



Horizon 2020  
European Union funding  
for Research & Innovation

Project ID: 768884  
H2020-NMBP-CSA-2017



Next generation Technologies for networked Europe

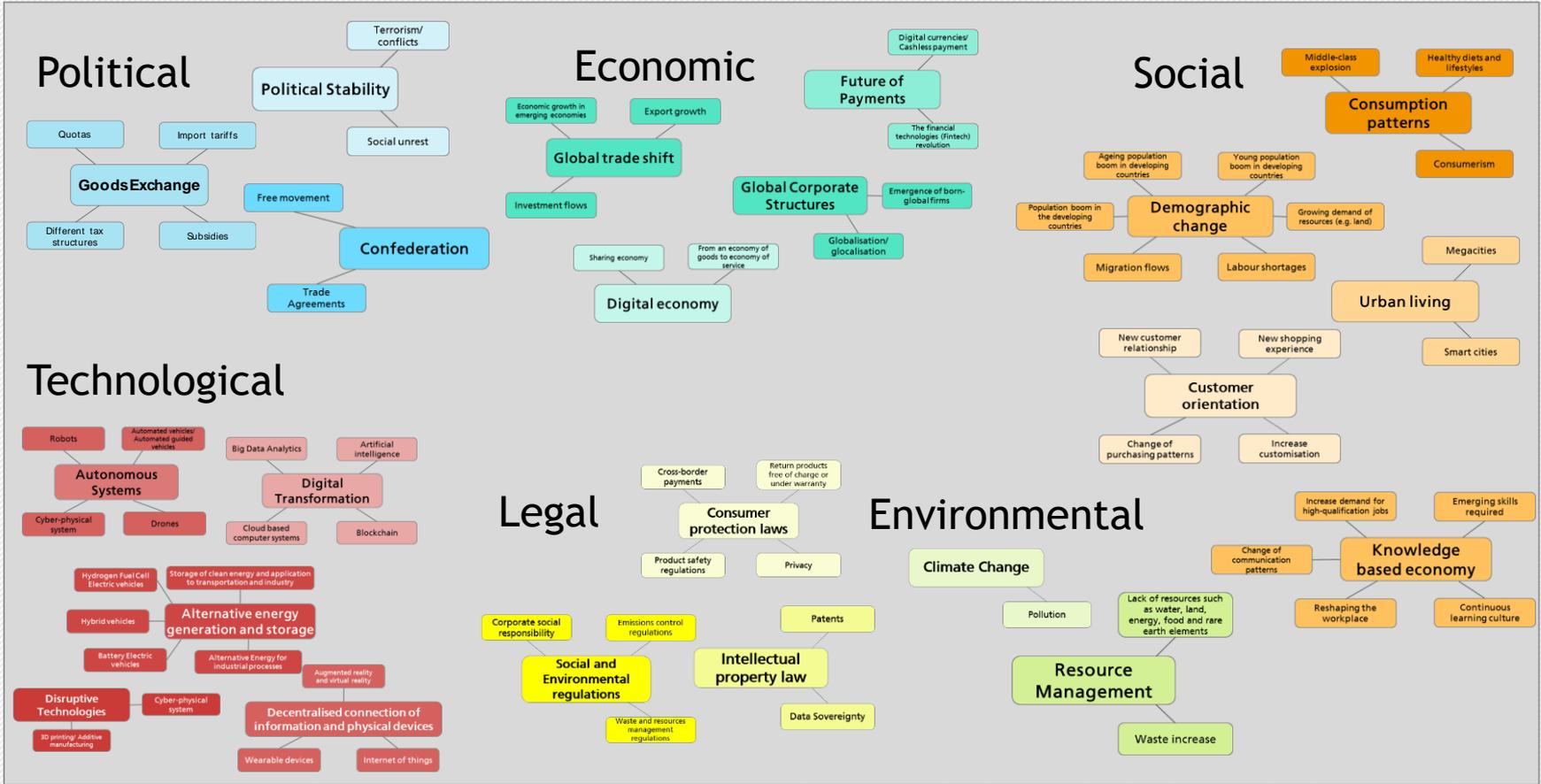
Generation of development paths

Fraunhofer Institute for Material Flow and Logistics

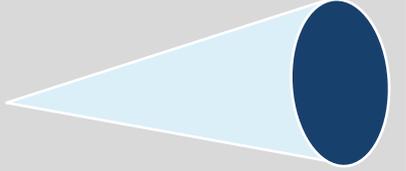
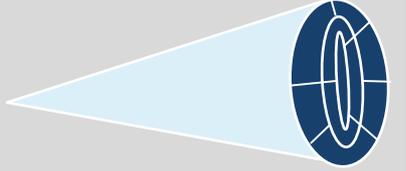
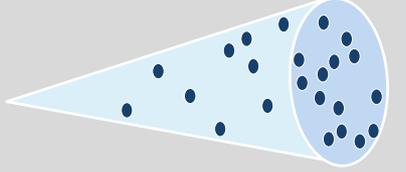
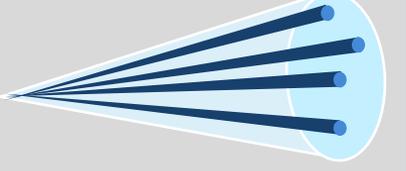
Saskia Sardesai, Denis Daus

# Megatrends and Trends

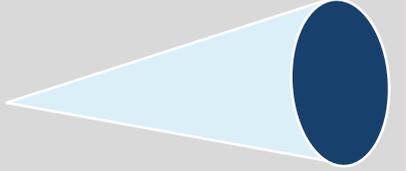
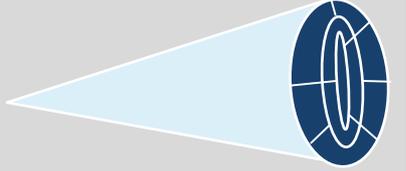
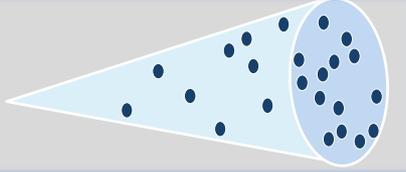
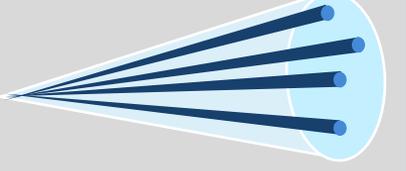
## Clustering of Trends



# NextNet Approach Based on the Gausemeier-Approach

Gausemeier-Approach		Next-Net Approach	
<b>Step 1: Scenario-Preparation</b>	<ul style="list-style-type: none"> <li>Project description</li> <li>Decision-Field-Analysis</li> </ul>		<ul style="list-style-type: none"> <li>PESTLE Approach</li> <li>Timeline until 2030</li> </ul>
