ESTIA
INSTITUTE OF TECHNOLOGY
ESTIA-TECH
CCI BAYONNE PAYS BASQUE
Euskal Herri

12/05/2022

Journée 4.0 – Usine du Futur

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AGENDA

- Présentation de l’Estia
- Présentation du projet CHAIN
- Introduction à l’industrie 4.0
- Les programmes d’accompagnement en Nouvelle-Aquitaine
- Exemples d’application

Institute Profile

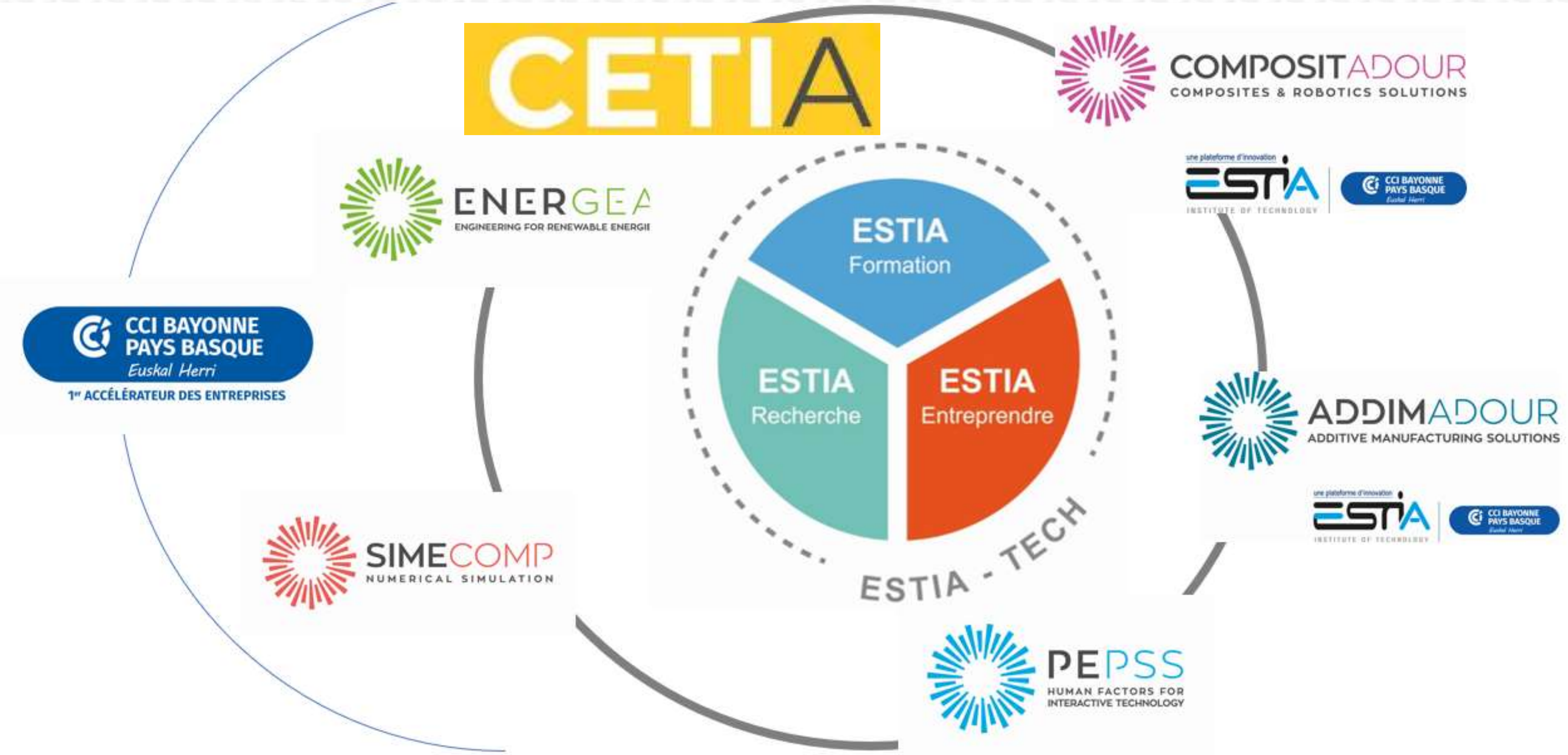
Founded in 1996, the **ESTIA INSTITUTE OF TECHNOLOGY** is a general engineering French school training trilingual versatile engineers, to undertake positions such as product engineer, supply chain planner/manager, quality manager, production manager, and project manager.

The ESTIA campus is an ecosystem which includes:

- Engineering courses & masters degrees
- Research teams in technology
- Technical platforms
- A company incubator

ESTIA TECH Ressources

ESTIATECH is the entity in charge of value-added research and technology transfer, fosters relationships between ESTIA and businesses looking for technological solutions, skills and training for their innovative projects, and stimulates partner-oriented research.



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CHAIN

Introduction to Industry 4.0

chainproject.eu

Project reference number 2018-1-PT01-KA203-047330

Co-funded by the Erasmus+ Programme of the European Union

What is CHAIN? - Aim

- Creation of new competencies for high education students and SMEs to deal with the change brought by this “revolution”.

- Provides companies with a guideline and a training course for promoting digitization

What is CHAIN? – Partners

Coordinator

POLITÉCNICO DE LEIRIA

Portugal

Partners

AidLearn

Portugal

ECQ

Bulgaria

ESTIA

France

FH JOANNEUM University of Applied Sciences

Austria

Funded by EC:
ERASMUS+

What is CHAIN? – Outputs

- Brochure on I4.0
  - Definition, review of theories of innovation/technological revolution/illustrative examples of the transformation impacting at the economy/society and SMEs.
- Battery of Case Studies
  - 8 prospective case studies of SMEs that in partner countries try to meet the challenges posed by Industry 4.0.
- Course: Strategic Digitisation of Organisations
  - 5 modules and organized in F2F sessions, including a practical Lab. Duration of 70 contact hours, 130 total hours and 6 ECTS.
- Strategic Guidelines
  - A concise and focused document for supplying HE organisations with relevant information for generating new skills required by Industry 4.0
- Interactive Documentary
  - Web interactive documentary, freely accessible via the project website in five languages (PT; BG; FR; DE;EN).

