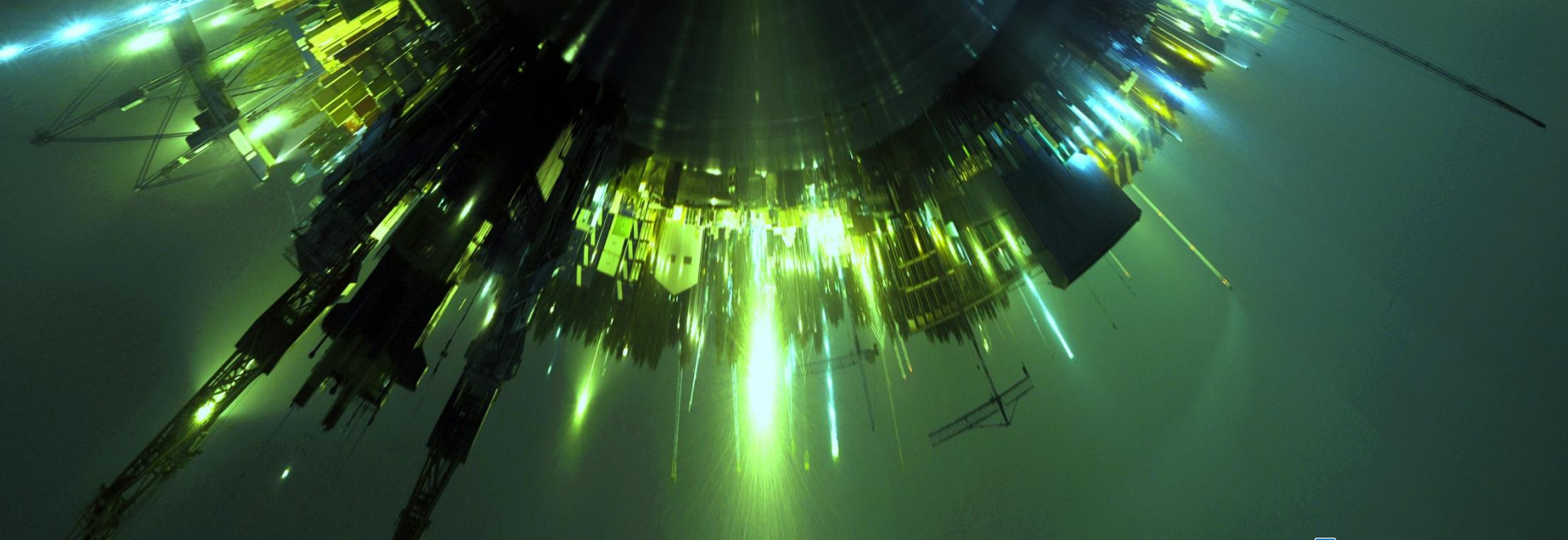


Digitalisation for Industry: Live Long and Prosper

The Chemical Industry at the heart of the 4th Industrial Revolution

January 31, 2018

Marco Mensink, Cefic Director General

Responsible Care®
OUR COMMITMENT TO SUSTAINABILITY

Profile of the EU Chemical Industry

- ✓ 29 000 companies, 96% SMEs
- ✓ 1.17 million of jobs
- ✓ €507 billion of revenues
- ✓ 15% of the world's chemical sales
- ✓ State of the art **innovative solutions**

= key EU economic sector

Source: Cefic Chemdata International - data for 2014

The “industry of industries” as key enabler for a prosperous future of EU economy

Process innovation

- Carbon capture and use
- Electrification of chemical processes
- Modular/flexible prodcution
- Demand Response
- **SusChem ETP**
- **SPIRE cPPP (H2020)**
- **BBI JU (H2020)**

Product innovation

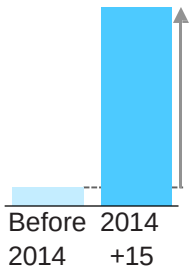
- New materials (e.g. insulation)
- Advanced (thin-film) Solar PV
- Liquid Energy Storage
- Methanol, Hydrogen
- Light-weight materials (cars, …)
- Solutions for **circular economy**
- Solutions for **low-carbon economy**
- Solutions for **digital economy**

SUSCHEM
European Technology Platform
For Sustainable Chemistry

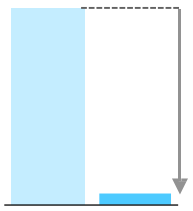
SPIRE
Sustainable Process Industry through
Resource and Energy Efficiency

