An overview of global megatrends and regional industry sector trends relevant for chemicals management and sustainable chemistry innovation

Regional Perspectives on Sustainable Chemistry Innovation and the Global Chemicals Outlook II: Understanding Trends, Risks and Opportunities

Regional Expert Workshop

Panama City, 12 – 13 April 2018
There are more people living inside this circle than outside of it.
Factor 1

OVERVIEW OF MEGATRENDS WITH GLOBAL AND REGIONAL IMPACT
What is a megatrend?

• Major global forces with significant and lasting impact
• Generating growth in new markets up and down the value chain and prompting unprecedented shifts in the industry.
• Creating disruption and opportunity for chemical companies over the next decade
• No consensus definition; 3 to 30 megatrends found in the literature
Overview of megatrends and drivers

Global economic shifts

- „Economic G3“?
- USA, China, EU dominating global economy
Overview of megatrends and drivers
Demographic transition

Figure 3. Population by region: estimates, 1950-2015, and medium-variant projection, 2015-2100

Overview of megatrends and drivers

Demographic transition

Figure 3. Population by region: estimates, 1950-2015, and medium-variant projection, 2015-2100

Overview of megatrends and drivers

Urbanisation

Figure 2.
Urban and rural population of the world, 1950–2050

A majority of the world’s population lives in urban areas

Overview of megatrends and drivers

Urbanisation

Figure 1.3
Latin America and the Caribbean. Evolution and projection of the rate of urbanization, 1970-2050

- More than 80% of Latin American population in cities
- Expected to grow to more than 85% by 2012
- Approaching 90% by 2050
- Southern Cone and Brazil leading urbanisation trend
- Central America least urbanised, quickly picking up


Overview of megatrends and drivers
Changing consumption patterns

- Middle class growing worldwide, more than double in Latin America by 2030
- Increasing consumer-driven demand for more goods and services, many chemicals-intensive
- Increasingly demanding sustainable and healthy alternatives
On average, CAS has registered one substance every 2.5 minutes since 1965.

In 2016, this has increased to **one new substance every 1.4 seconds**.
Overview of megatrends and drivers
Technological change

Source: OECD Science, Technology and Innovation Outlook 2016, 40 key and emerging technologies for the future
Overview of megatrends and drivers

Resource competition and pollution

• Industrial energy demand rises by about 25 percent by 2040, led by growth in the chemicals sector
Overview of megatrends and drivers
Resource competition and pollution

Pollution Kills 3x As Many As AIDS, TB & Malaria Combined
Global estimated deaths by major risk factor and cause in 2015

- Total pollution (air, water and soil) 9.19m
- Tobacco smoking 7.17m
- AIDS, malaria and tuberculosis 3.04m
- Alcohol use risk 2.31m
- Malnutrition (child and maternal) 1.41m
- Road accidents 1.36m
- Drug use risk 0.49m
- War and murder (interpersonal violence, 2015) 0.41m
- Ebola* 0.01m

* 2014
Sources: The Lancet, NPR
### Overview of megatrends

<table>
<thead>
<tr>
<th>Global economic shifts</th>
<th>Demographic transition</th>
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<tbody>
<tr>
<td>- Strong growth in emerging economies</td>
<td>- Growing population (esp. South Asia and Africa)</td>
</tr>
<tr>
<td>- Shifts in innovation capabilities</td>
<td>- Ageing populations (esp. in OECD countries)</td>
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<td>- Complex international value chains</td>
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<table>
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<tr>
<th>Technological change</th>
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<tbody>
<tr>
<td>- Digitalization</td>
<td>- Massive move from rural to urban areas</td>
</tr>
<tr>
<td>- Acceleration of innovation pace</td>
<td>- Construction boom (housing and infrastructure)</td>
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<tr>
<td>- Additive manufacturing</td>
<td>- Changing transportation needs</td>
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<table>
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<tr>
<th>Resource competition and pollution</th>
<th>Changing consumption patterns</th>
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<tr>
<td>- Scarcce resources: Minerals, land, etc.</td>
<td>- Rapidly growing consumer/middle class</td>
</tr>
<tr>
<td>- Impacts of climate change</td>
<td>- Individualisation</td>
</tr>
<tr>
<td>- Impacts of pollution (air, water, soil)</td>
<td>- Lifestyles on sustainability and health</td>
</tr>
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Prepared by
Factor 2
SHIFTING OF INNOVATION CAPACITIES AND MANUFACTURING HUBS
Innovation: Expenditures on R&D