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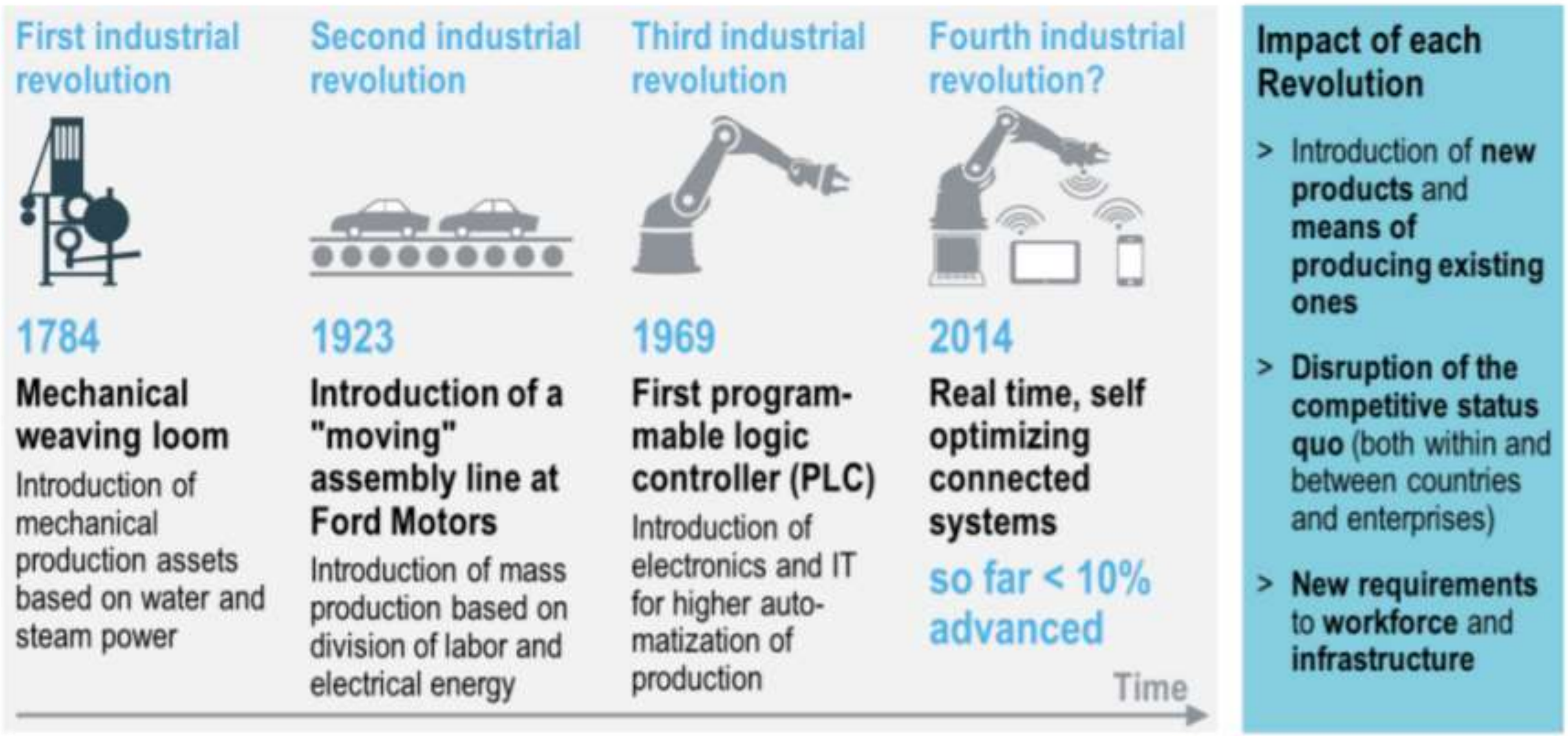
Development stages of industrial manufacturing