The digital revolution: Keeping pace is crucial for EU to remain competitive

Data availability & costs



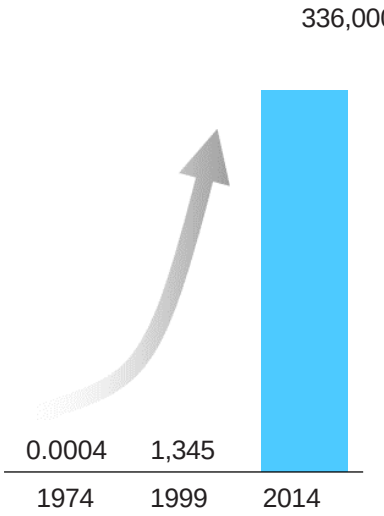
90%
of the global data was generated in the last two years



Cost of data storage reduced by
>95%

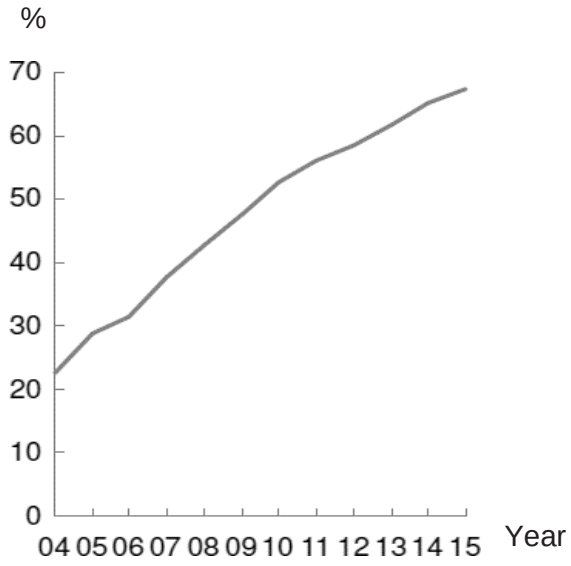
Computing capacity

PC capacity in BIPS
(billions of instructions per second)