Gross domestic expenditures on R&D (GERD)

Source: www.innovationpolicyplatform.org
Innovation:
Expenditures on R&D
Shifting of innovation hubs: Regional differentiation

Patent grants on: Organic fine chemistry; biotechnology; pharmaceuticals; macromolecular chemistry, polymers; food chemistry; basic materials chemistry; materials, metallurgy; surface technology, coating; micro-structural and nano-technology; chemical engineering. Source: WIPO

Prepared by

Intellectual property right: Patent; Year range: 1987 – 2016; Reporting type: Total count by filing office; Indicator: 5 - Patent grants by technology
Innovation: Situation in the Americas

Patents on: Organic fine chemistry; biotechnology; pharmaceuticals; macromolecular chemistry, polymers; food chemistry; basic materials chemistry; materials, metallurgy; surface technology, coating; microstructural and nano-technology; chemical engineering. Source: WIPO

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Prepared by
Innovation: Situation in Latin America

Patents on: Organic fine chemistry; biotechnology; pharmaceuticals; macromolecular chemistry, polymers; food chemistry; basic materials chemistry; materials, metallurgy; surface technology, coating; microstructural and nano-technology; chemical engineering. Source: WIPO

1. Brazil
2. Mexico
3. Cuba
4. Chile
5. Argentina

Intellectual property right: Patent; Year range: 1987 – 2016; Reporting type: Total count by applicant's origin (equivalent count); Indicator: 5 - Patent grants by technology
Number of patents filed in Latin America by technology

Intellectual property right: Patent; Year range: 1987 – 2016; Reporting type: Total count by filing office; Indicator: 5 - Patent grants by technology
Number of patents filed in USA and Canada by technology

Intellectual property right: Patent; Year range: 1987 – 2016; Reporting type: Total count by filing office; Indicator: 5 - Patent grants by technology
Factor 3

THE CHEMICALS INDUSTRY
Global chemical shipments/turnover

<table>
<thead>
<tr>
<th>Region</th>
<th>2016 (in billion US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>870.1</td>
</tr>
<tr>
<td>Latin America</td>
<td>216.0</td>
</tr>
<tr>
<td>Western Europe</td>
<td>1,048.9</td>
</tr>
<tr>
<td>Central &amp; Eastern Europe</td>
<td>109.5</td>
</tr>
<tr>
<td>Africa and Middle East</td>
<td>161.0</td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>2,792.1</td>
</tr>
<tr>
<td>World Total</td>
<td>5,197.6</td>
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Chemical industry – Focal sectors (outlook 2035)

Global chemical market more than doubling till 2035; agrochemicals and engineering plastics delivering strongest growth

Issues to focus on:

1. Access to & cost of feedstocks
2. Shifts in chemical manufacturing hubs (China, India, others)
3. Development of policy & regulatory framework → levelling playing field?
4. Shifts & relocations in application manufacturing
5. Shifts in terms of new products demands as well as markets
Chemical industry in Latin America

Development of share of segments in Latin American chemical sector

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inorganics</td>
<td>9.8</td>
<td>17.3</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>11.1</td>
<td>20.1</td>
</tr>
<tr>
<td>Polymers</td>
<td>18.7</td>
<td>18.7</td>
</tr>
<tr>
<td>Specialties</td>
<td>18.1</td>
<td>21.1</td>
</tr>
<tr>
<td>Household chemicals / cosmetics</td>
<td>10.5</td>
<td>12.1</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>19.9</td>
<td>17.7</td>
</tr>
</tbody>
</table>
Chemical industry – The Americas

Global chemicals sales (2015): US$3.84 trillion

**North America (16.5% market share in 2015)**
- Supply-driven price decline, benefits of domestic production and shorter supply chain will spur demand for chemicals.
- A dynamic shift from net importer to net exporter is likely.
- The new US Government is likely to boost the shale gas production in the US enabling the growth of the domestic chemicals industry.

US$ billion

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2020F</th>
<th>2025F</th>
<th>2030F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>633</td>
<td>951</td>
<td>951</td>
<td>951</td>
</tr>
</tbody>
</table>

**Latin America (3.8% market share in 2015)**
- **Boost in investment projects** in Brazil is driven by low-cost shale gas in North America.
- Steady economic growth coupled with demand for chemicals and finished goods makes Latin America an attractive export option for North America.