Figure 1: Development stages of industrial manufacturing



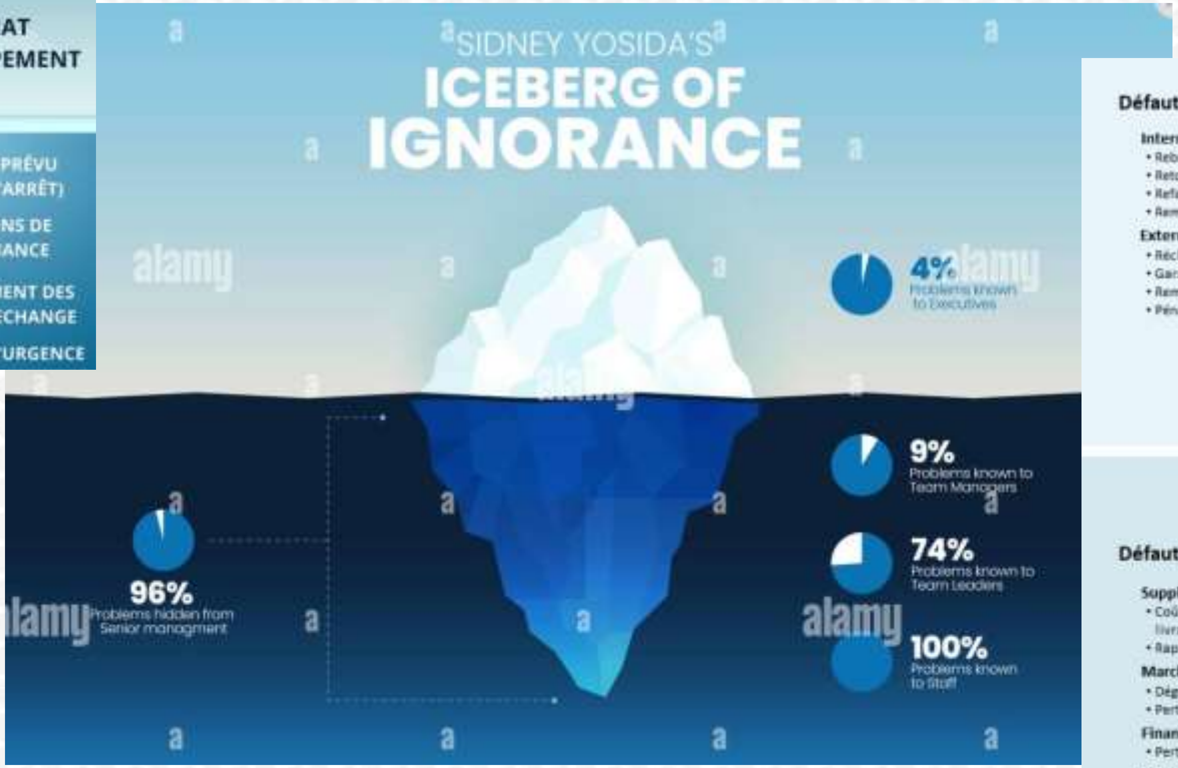
Source: Roland Berger

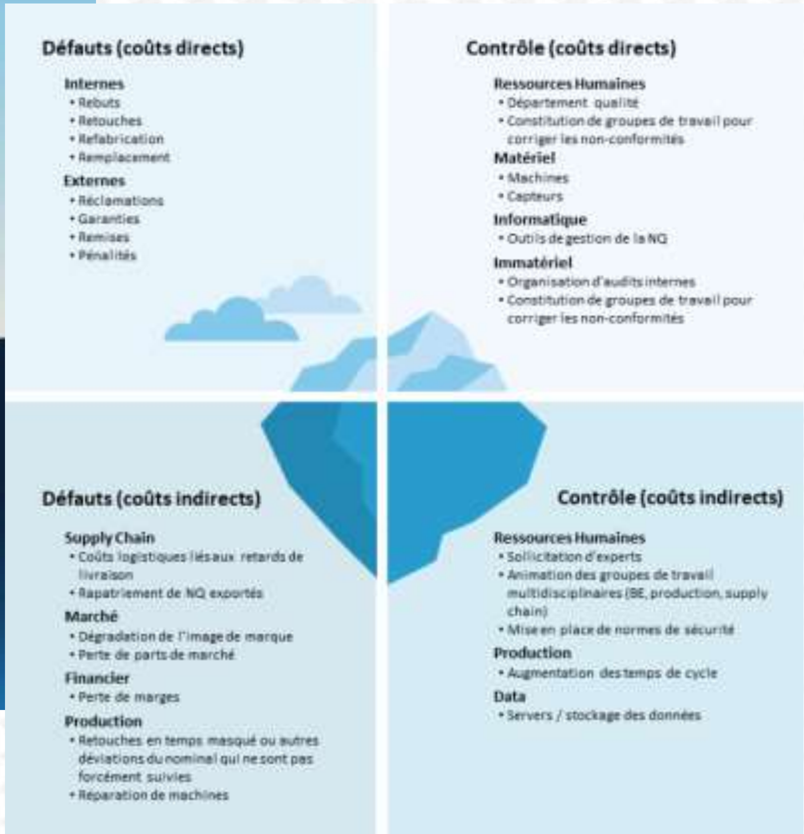
How do we define Industry 4.0? Different approaches

Virtualisation / Machines et produits connectés / usine numérique / Optimisation de la chaîne des fournisseurs	Place de l'homme dans l'Usine/ Cobotique / Réalité augmentée
Procédés avancés de production (fabrication additive, compression isostatique à chaud, etc.)	Monitoring et contrôle
Composites, nouveaux matériaux et assemblage	« Transitique »/ Robotique de process / Automatisation
Efficacité Energétique et Empreinte Environnementale	Processus hybrides continu-discrets ou spéciaux

Thématiques Usine du Futur	**Les nouveaux procédés de fabrication** Robotique avancée, cobotique, additive manufacturing, impression 3D…	**La digitalisation :** outils numériques avancés, outils de simulation, IoT, réalité virtuelle & augmentée, objets connectés…	**Les nouvelles formes d'organisation des entreprises et de leur écosystème :** nouvelles organisations, qualité de vie au travail, nouveaux business models… éco-conception et éco-innovation…	**Les enjeux sociétaux :** changement climatique, transition énergétique, efficience des ressources, croissance bleue, silver économie…

Industry 4.0 : What for? The iceberg approach





How do we define Industry 4.0? Horizontal / vertical integration…

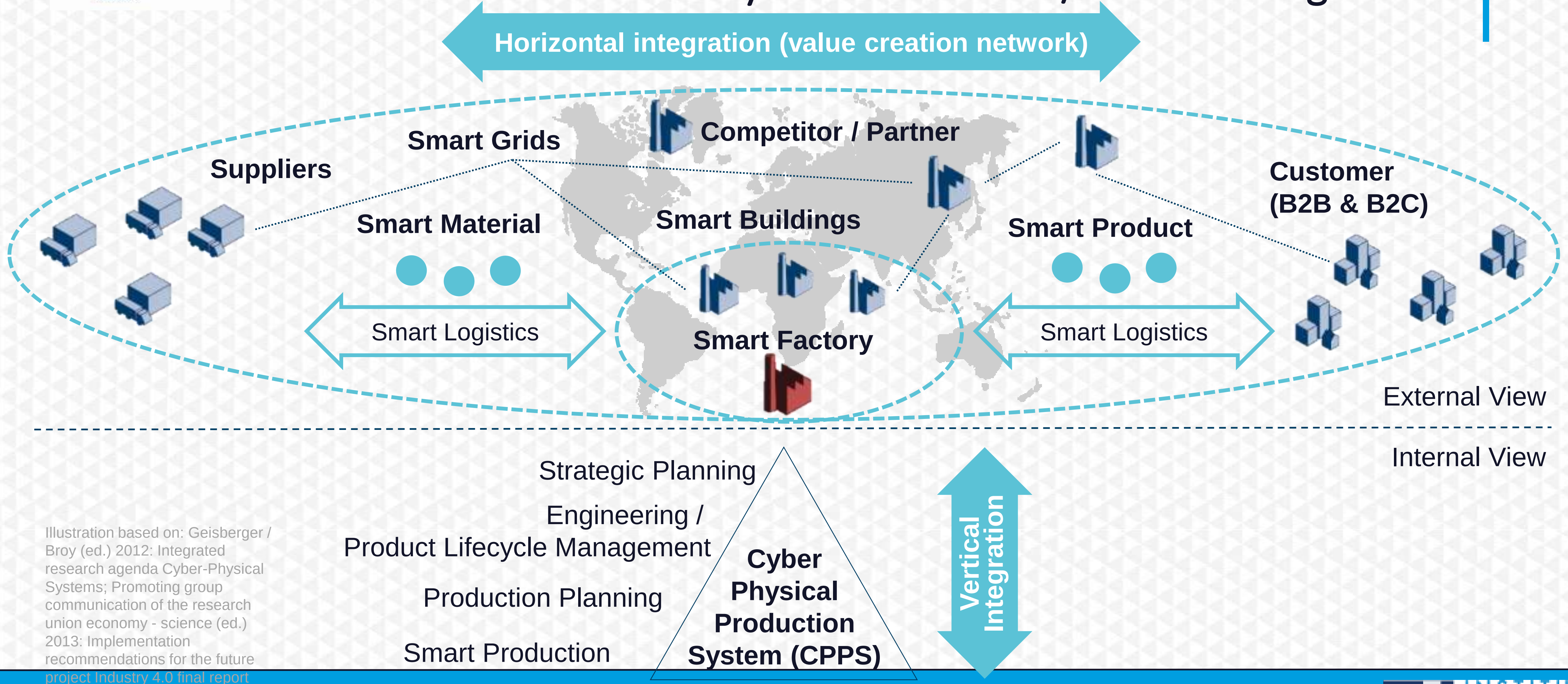
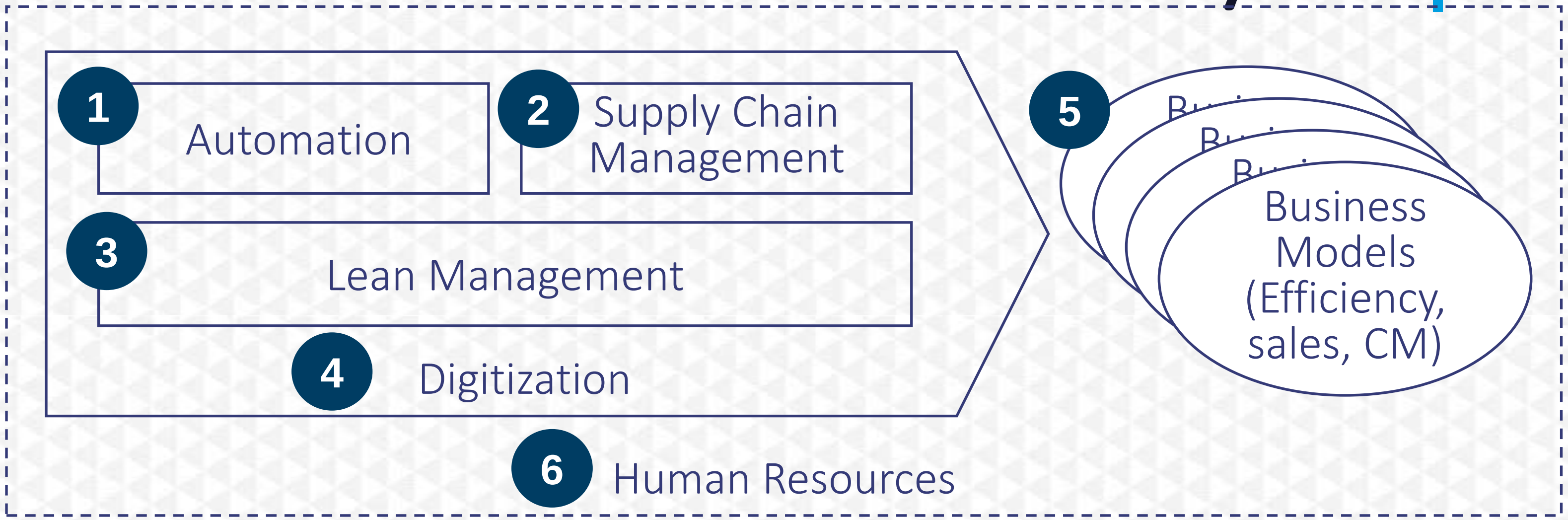