<b>Step 2: Scenario-Field-Analysis</b>	Identification of <ul style="list-style-type: none"> <li>influence areas</li> <li>influencing factors</li> <li>key factors</li> </ul>		<ul style="list-style-type: none"> <li>Megatrend-Analysis &amp;</li> <li>Trend-Analysis by ASTON</li> </ul>
<b>Step 3: Scenario-Prognostic</b>	<ul style="list-style-type: none"> <li>Preparation of the key factors</li> <li>Identification of future projections</li> </ul>		Identification of <ul style="list-style-type: none"> <li>Development paths</li> <li>Likelihood/Uncertainty for a path</li> </ul>
<b>Step 4: Scenario-Building</b>	<ul style="list-style-type: none"> <li>Projection bundles</li> <li>Prescenario-building</li> <li>Future mapping</li> <li>Scenario description</li> </ul>		<ul style="list-style-type: none"> <li>Cross-Impact-Matrix to assess development paths</li> <li>Development of Prescenarios</li> </ul>

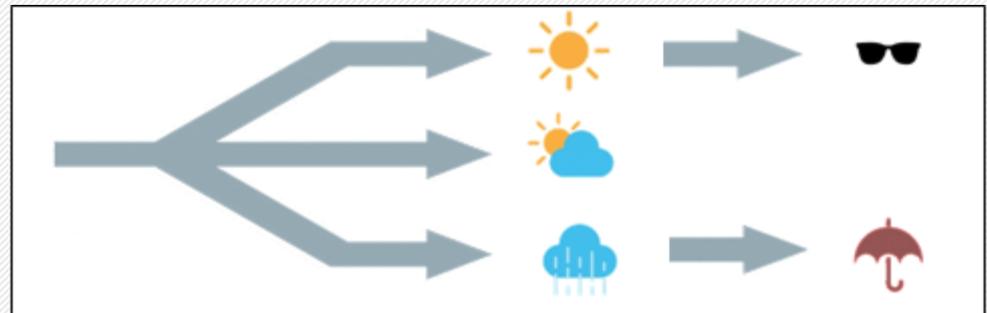
# NextNet Approach Based on the Gausemeier-Approach

