Digitization within the Chemical Industry

ECRN Event on Digitizing European Industry

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Profile of the EU Chemical Industry

- 29 000 companies, 96% SMEs
- 1.17 million of jobs
- €551 billion of revenues
- 15% of the world’s chemical sales

= key EU economic sector

Source: Cefic Chemdata International - data for 2014
EU chemicals sales increase by nearly 60% in 20 years, while its world market share halves

EU share of global chemicals market

Source: Cefic Chemdata International 2016
Providing the essentials through the value chain
Digital deeply impacts all industries including the Chemical sector

300 decision makers were surveyed, 30 CEOs interviewed, expert workshops held on:

The four levers of the digital transformation …

… and their impact on the industrial heart of Europe [bn GVA]

- Automotive: 140
- Aerospace & aviation: 35
- Chemicals: 124
- Electrical engineering: 87
- Medical technology: 43
- Mechanical & plant engineering: 299
- Logistics: 271

1) GVA = Gross value added, 2013, EU-15 states plus Norway, Turkey
2) Including energy systems

Source: Roland Berger
Digitization as key element to industry challenges and competitiveness

Source: Deloitte 2015
Emergence of new digital technologies – development goes faster and faster

- 5G
- Cloud Technology
- IoT
- Data Fusion
- PAT
- Big Data
- HPC
- Social Media
- Cognitive Computing
- Digital Twins
- Virtual Reality
- Gamification
- Track & Trace
- RFID
- Deep Learning
Transforming data in knowledge will be key to transform the industry.

Data Management and Analysis
Key enablers in all fields of Process Industry

- Digital Factory
  - Yield
  - Increased Uptime
  - Energy

- Digital Supply Chains
  - Smart Supply Chain
  - Flawless Performance towards Customer

- Digital Services
  - New Services
  - New Models

Discover Value out of Big Data
Novel methods are required to capture relevant information from many independent data sources.
Digitization transforms the Chemical Industry rapidly across its entire horizontal value chain

**Big-data/advanced analytics in OpEx/CapEx:**
Big data-driven raw material analytics to optimize feedstock costs

**End to end supply chain integration:**
Production data sharing with suppliers/real-time supply tracking

**Process automation:**
Sensor-based production control and real-time optimization of YETQ

**Integrated lean system:**
IT-based integrated lean system to drive manufacturing excellence

**Engineering/R&D 4.0:**
Machine-learning-driven recipe and formulation improvements

**New roads to market:**
Using online/marketplace sales channels

**Digitization of customer experience:**
Customer self-service platform

**Digital procurement tools:**
Digital tools enabling more efficient procurement processes

**Predictive maintenance:**
Advanced analytics-based predictive and risk-based maintenance

**Digital manufacturing:**
Production automation by application of autonomous logistics, drone inspections

**Risk management:**
Advanced analytics-based risk management/cyber security

**G&A 4.0:**
Back office automation, e.g., no touch orders

**Commercial engines:**
Use advanced analytics for lead generation, etc.

**PLUS: new, radically different business models**

1 Yield, energy, throughput, and quality

*SOURCE: GEM Digital Task Force*
1) Digital Plant

Digitalization enables the entire manufacturing chain for more efficient operations

a. Real-time capability - provide correct process information to authorized users in real-time
   ✓ Higher plant availability and throughput

b. Feedback control to detect deviations and adjust operations immediately decision support
   ✓ Better predictability of manufacturing
   ✓ Reduced lead times
   ✓ Higher flexibility and agility/remote operations

c. Asset performance management/predictive maintenance
   ✓ Less quality issues
   ✓ Less consumption of energy and raw materials
   ✓ Less costs for lab analyses

d. Advanced operator support
   ✓ More efficient plant maintenance

  e. ‘Digital Twin’ (virtual plant models) to predict the impact of (design) decisions and to anticipate looming events and bottlenecks
   ✓ More efficient allocation of staff

f. Integrated production planning

  g. Information integration across operations and enterprise technology layers

  h. End-to-end (financial) visibility from top-floor to shop-floor

Source: SusChem/SPIRE Working Groups, Accenture
2) Digital Marketing & Sales

Exploit new revenue opportunities incl. radically different business models

a. Pricing excellence
b. Sales and service excellence
c. Marketing excellence
d. Marketing & sales channel optimization