Illustration based on: Geisberger / Broy (ed.) 2012: Integrated research agenda Cyber-Physical Systems; Promoting group communication of the research union economy - science (ed.) 2013: Implementation recommendations for the future project Industry 4.0 final report

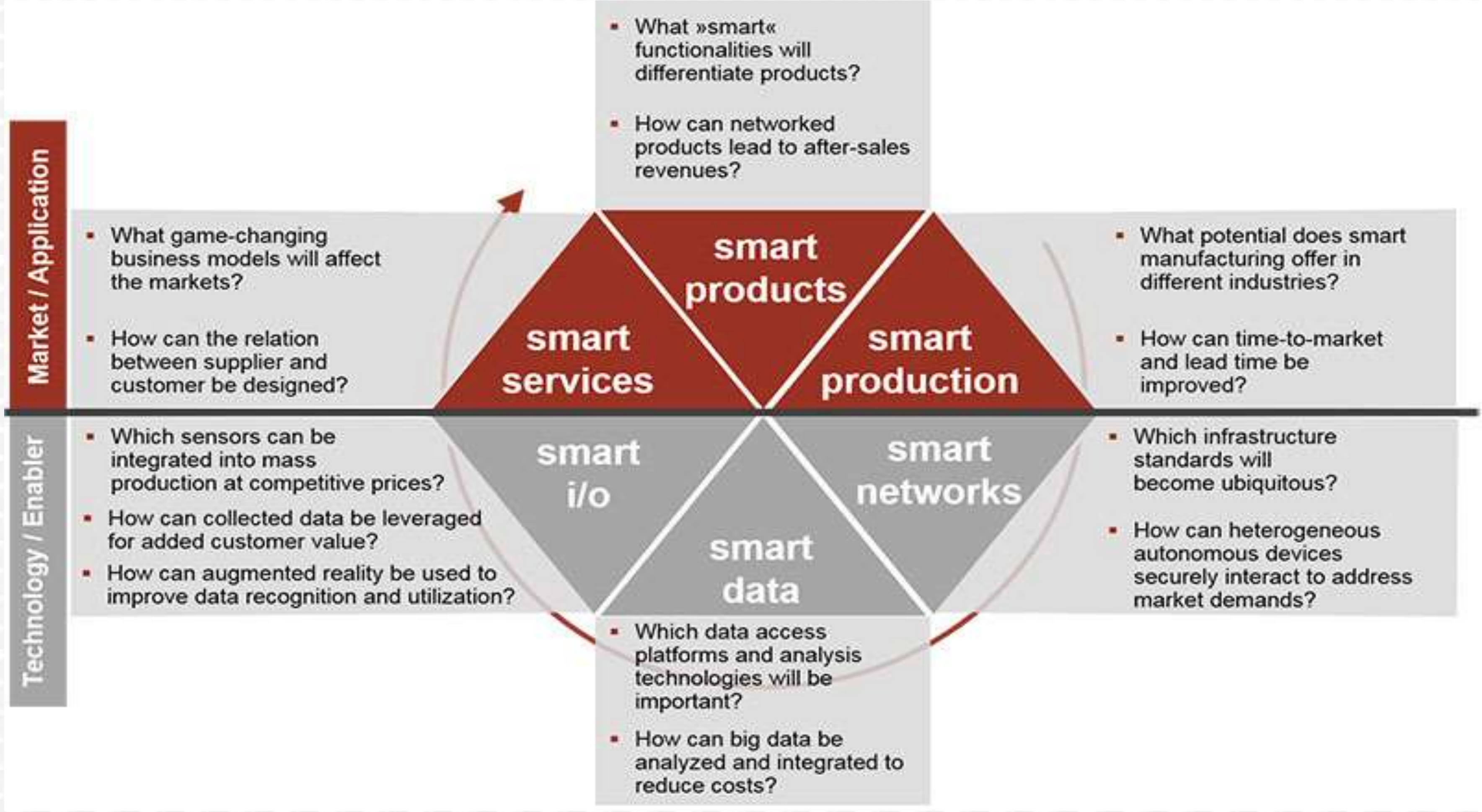
The 6 fields of action of Industry 4.0



1. The **degree of automation** in production, (in-house) logistics and planning and control services.
2. The **degree of involvement** of customers and business partners in the value creation processes continues to increase (supply chain management).
3. Digitization requires (even) leaner processes (**lean production / management**).
4. The **degree of digitization** throughout the company, especially with automation and customer / business partner integration, is increasing strongly : embedded systems and cyber-physical systems (CPS), smart factories, robust networks, cloud computing and IT security.
5. From this - evolutionarily or disruptively - opportunities and risks result from **new business models** that lead to more sales and / or more efficiency and / or higher margins.
6. The **demands on employees** with regard to training / education and willingness to change are increasing.

