costs in Europe and a potential reduction of European industry competitiveness

5. Larger and integrated new "megasites" in the Middle East and in Asia copy successful European examples

Are there unique advantages for European based value add in production, innovation and business management?
Asian and Middle East chemical companies gain importance
Global top 10 chemical companies 1980–2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>1980</th>
<th>Chemical sales (B$)</th>
<th>1995</th>
<th>Chemical sales (B$)</th>
<th>2011</th>
<th>Chemical sales (B$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14.1</td>
<td>24.2</td>
<td>79.6</td>
<td>6.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>14.1</td>
<td>22.1</td>
<td>60.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>13.8</td>
<td>21.2</td>
<td>58.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>13.7</td>
<td>18.0</td>
<td>57.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>13.7</td>
<td>17.9</td>
<td>50.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10.6</td>
<td>15.9</td>
<td>50.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>10.0</td>
<td>15.3</td>
<td>38.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8.4</td>
<td>15.1</td>
<td>37.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>7.6</td>
<td>14.5</td>
<td>33.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7.0</td>
<td>13.3</td>
<td>29.6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Several new leaders are part of national economic agendas
"decision making beyond IIR and quarterly reporting"

Note: Asian and Middle East companies in orange boxes
Source: Chemical and Engineering News, ICIS Top 100, Chemical Week; Company websites; BCG analysis
Many factors influencing the future of the European chemical production base

Overview of most relevant system dynamics

- European chemical demand
  - GDP-driven
  - Growth of segment “55+”

- Changes in trade balances
  - Asset invests
  - Innovation invests
  - Relocation of decision centers
  - Investment decisions of the chemical industry/companies
  - Perceived as growth regions

- Cluster competitiveness
  - New advantaged capacities in growth regions
  - Raw material differentials
  - European competitiveness in specific segments
  - Invest focus on competitive clusters
  - Exit hurdles non-competitive clusters

- End-industry production and innovation networks
  - Share of new invest into growth regions

- Relocation of networks towards growth regions

- Industry structure
  - Share of foreign asset ownership

- European chemical demand

- Public and political sentiment
  - Share of SMEs
  - Global market position of European-based ChemCos in specific segments

- Perception shaping

Copyright © 2011 by The Boston Consulting Group, Inc. All rights reserved.
European Advantage (I): The competitiveness of chemical sites and clusters in Europe will become even more decisive

<table>
<thead>
<tr>
<th>Region</th>
<th>Size (employees)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheinland-Pfalz (Mainz), DE</td>
<td>40,075</td>
</tr>
<tr>
<td>Düsseldorf, DE</td>
<td>25,284</td>
</tr>
<tr>
<td>Vlaams Gewest (Antwerpen), BE</td>
<td>21,937</td>
</tr>
<tr>
<td>Rhône-Alpes (Lyon), FR</td>
<td>20,361</td>
</tr>
<tr>
<td>Istanbul, TR</td>
<td>18,133</td>
</tr>
<tr>
<td>Darmstadt (Frankfurt am Main), DE</td>
<td>16,250</td>
</tr>
<tr>
<td>Köln, DE</td>
<td>15,928</td>
</tr>
<tr>
<td>Ege (İzmir), TR</td>
<td>10,587</td>
</tr>
<tr>
<td>Münster, DE</td>
<td>9,590</td>
</tr>
<tr>
<td>Cheshire (Chester), UK</td>
<td>9,108</td>
</tr>
<tr>
<td>Nordwestschweiz (Basel), CH</td>
<td>8,549</td>
</tr>
</tbody>
</table>

Value added provided by industrial parks and industry cluster

- **Better access to raw materials** (for chemical industries)
- **Easier movement of final outputs** as inputs to other downstream sectors
- Reduction in **energy footprint** and increased **efficiency**
- Common investment in required **infrastructures** (rail, ports, pipelines, …) reduce investment requirements and minimizes environmental footprint
- Opportunities to **coordinate and cooperate** in key fields (distribution, R&D, purchasing, …)
- Option to leverage **larger scale projects** though associations

A unique "German advantage": cross-industry production, innovation and supply chain clusters—driven by the "Mittelstand champions"
**European Advantage (II): Innovation and orchestration of chemical value chains**

### Feedstock

<table>
<thead>
<tr>
<th>Organic/inorganic feedstock</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td>1 New feedstocks based on gas/coal</td>
</tr>
<tr>
<td>2 New feedstocks based on biomass</td>
</tr>
<tr>
<td>3 Water scarcity and means of alternative energy input</td>
</tr>
<tr>
<td>4 CO₂ as new building block</td>
</tr>
<tr>
<td>5 Noble earth substitution in industrial application</td>
</tr>
</tbody>
</table>