Gausemeier-Approach		Next-Net Approach	
<b>Step 1: Scenario-Preparation</b>	<ul style="list-style-type: none"> <li>Project description</li> <li>Decision-Field-Analysis</li> </ul>		<ul style="list-style-type: none"> <li>PESTLE Approach</li> <li>Timeline until 2030</li> </ul>
<b>Step 2: Scenario-Field-Analysis</b>	Identification of <ul style="list-style-type: none"> <li>influence areas</li> <li>influencing factors</li> <li>key factors</li> </ul>		<ul style="list-style-type: none"> <li>Megatrend-Analysis &amp;</li> <li>Trend-Analysis by ASTON</li> </ul>
<b>Step 3: Scenario-Prognostic</b>	<ul style="list-style-type: none"> <li>Preparation of the key factors</li> <li>Identification of future projections</li> </ul>		Identification of <ul style="list-style-type: none"> <li>Development paths</li> <li>Uncertainty factor for a path</li> </ul>
<b>Step 4: Scenario-Building</b>	<ul style="list-style-type: none"> <li>Projection bundles</li> <li>Prescenario-building</li> <li>Future mapping</li> <li>Scenario description</li> </ul>		<ul style="list-style-type: none"> <li>Cross-Impact-Matrix to assess development paths</li> <li>Development of Prescenarios</li> </ul>

# Determination of Development Paths

## Important points

- Clearly defined question and time horizon to establish a common starting point: “How will a descriptor develop until 2030?”
- Possible developments of a descriptor
  - Check possible positive, neutral and/or negative development paths.
- Naming the alternatives
  - Possible developments a descriptor might have in the future
  - Generate alternative developments which can be clearly distinguished
  - Goal: formulation of 1-3 possible developments per descriptor
- Quality criteria for the future projections
  - Plausibility
  - Dissimilarity
  - Completeness
  - Relevance
  - Information content



# Example 1: Goods exchange / Trade policy



## Descriptor: Goods exchange / Trade policy

### Development paths



The descriptor entails trade policies and agreements between domestic industries and foreign competitors. It includes the trends

- **quotas,**
- **import tariffs,**
- **different tax structures and**
- **subsidies.**

# Example 1: Goods exchange



## Goods exchange

### Development paths

#### → Protectionism

- Barriers of trade like tariffs, import quotas restrict the establishment of foreign exchange
- Trade barriers complicate logistics structures of importing companies

#### → Free Trade

- Policy of open trade
- Reduction in trade barriers facilitate global trade
- Several trade agreements exist

The descriptor entails trade policies and agreements between domestic industries and foreign competitors. It includes the trends

- **quotas,**
- **import tariffs,**
- **different tax structures and**
- **subsidies.**

# Set up of the Workshop

Split into 3 equally sized groups -  
Each group works on one descriptor

---

## Individual Brainstorming

*“How can a possible development path for the descriptor look like?”*



5 min

Take the trends into account.

---

## Discussion round

1. Explain your thoughts to the group
2. Sort your card to a similar category



15-20 min

---

## Name the development path

Think of a suitable and easy understandable name



10 min

---

Short summary for the complete workshop round



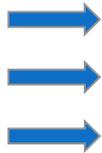
15 min -  
5 min each  
group

# Descriptor 1: Digital Economy



## Digital Economy

### Development paths



The term “digital economy” refers specifically to the recent and still largely unrealized transformation of all sectors of the economy by the digitization of information.

### Trends:

---

#### Sharing Economy

Customers use the internet to create online platforms (e.g. Airbnb, Uber) which facilitate the process of sharing.

---

#### From an economy of goods to an economy of services

Media consumption is increasingly happening in digital formats. This trend is also about the introduction of new selling platform or new, upcoming internet services.

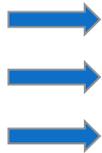
---

# Descriptor 2: Future of Payments / Financial Innovation



## Future of Payments / Financial Innovation

### Development paths



The way that a buyer chooses to compensate the seller of a good or service that is also acceptable to the seller. Typical payment methods used in a modern business context include cash, checks, credit or debit cards, money orders, bank transfers and online payment services such as PayPal.