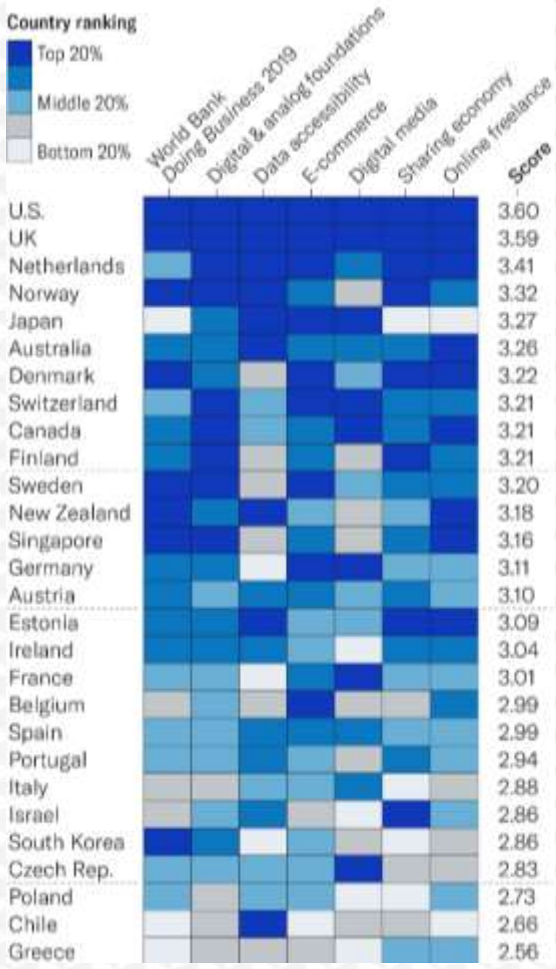
Smart Products & Smart Services

'Smart Products', 'Smart Services' and 'Smart Production' are made possible by intelligent **data** (use) and **networking** as well as **sensors** and **actuators**.



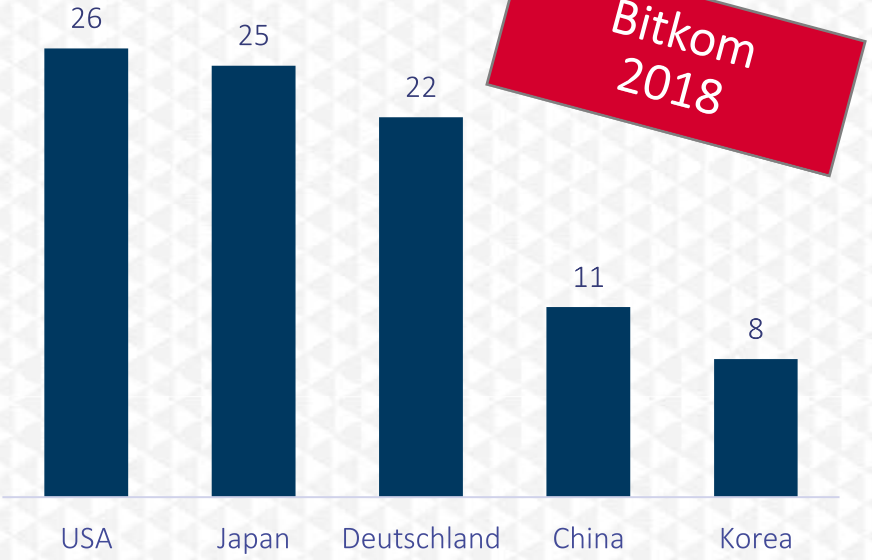
KEX AG, project on "Digitalization in Process Manufacturing"

Which industrial nation leads? Are the USA really the frontrunners? According to studies, yes, with Europe catching up!



HBR 2019

Comparison of countries doing digital business



Bitkom 2018

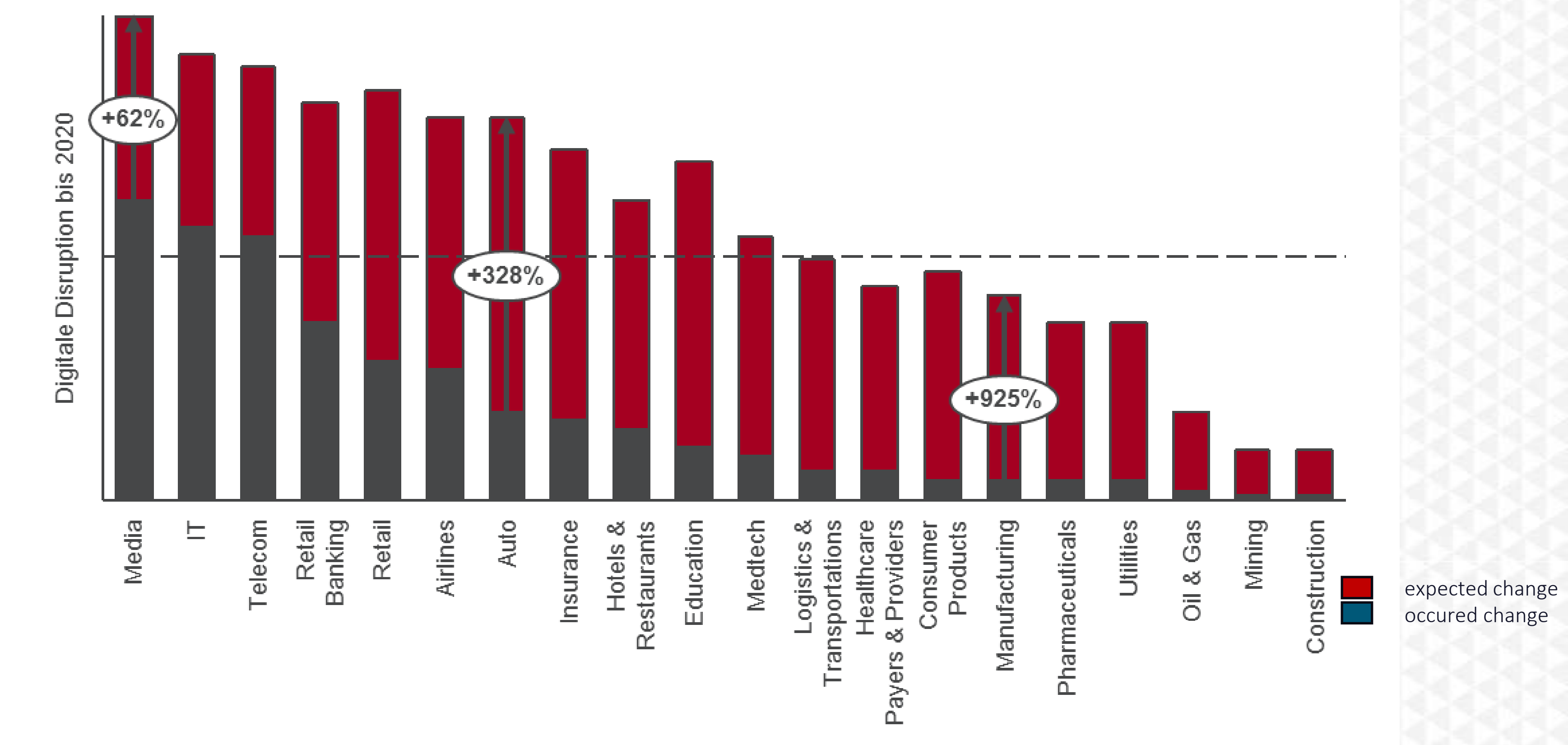
CONCLUSION

1. Investments in Industry 4.0 vary significantly between countries [%].
2. Germany (1st in a DACH comparison) far behind the USA.
3. To ensure competitiveness, European companies must recognize the potential of Industry 4.0 and drive digital transformation in the company.