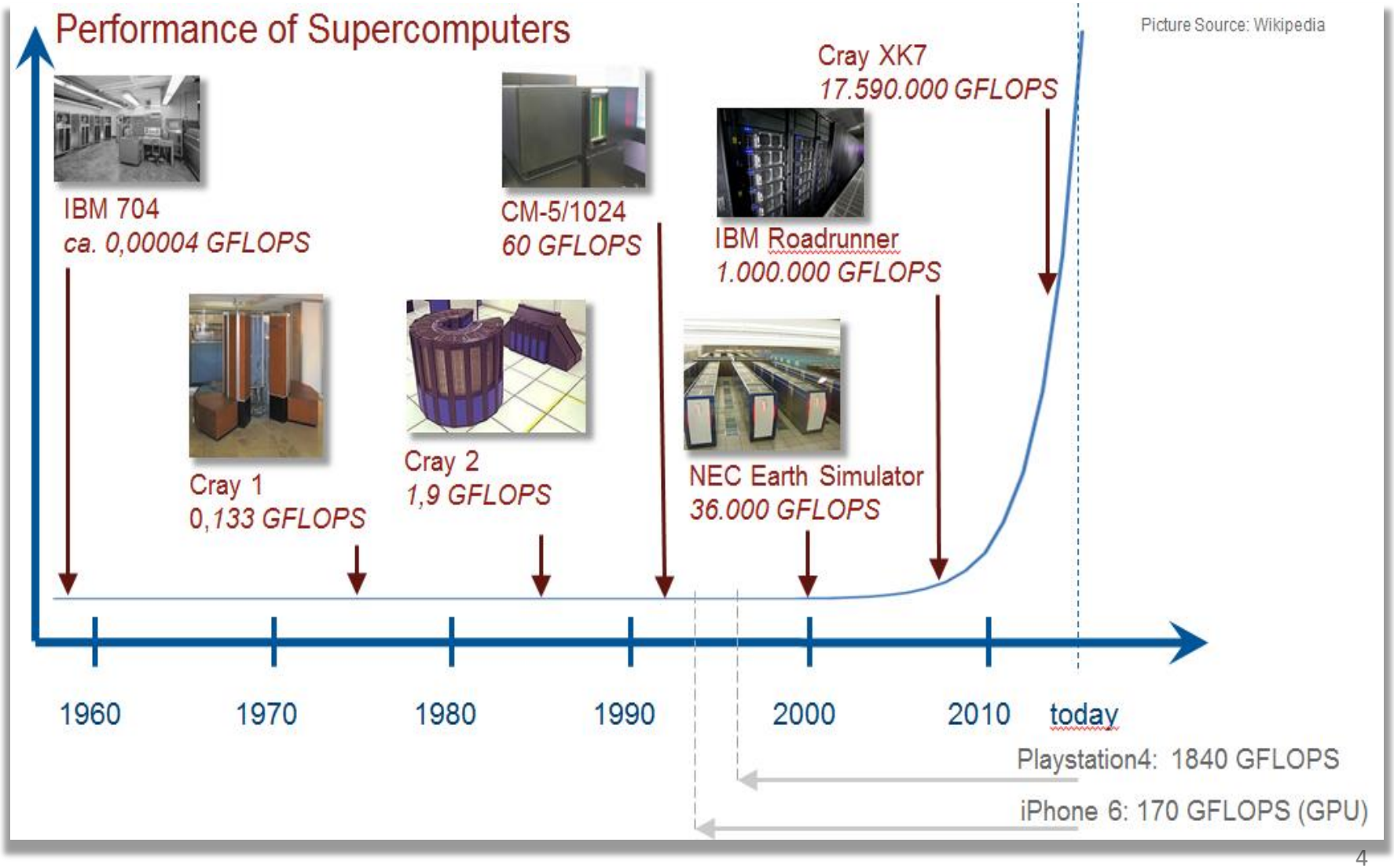
Readiness of society

Share of Internet users

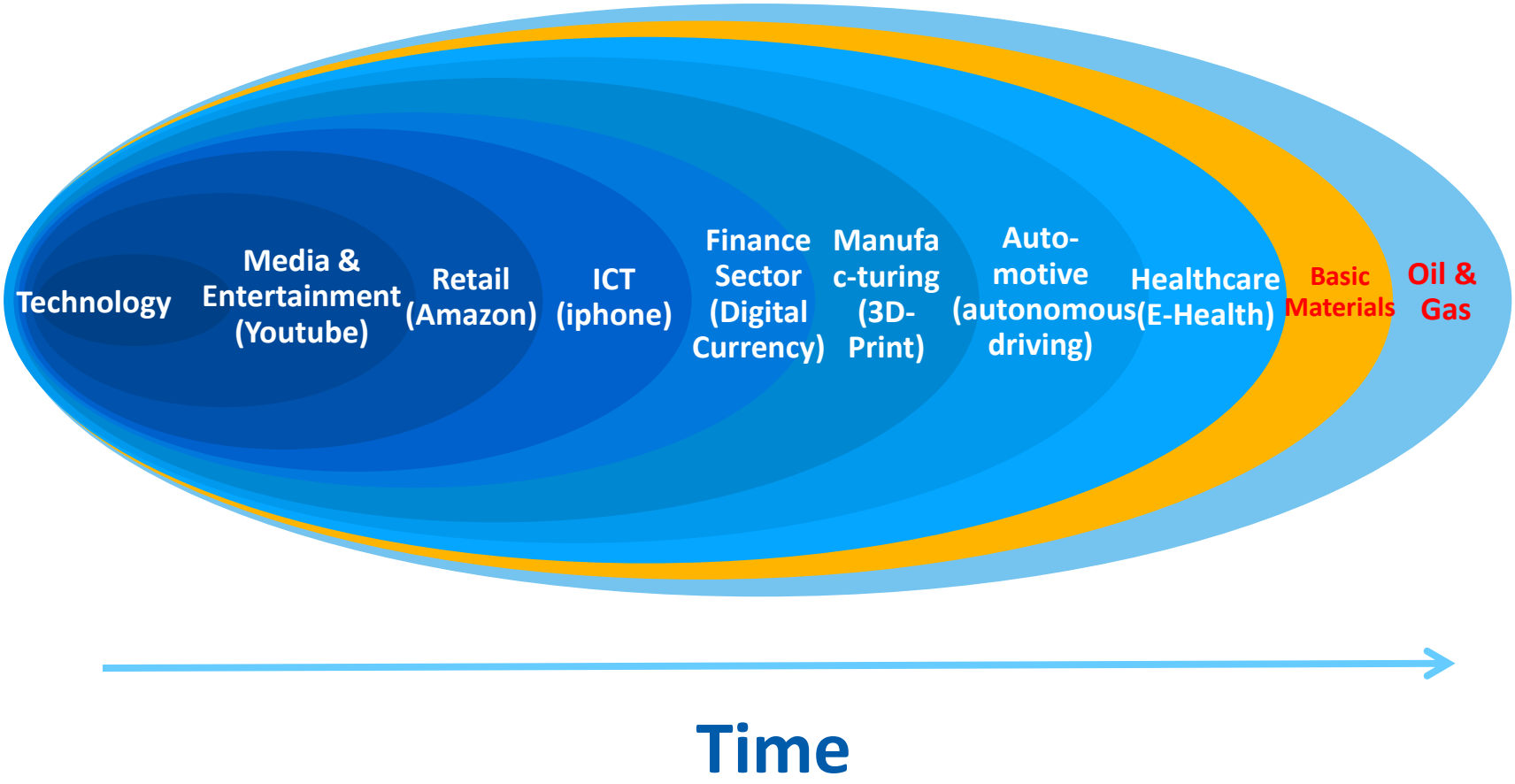


Source: Clariant 2017