### Trends:

Digital currencies/ Cashless payment

Digital currencies as well as cryptocurrencies are gaining attention particularly in e-commerce. A cryptocurrency is a medium of exchange such as the US dollar but has no physical form. Blockchain serves as an enabler.

The financial technologies (Fintech) revolution

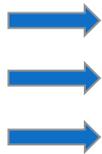
FinTech is a dynamic segment where technology-focused start-ups and new market entrants provide innovative products and services that are currently offered by the traditional financial services industry (e.g. PayPal, paytm).

# Descriptor 4 - Backup: Environmental Resource Management



## Environmental Resource Management

### Development paths



Environmental resources management aims to ensure that ecosystem services are protected and maintained for future human generations, and also maintain ecosystem integrity through considering ethical, economic, and scientific (ecological) variables.

### Trends:

---

#### *Water Scarcity*

Water scarcity has been identified as a higher risk than oil (annual renewable water supplies are less than 1,000 cbm/person).

---

#### *Land and Food Scarcity*

Land scarcity has been identified in densely populated cities. Demand for food will also increase, mostly driven by better living conditions and changing eating habits.

---

#### *Energy scarcity*

Growing population, GDP growth, increasing urbanisation and expanding middle class, drive increase the energy demand

---

#### *Rare earth elements*

Rare earth elements are used in high technologies, medical devices, and military defense systems, in emerging clean energy.