Bhaskar Chakravorti / Ravi Shankar Chaturvedi: Ranking 42 Countries by Ease of Doing Digital Business, Harvard Business Review, 2019
https://hbr.org/2019/09/ranking-42-countries-by-ease-of-doing-digital-business#

Digitalization: Major Challenges Still Ahead of Us

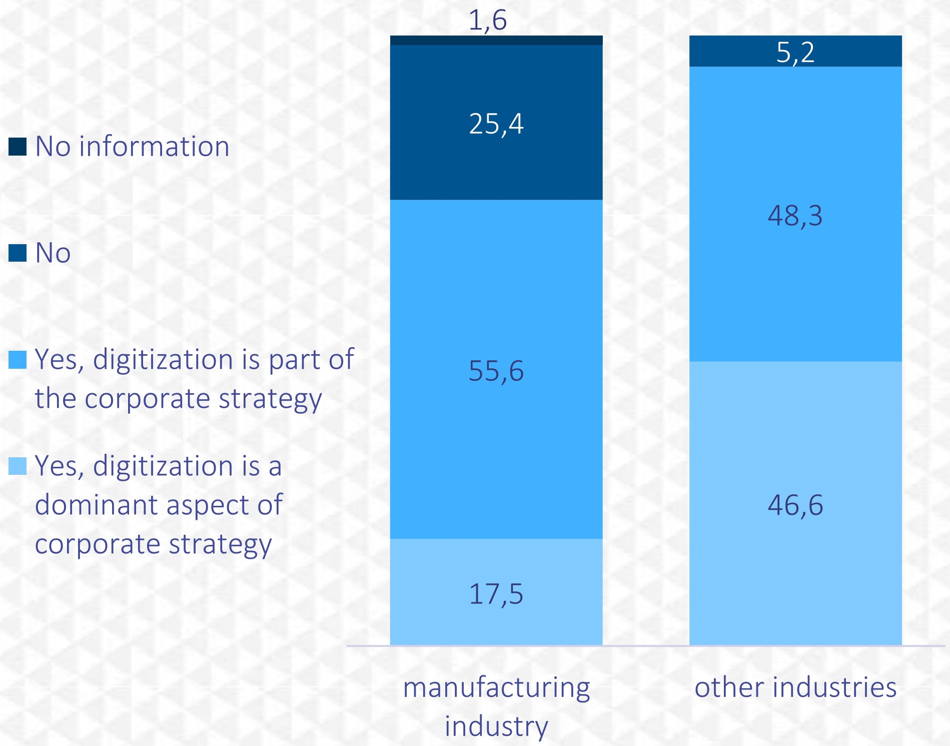
Progress in digitalization per industry today and 2020



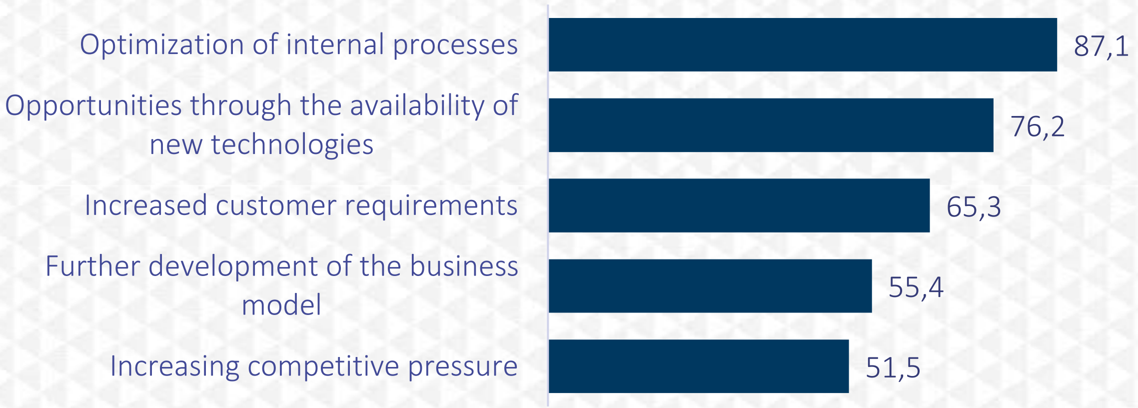
1. Different levels of digitalization per industry
2. Digital transformation still in an early phase
3. Major changes still to come

Challenge in digitalization – e.g. digitization strategy in SMEs

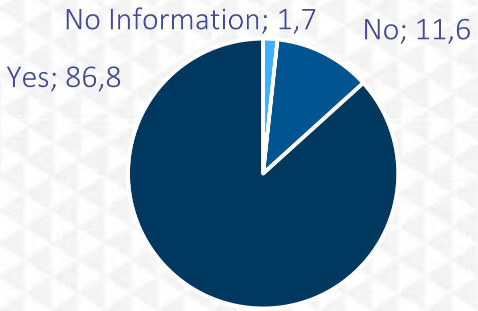
Strategic pent-up demand in manufacturing



Top 5 reasons for implementing a digitization strategy



Did you carry out digitization projects in 2016 - 2017?