The rise of Supercomputers is now

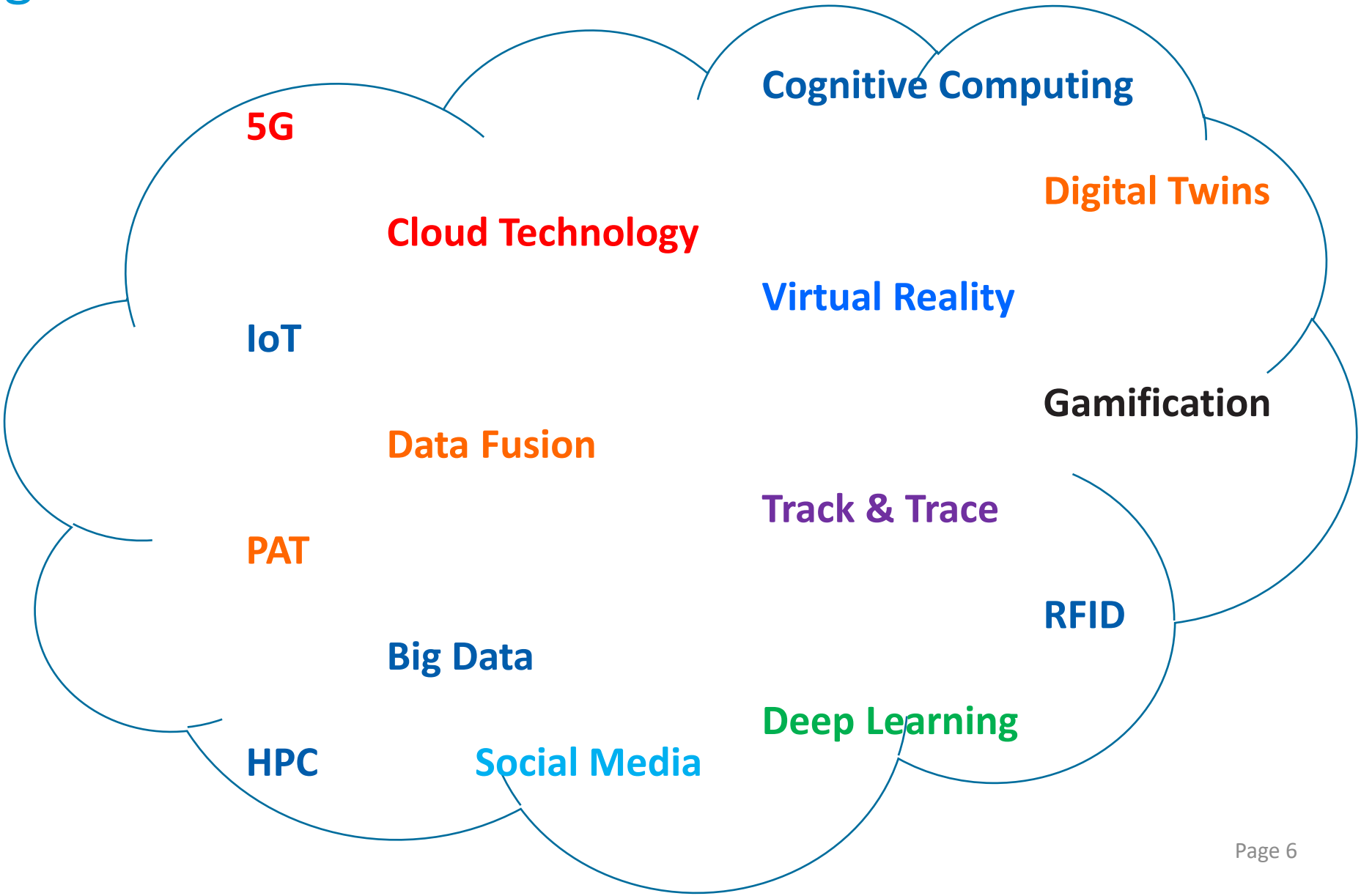


Digitization across the whole EU Economy



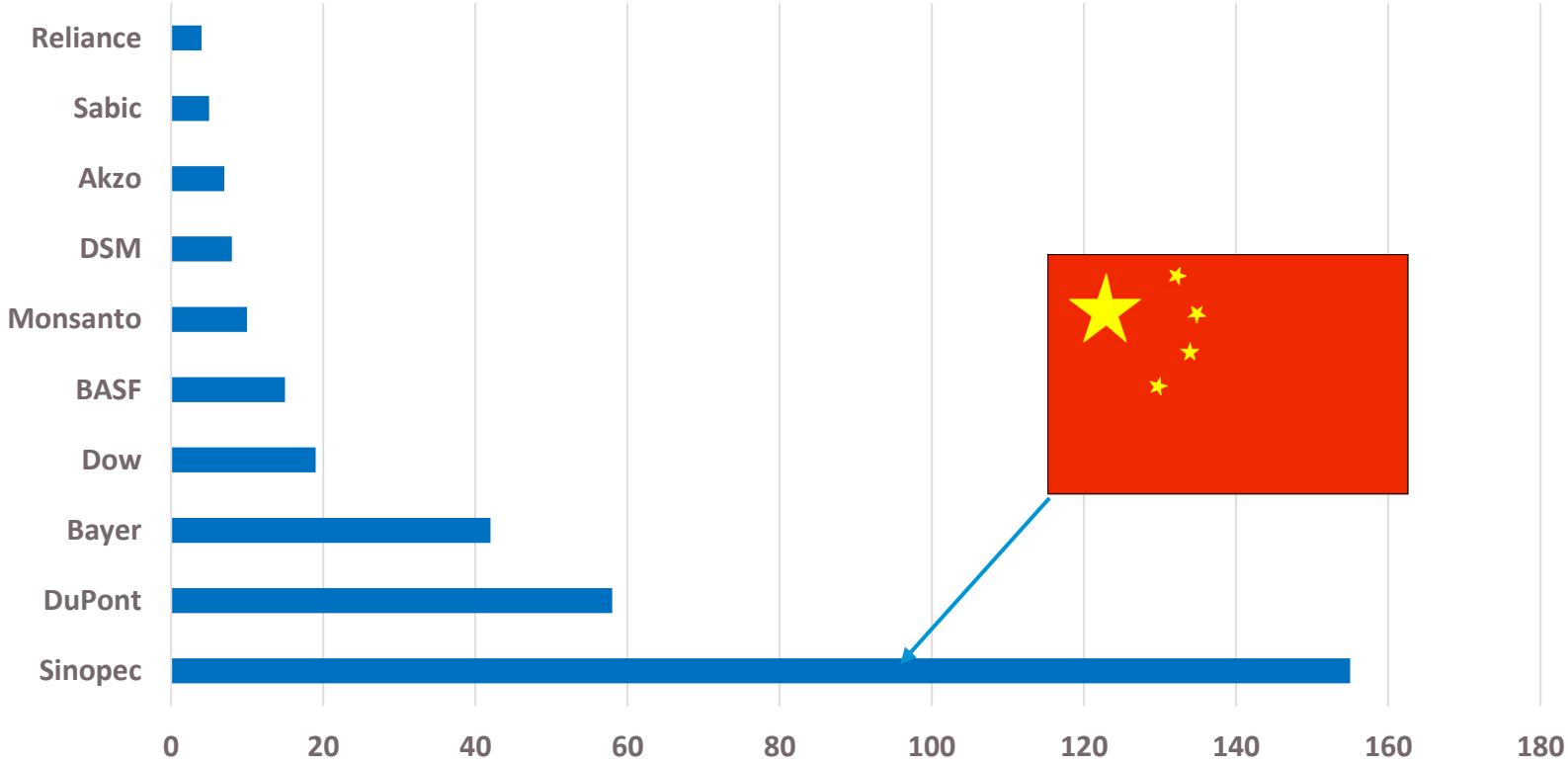
Source: Global Center for Digital Business Transformation, an IMD (Lausanne, Switzerland) and Cisco Initiative with Accenture https://www.accenture.com/de-de/insight-digital-oil-and-gas)