- New business models
- Increase revenue/decrease cost-to-serve
- Seamless multi-channel experience
- Better understanding of evolving market needs
- Improved insight into the competitive landscape
- Ability to more quickly react to market demand and cyclicality
- Tailored products
- Customer awareness

Source: SusChem/SPIRE Working Groups, Accenture
Example innovation in process digitization

Advance the production of high-value products that meet high quality demands in flexible intensified continuous plants: Not possible without fast and accurate online sensing of key product and process parameters including closed-loop control and online optimization.

**Characteristics**
- Miniaturized equipment
- Intensified heat & mass transfer
- Possibly modular setup

**Benefits**
- Product uniformity
- Sustainability
- Fast adaption to market demand
- Innovative products

Source: CONSENS
Investment in digital innovation to strengthen competitiveness of industry is required

- **Modeling, Simulation and Forecast**: integrate modelling of single processes into production routes and value chains

- **Digital Twin - Virtual Plant Models**: predict the impact of (design-) decisions and to anticipate looming events and bottlenecks

- **Real Time Data Availability**: through reliable, fast, accurate and intelligent self-optimizing measurement systems (sensors), product quality, plant equipment

- **Transforming ‘Big Data’ to relevant Information**: identify universal and reliable solutions to “mine”, handle and interpret data, high performance computing

- **Condition Based Advanced Maintenance**: develop tools and methods allowing remote control of equipment, prediction and prevention of failures

- **Resource and Energy Life-Cycle Assessment**: enable monitoring of environmental targets into all control systems to optimize performance

- **Data Security**: develop advanced security solutions to prevent misuses of stored / cloud data

- **Standardization**: software and hardware platforms

- **Human-Machine Interface**: develop intuitive and user friendly interfaces

- **Operator Skills**: The digital engineer and plant operator
Summary

1. Companies supply chains, manufacturing plants & sites, sales & marketing organization more and more benefit from integrating digital innovations such as novel sensors, data capturing, planning and control, modelling and simulation, cloud computing and (big) data analysis into their operations.

2. Manufacturing is both “discrete” and “continuous”: Needs of process/continuous industries should be equally considered in comparison to discrete manufacturing to avoid lacking behind. The European chemical industry strongly contributes to the economic roots of the European economy by transforming raw materials into intermediate as base for end-user products.

3. Beyond extensive use of digital technology the chemical industry is a key provider of many materials and manufacturing technologies which enable many of todays and future ICT solutions.

4. Further investments in innovation (e.g. by the SPIRE cPPP funding instrument on European level) is required to support the development and demonstration/implementation of fast emerging digital technologies.
Thank you for your attention

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Digitization transforms the Chemical Industry rapidly

Supply Chain/Raw Material Sourcing
- Supplier management
- Inbound logistic
- Warehouse management

Manufacturing Operations
Production planning
Quality management
Blending/customizing
Optimization
Maintenance

Distribution
Filling/packaging/labeling
Order processing
Outbound logistic
Warehouse management
Claims/returns management

Delivery
Transport management
Customer relationship
Differentiated service
Digitization transforms the Chemical Industry rapidly across its entire chain

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**End to end supply chain integration:**
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**YETQ/RPO:**
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**Integrated lean system:**
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**DIGITAL ENABLERS**

**Strategy:** Long-term oriented digital strategy, aligned with corporate goals and centered around customer needs

**Capabilities:** Technology infrastructure, advanced analytics skills, big data, machine learning etc.

**Organization:** Well-performing digital organization based on digital talent/leadership, governance/KPIs, and clear digital roles/responsibilities

**Culture:** Digital-embracing culture with highly agile digital organization, “test and learn” environment, and strong digital risk appetite

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1. Yield, energy, throughput, and quality

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