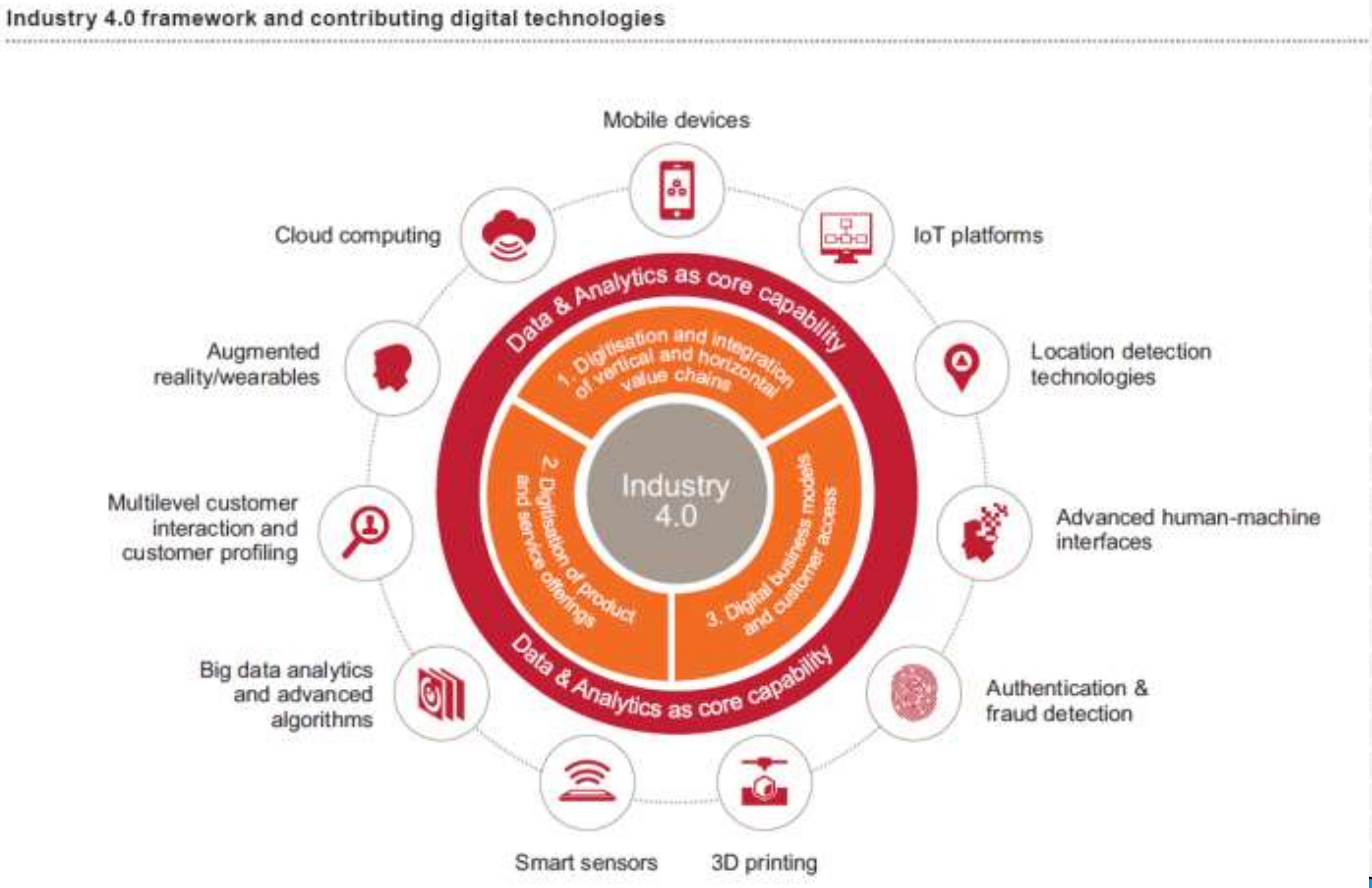


Schulke A.,/ Jütte S.:Digitalisierung im Mittelstand 2018,iubh internationale Hochschule

8 barriers, especially for SME...

1. IT and data security
2. High investment costs
3. Unclear return on investment
4. Lack of appropriately qualified employees
5. Employees' fears of change
6. Uncertainty about the technical development path
7. Unsolved technical problems and unclear standards
8. Use of cloud infrastructures

One cake, many pieces: Core elements of I4.0, or: what are its digital technologies?



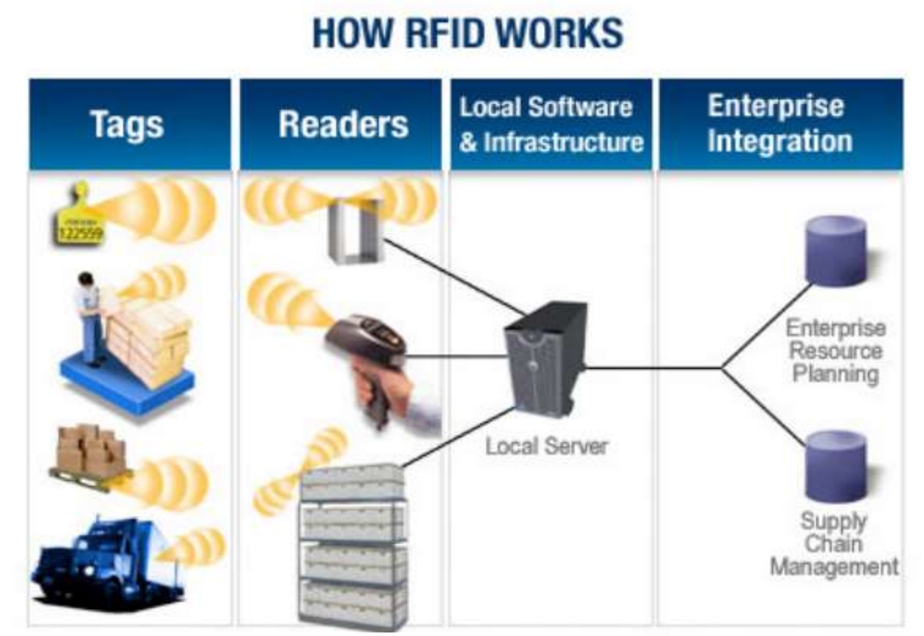
Core element 1: RFID (Radio Frequency Identification)

... describes the identification of various objects using readers and electromagnetic waves emitted by RFID tags attached to the object.

The identification of any objects within logistic process chains as well as the linking of objects and information and thus the optimization of processes are the goals of the use of RFID systems.

Siepmann 2016, p. 51-53; Krieger 2014, requeste date: 19.12.2018; Geisberger/Broy 2013, p. 254.