The emergence of new digital technologies goes faster and faster



In the digital innovation race China dominates

Patent filings in the chemical industry 2010-2015 with “Digital” background



China issued *“Intelligent Manufacturing Development Plan (2016-2020)”*, encouraging (petro)-chemical industry to develop *Intelligent Manufacturing*

Source: Netherlands Office for Science & Technology (NOST) in China

The benefits of digitization to society and the economy

1. **Social benefits**: Digitalisation has the potential to **improve health** conditions and the **quality of life**, to **prevent accidents and injuries and to protect better the environment** ***(e.g. reduce CO_2 emissions by 60-100 million tonnes*** *over the next decade****).***

2. **Economic benefits:** Across value migration and value addition to the chemical industry, the estimated cumulative **economic value** for the period 2016 to 2025 ranges from approximately **€250 billion** to **€500 billion**.

Source: World Economic Forum, Digital Transformation Initiative, Chemistry and Advanced Materials Industry, 2017

The EU Chemicals industry thinks already beyond providing chemicals and materials only

Stefan Oschmann
Chairmann of Executive Board & CEO

MERCK

"Big data is becoming as important as chemistry for us"

"BASF applies big data in catalyst research - we reached a factor of 3 reduction in cycle times from customer request to the first promising product proposal"

Frithjof Netzer
Senior Vice President BASF 4.0

BASF
We create chemistry

Felix Hanisch
Head of Technology and Innovation

covestro

"Covestro's approach to digital constitutes of three horizons of implementation: Optimize supply, leverage growth and start a new game"

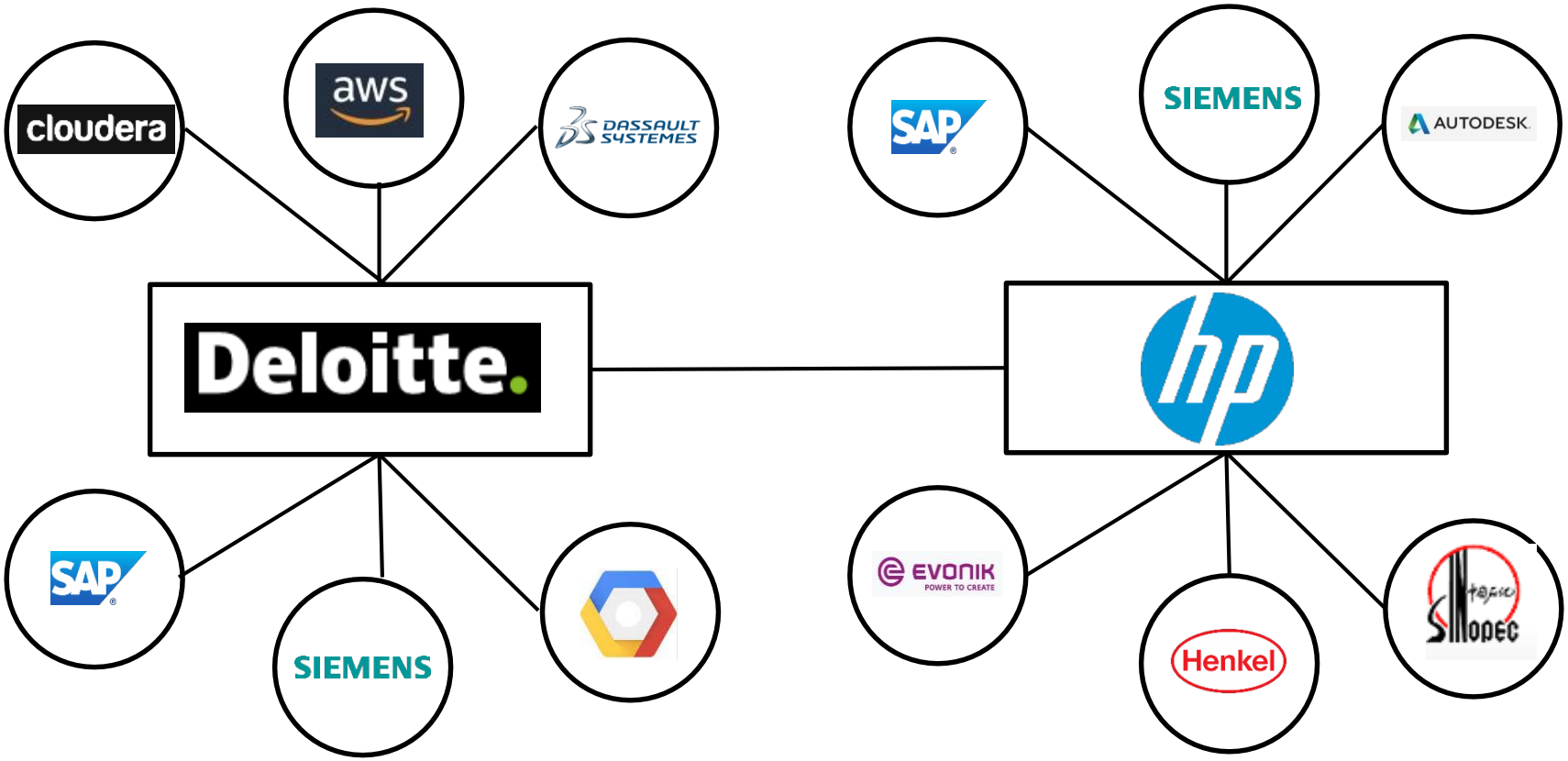
"Digitalization is a growth driver for our company. Our goal is to open up a market that is worth billions"