### Technologies

<table>
<thead>
<tr>
<th>Proven technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 White biotechnology</td>
</tr>
<tr>
<td>2 Biomimetic catalysts</td>
</tr>
<tr>
<td>3 Improving bi-processing with GMO</td>
</tr>
<tr>
<td>4 Methane coupling</td>
</tr>
<tr>
<td>5 Process intensification</td>
</tr>
</tbody>
</table>

### Products

<table>
<thead>
<tr>
<th>Low carbon intense products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Energy storages</td>
</tr>
<tr>
<td>2 Leight weighted materials</td>
</tr>
<tr>
<td>3 Organo-electronics</td>
</tr>
<tr>
<td>4 Chemicals for enhanced oil recovery</td>
</tr>
<tr>
<td>5 Active agro ingredients</td>
</tr>
</tbody>
</table>

### Germany has a unique value proposition in cross industry innovation

<table>
<thead>
<tr>
<th>Key R&amp;D topic</th>
<th>Driver and maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source:
145420-34-18-AchemaPräsentation-June18-JF-FRA-RBHS.pptx

**The Boston Consulting Group**

Draft—for discussion only

Copyright © 2011 by The Boston Consulting Group, Inc. All rights reserved.
Value creation of German pharmaceutical companies in the global context

5 years (2007–2011)

Rank (n=306)  Quartile TSR (p.a. in %)

-40 -20 0% 20 40 60

annual TSR1

Novo Nordisk
Biogen Idec
Biotest
AstraZeneca
Pfizer
Morphosys
Novartis
Evotec
Stada

18.5%
5.9%

10 years (2002–2011)

Rank (n=248)  Quartile TSR (p.a. in %)

-40 -20 0% 20 40 60

annual TSR1

Novo Nordisk
Merck KGaA
Bayer
Biogen Idec
AstraZeneca
Novartis
Morphosys
Evotec
Pfizer

13.2%
4.2%

20 years (1992–2011)

Rank (n=90)  Quartile TSR (p.a. in %)

-40 -20 0% 20 40 60

annual TSR1

Novo Nordisk
Biogen Idec
Sanofi
Roche
Bayer
Pfizer
Stada
Astrazeneca
Biogen Idec
Bayer

14.1%
6.8%

1. TSR derived from calendar year data in local currency
Note: Worldwide industry sample based on Thomson Reuters DataStream supersector segment excluding firms not continually listed within the respective timeframe
Source: Thomson Reuters DataStream; BCG analysis
Leading pharma companies emerged from M&A

Note: Only a selection is shown on this slide.
Source: Company webpage; BCG analysis

Legend:
- **Buyer**
- **Target**
- **Year when it happened**

Copyright © 2011 by The Boston Consulting Group, Inc. All rights reserved.
Draft—for discussion only
Pharmaceutical market still dominated by US and EU players
Global top 10 pharmaceutical companies 1980–2011

<table>
<thead>
<tr>
<th>Rank</th>
<th>1980 Pharma sales (B$)</th>
<th>1995 Pharma sales (B$)</th>
<th>2011 Pharma sales (B$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.6</td>
<td>9.7</td>
<td>56.3</td>
</tr>
<tr>
<td>2</td>
<td>1.4</td>
<td>9.6</td>
<td>51.5</td>
</tr>
<tr>
<td>3</td>
<td>1.4</td>
<td>7.8</td>
<td>40.1</td>
</tr>
<tr>
<td>4</td>
<td>1.2</td>
<td>7.7</td>
<td>39.3</td>
</tr>
<tr>
<td>5</td>
<td>1.2</td>
<td>6.8</td>
<td>37.0</td>
</tr>
<tr>
<td>6</td>
<td>1.1</td>
<td>6.5</td>
<td>34.5</td>
</tr>
<tr>
<td>7</td>
<td>1.0</td>
<td>6.2</td>
<td>34.3</td>
</tr>
<tr>
<td>8</td>
<td>1.0</td>
<td>6.1</td>
<td>27.6</td>
</tr>
<tr>
<td>9</td>
<td>1.0</td>
<td>5.7</td>
<td>25.8</td>
</tr>
<tr>
<td>10</td>
<td>0.9</td>
<td>5.5</td>
<td>23.9</td>
</tr>
</tbody>
</table>

Source: IMS Health; BCG analysis
The future of value creation in the German chemical and pharmaceutical industry

Obviously the global context matters

- 2-speed global economy, the rise of state owned enterprises in chemicals, self-sustainability agenda in pharma and in chemicals in many growth regions

Company perspective

- To grow profitably and to create value European and German based chemical and pharmaceutical companies will continue to globalize their business models—and invest in "localization" in the growth regions (production, R&D, decision center relocation)

Location perspective

- European chemical and pharmaceutical company have proven their ability to create value with differentiated and diverse business model (management of complexity)
- The attractiveness of Europe and Germany as a location for innovation and production is driven by the "integrated attractiveness" (infrastructure, logistics, resource efficiency) of sites and clusters
- Cross-industry innovation and production cluster are largely a unique German advantage driven by the unmatched density of "Mittelstand-champions"