US$ billion

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2020F</th>
<th>2025F</th>
<th>2030F</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>147</td>
<td>340</td>
<td>340</td>
<td>340</td>
</tr>
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</table>

Source: CEFIC Chemdata International 2016
Factor 4

INDUSTRY SECTOR TRENDS
Construction

General market outlook

- Construction chemicals market expected to grow by 9% per year, increase to more than US$ 50 billion by 2025
- Chemicals include asphalt modifiers, concrete admixtures, adhesives, sealants, coatings etc.
- Largest markets China, India, Japan and US.


TABLE ES1: Latin America invests the least in infrastructure among developing regions
(public and private infrastructure investments, latest year available)

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Asia and the Pacific</td>
<td>7.7</td>
</tr>
<tr>
<td>Central Asia</td>
<td>4.0</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>2.8</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>6.9</td>
</tr>
<tr>
<td>South Asia</td>
<td>5.0</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Source: World Bank 2017: Rethinking Infrastructure in Latin America and the Caribbean
Construction

**FIGURE 2: Infrastructure investment levels varied enormously across countries in 2008-13**
(percent of GDP)

Source: www.infralatam.info, downloaded on May 2, 2016.

Source: World Bank 2017: Rethinking Infrastructure in Latin America and the Caribbean
Automotive and mobility

- 2015 – 2040: Global transportation demand growing about 25%
- Personal mobility demands continuing to increase, as does commercial transportation
- Heavy duty growth is the largest by volume, but marine and aviation grow the largest by percentage
Automotive and mobility

Some key industry trends

- Enhancing safety and user comfort
- e-vehicles, e-scooters, e-light commercial vehicles
- Growing adoption of “green” vehicles
- Stronger, lighter weight and different materials as key response to the megatrend of green/sustainability issues and circular economy

Greater emphasis on emission reductions and tighter regulatory norms for automobiles and trucks

- More focus on improving fuel efficiency and alternative fuels, weight reduction of vehicles
- e-mobility outlook high in selected markets (China, India, Europe)

Changing consumer behaviour

- Car ownership significantly increases in the non-OECD with rising incomes
- Shared economy concepts among younger generation, particularly in urban areas
Energy production and consumption

Energy underpins economic growth

- Middle class will more than double in the next 15 years
- Demand for energy increases with more people expecting access to air-conditioned homes, cars and appliances like refrigerators, dishwashers and smartphones
- Continuing urbanization in China and India, with people moving from rural areas to cities, will add to economic growth
Energy production and consumption

- Installed PV strongly increasing worldwide and in Latin America
Agriculture & food industry

- **Upward demand for food production** (incl. more diverse food diets, particularly with growing disposable income)
- **Increasing demand in post-farm segments efficiency** → preservation, packaging, productivity enhancing investments in cold-chain & storage facilities, food preparation away from home)
- **Transformation of rural on-farm and non-farm economy** → emergence of local food industries and processing facilities
- **Need and opportunity for urban/vertical farming** and non-traditional food production

<table>
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<tr>
<th>Region</th>
<th>2015</th>
<th>% change</th>
<th>2016</th>
</tr>
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<tbody>
<tr>
<td>Latin America</td>
<td>14,052</td>
<td>-6.9</td>
<td>13,076</td>
</tr>
<tr>
<td>Asia</td>
<td>14,040</td>
<td>-1.2</td>
<td>13,866</td>
</tr>
<tr>
<td>Europe</td>
<td>11,604</td>
<td>-1.3</td>
<td>11,453</td>
</tr>
<tr>
<td>North America</td>
<td>9,356</td>
<td>+1.3</td>
<td>9,475</td>
</tr>
<tr>
<td>Rest of the world</td>
<td>2,158</td>
<td>-2.0</td>
<td>2,115</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>51,210</strong></td>
<td>-2.4</td>
<td><strong>49,985</strong></td>
</tr>
</tbody>
</table>

Source: Phillips McDougall

**Use of fertilizer per hectare of cultivated land**
- 22 kg in Africa
- 127 kg in Latin America
- 157kg in European Union
- 506 kg in China

Source: World Bank
“Everything is possible. The impossible just takes longer”
(Dan Brown)

„A chemical plant to go, please!“