Henrik Hahn
Evonik Chief Digital Officer//Evonik Digital

EVONIK
POWER TO CREATE

Source: Public statements

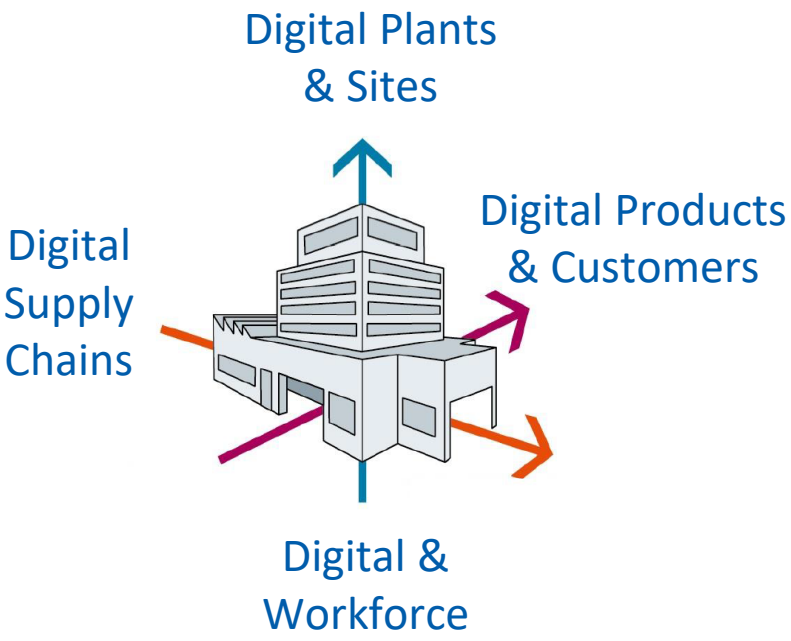
EU Chemicals companies participate in businesses alliances bringing together digital, materials and manufacturing to create high added value for the EU