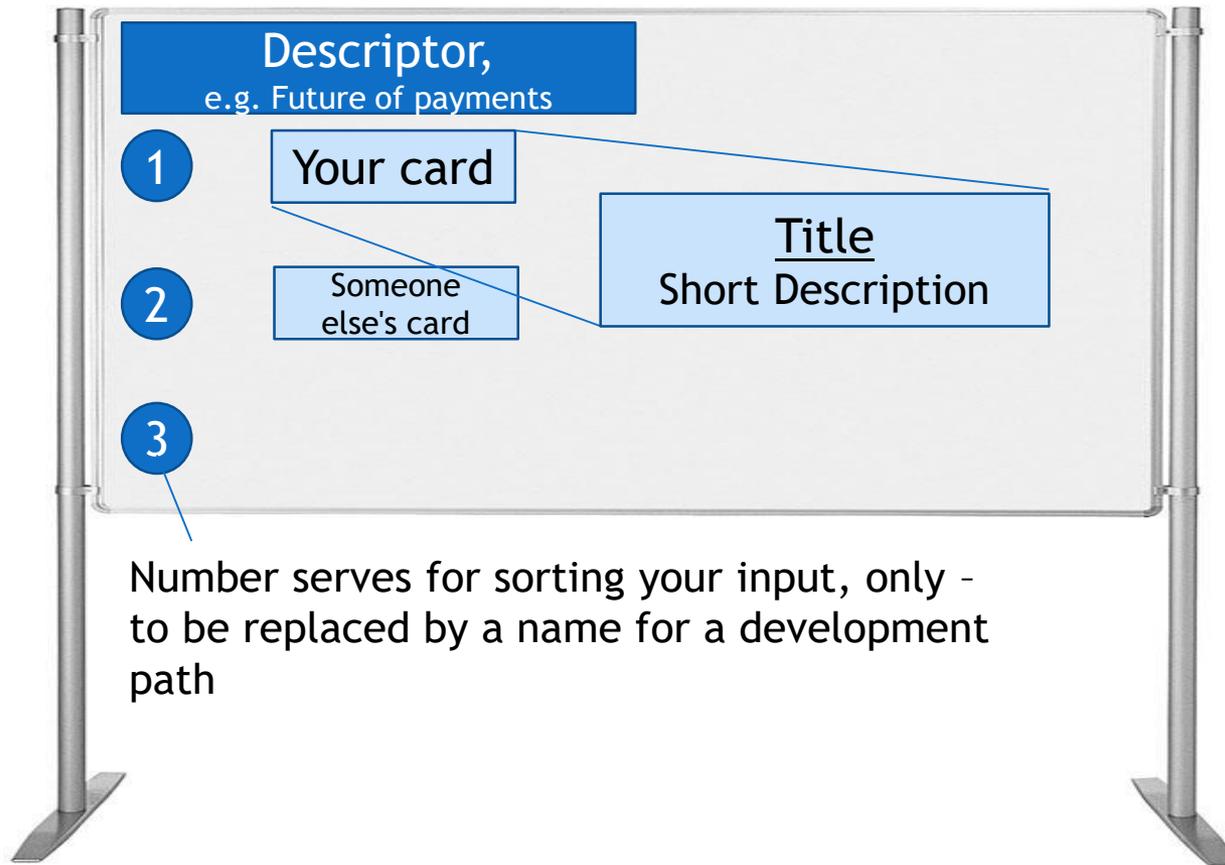
---

#### *Waste management*

Economic growth in emerging economies is raising more waste of all kinds.

---

# Example



# Set up of the Workshop

Split into 3 equally sized groups -  
Each group works on one descriptor

---

## Individual Brainstorming

*“How can a possible development path for the descriptor look like?”*



5 min

Take the trends into account.

---

## Discussion round

1. Explain your thoughts to the group
2. Sort your card to a similar category



15-20 min

---

## Name the development path

Think of a suitable and easy understandable name



10 min

---

Short summary for the complete workshop round



15 min -  
5 min each  
group

# Next steps in NextNet



February

**Development paths**

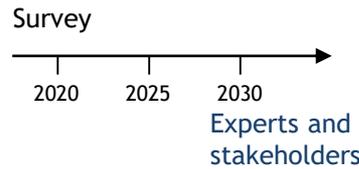
**NextNet partner**

Development Path	Description	Lead	Start
1. Protectionism	The world is being divided in further isolated political environments. The emergence of a group of protectionist countries against open trade agreements is leading to a new global trade system. This system is characterized by a high degree of protectionism, leading to a global trade system that is more isolated than ever. This system is characterized by a high degree of protectionism, leading to a global trade system that is more isolated than ever.	Yes	2020
2. Free Trade	The emergence of a group of free trade countries is leading to a new global trade system. This system is characterized by a high degree of free trade, leading to a global trade system that is more open than ever. This system is characterized by a high degree of free trade, leading to a global trade system that is more open than ever.	Yes	2020



NextNet partner  
Analysis of existing roadmaps

March



NextNet partner

**Cross-Impact Matrix**  
How strong is the influence of factor A on factor B?

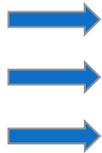
	Big Data	Big Data	Sustainability	Digitization	Factor 0	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor sum
Factor A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor B	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor C	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor D	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor E	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor F	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor G	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor H	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor I	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor J	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor K	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor L	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor M	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor O	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor P	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor Q	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor R	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor T	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor U	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor V	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor X	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor Y	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor Z	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AB	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AD	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AK	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AO	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AR	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AU	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor AZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BB	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BD	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BK	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BO	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BR	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BU	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BX	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor BZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CB	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CD	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CK	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CL	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CN	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CO	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CR	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CU	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Factor CX	0	0	0											

# Descriptor 5: Digital Transformation



## Digital Transformation

### Development paths



Digital transformation describes the changes associated with digital technology application and integration into all aspects of human life and society e.g. to improve performance of enterprises or convenience of social life.

### Trends:

---

#### Big Data Analytics

Big Data Analytics is the application of advanced statistics to any kind of stored electronic communication.

---

#### Artificial Intelligence

Artificial intelligence includes software algorithms for decision-making tasks in order to mimic the human thought processes and senses.

---

#### Blockchain

Blockchain can be defined as a “distributed, shared, encrypted database that serves as an irreversible and incorruptible repository of information”

---

#### Cloud based computer systems

Cloud computing is a method for delivering information technology (IT) services in which resources are retrieved from the Internet.

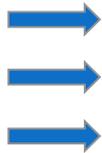
---

# Descriptor 4: Disruptive Production Technologies



## Disruptive Technologies

### Development paths



A disruptive technology is one that displaces an established technology and shakes up the industry or a ground-breaking product that creates a completely new industry.

### Trends:

New technologies like additive manufacturing or selective laser melting

Additive manufacturing is an alternative to the traditional product manufacturing process. There are different subtypes of additive manufacturing including 3D printing, but also rapid prototyping and direct digital manufacturing (DDM).

Cyber-physical systems (CPS)

Cyber-physical systems integrate computing and physical processes where the key focus is on link between computational and physical elements