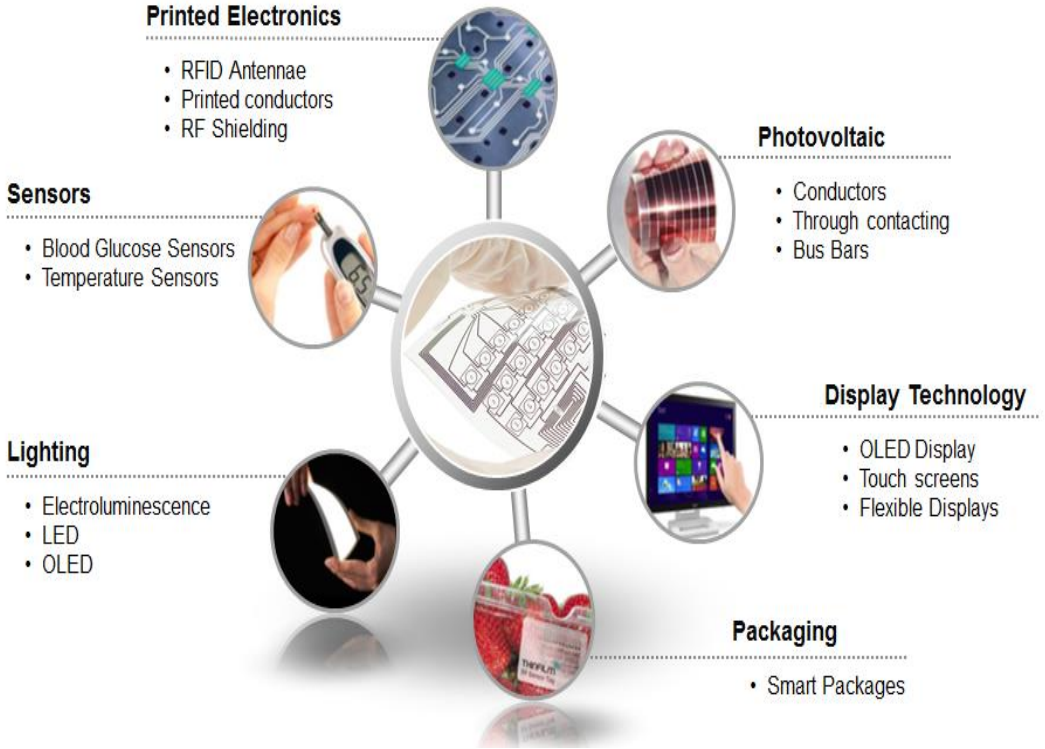


Source: *https://www2.deloitte.com*

The two aspects of digitization for the EU Chemicals Industry

1. Digitization as key driver for the transformation of the industry
2. Advanced materials as key driver for digitization





Beyond the EU Chemical Industry: **SPIRE** supports digitization across 8 process industries

Flexible intensified continuous plants: Possible only with 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**

SPIRE Sustainable Process Industry through Resource and Energy Efficiency

Source: CONSENS

Digitalization enables the entire manufacturing chain for more efficient operations

a. **Real-time sensing capability** - provide correct process information to authorized users in real-time

b. **Feedback control** to detect deviations and adjust operations immediately decision support

c. **Asset performance management**/predictive maintenance

d. Advanced **operator support**

e. **'Digital Twin'** (virtual plant/process models) to predict the of impact of (design) decisions and to anticipate looming events and bottlenecks

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

- ✓ **Higher plant availability and throughput**
- ✓ **Better predictability of manufacturing**
- ✓ **Reduced lead times**
- ✓ **Higher flexibility and agility/remote operations**
- ✓ **Less quality issues**
- ✓ **Less consumption of energy and raw materials**
- ✓ **Less costs for lab analyses**
- ✓ **More efficient plant maintenance**
- ✓ **More efficient allocation of staff**

….

Source: SusChem/SPIRE Working Groups, Accenture

Digital enables new business models

TODAYS SELL	TOMORROWS GUARANTEE
Products such as seeds, fertilizer etc.	A certain yield
Water-treatment chemicals	Quantity of clean water
Industrial lubricants	Guaranteed machine hours
Paints	Years of preservation
Treatment chemicals	Quantity of noxious substances removed
Fixed pricing	Value-based pricing depending on outcome
Fixed quantities	Automatic refill, fluid as a leased service

Source: Accenture, 2017

EU support for Innovation: towards FP9

1. **A Competitive Innovation Ecosystem**: Engaging all actors in the research and innovation ecosystem is a prerequisite to ensure long-term leadership and the delivery of impact for the benefit of society. Industry has a leading role in the EU innovation ecosystem.

2. **A Balanced R&I Portfolio**: Planning and steering initiatives across all technology readiness levels with the aim of continuously delivering the highest overall impact.

3. **A Competitive European Manufacturing Base**: Key enabling technologies (KETs), including advanced process digital technologies and advanced materials, provide the backbone to boost manufacturing and digitization in Europe.

4. **Sustainable Development & Impact:** Results should be measured in terms of impact, replication potential, and benefits to society, the environment and the economy to accelerate growth and jobs creation.

Conclusions

1. **Digital** is a **clear growth opportunity** - chemical value chains might change completely through digitalisation, products and related process will get more personalized creating and delivering **higher value for customers**
2. **Digital** will further **improve operations**, e.g. cognitive plants, advanced maintenance, digital process and plant design through in-silico “digital twins”
3. Many chemical companies have **built-up significant resources and additional organizational structures** to start capture the full range of digital opportunities. **Collaboration** is becoming a key success factor
4. New type of **education and job profiles** will be required to transform the industry
5. The EU Chemicals Industry is a **solution provider** also for the digital economy: **Innovation brings added value to the EU**

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B-1160 Brussels – Belgium

www.cefic.org/About-us
www.twitter.com/Cefic

Chemistry can

Thank you for your attention