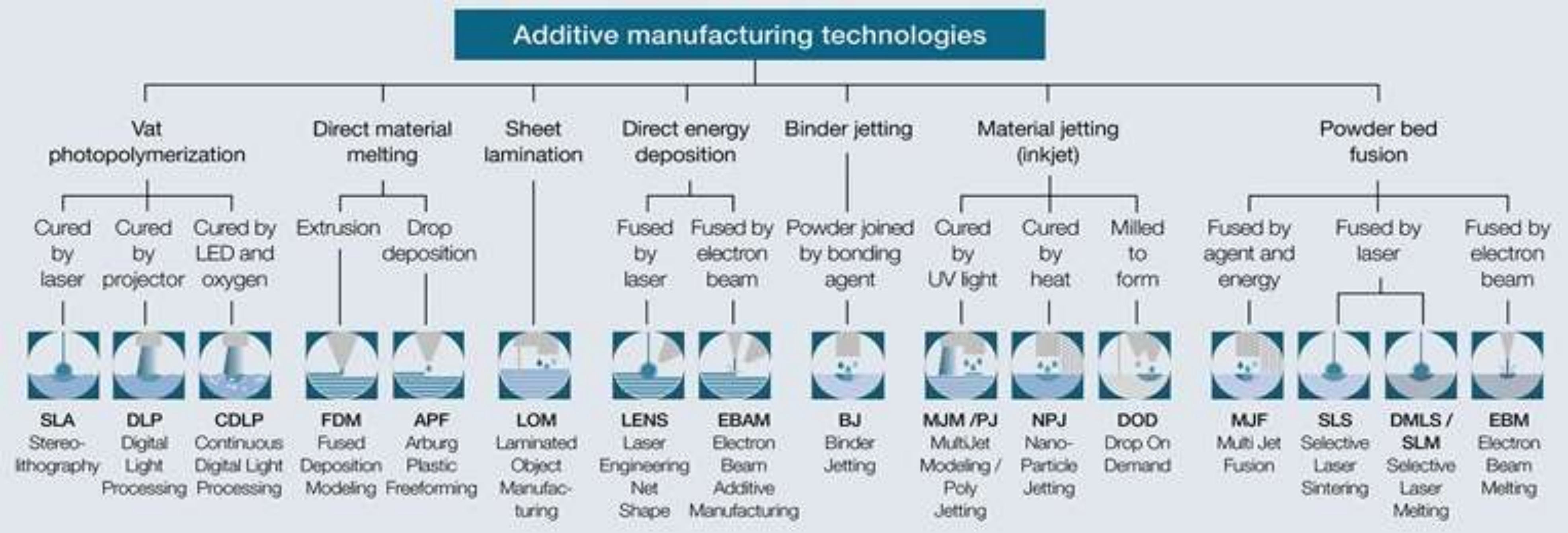
https://stock.adobe.com/at/images/banner-rfid-radio-frequency-identification/249367984



https://www.pinterest.com/pin/686024955711313652/

Core element 2: Additive Manufacturing

… is used to create a three-dimensional object from a digital model by adding material layer by layer.



https://www.sulzer.com/en/shared/about-us/additive-manufacturing-technologies-at-sulzer

It allows designers and manufacturers to build complex parts such as tools, toys, spare parts, etc., at a fraction of the cost compared to what it takes to buy the actual product and saves the time involved in the copying, moulding, and shaping processes.

Gebhardt 2017; Kumar, Pandey, Wimpenny 2018; Maheshwari 2019.

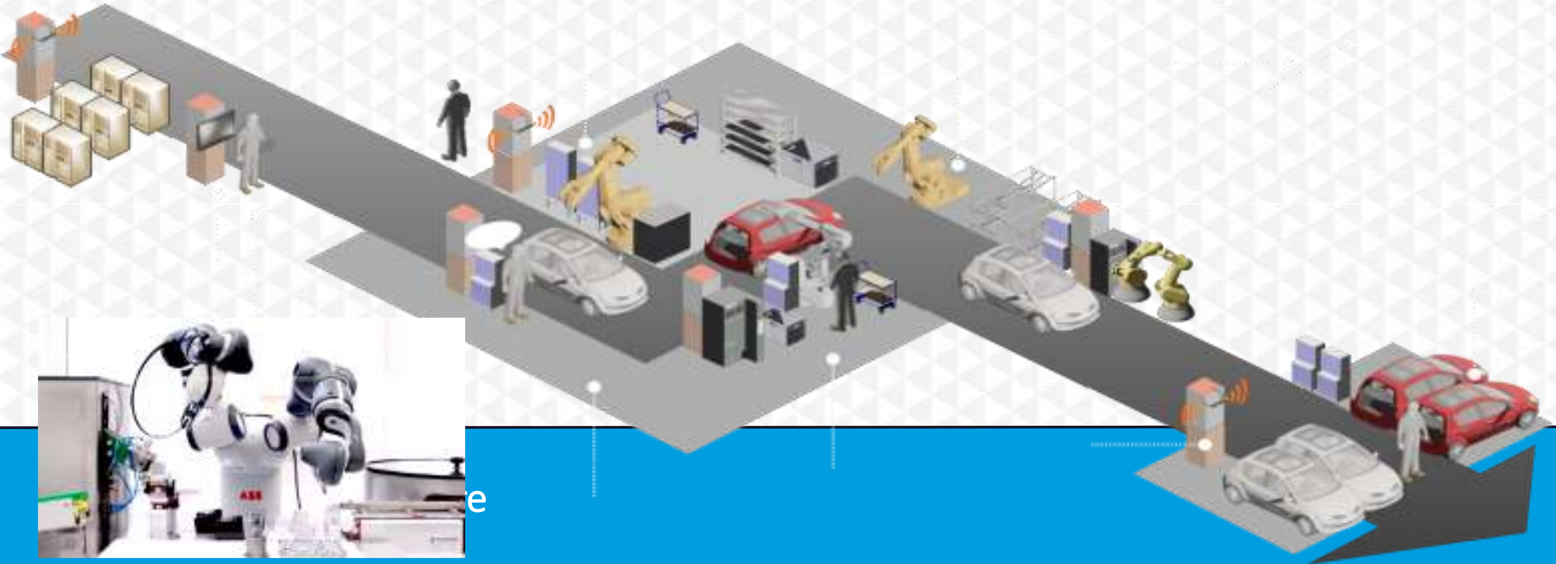
Core element 3: Automation and Robotics

…Automation and Robotics: initially replace humans on simple and repetitive tasks, by now, the workstation is completely transformed to facilitate interaction and cohabitation between the human and the robot…

…Exoskeletons: improve physical performance and reduce the arduousness of certain tasks or compensate human disability …

…Cobotics: collaborative robot interpreting the person's actions and needs to provide the best response and increase human performance

…Mobile robotics: drones (even submarine), autonomous vehicules…



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Core element 4: Cloud computing

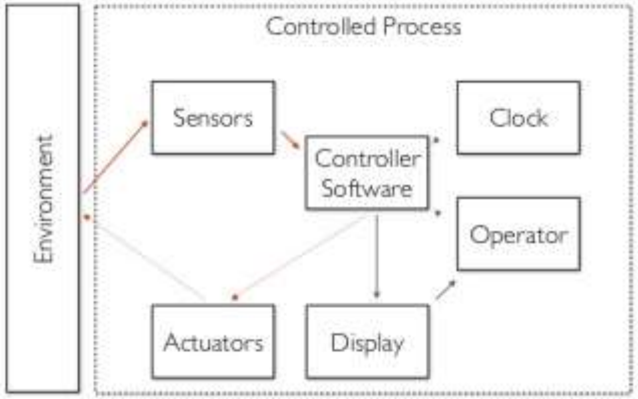
... refers to hardware functions, software or digital applications made available as services via the Internet.

Applications are stored in a virtual "cloud" operated by the provider – the cloud is comparable to a data centre.

Thus, it´s a new technology that refers to a centralized storage space that is made possible by remote servers software on the world wide web. Users share resources over the network, share the services and ultimately maximize efficiency.

Fallenbeck/Eckert 2014, p. 397-431; Ortner/Gerhardter 2012, p. 37-42; Mell/Grance 2011, p. 3; www.computersciencedegreehub.com/faq/cloud-computing/

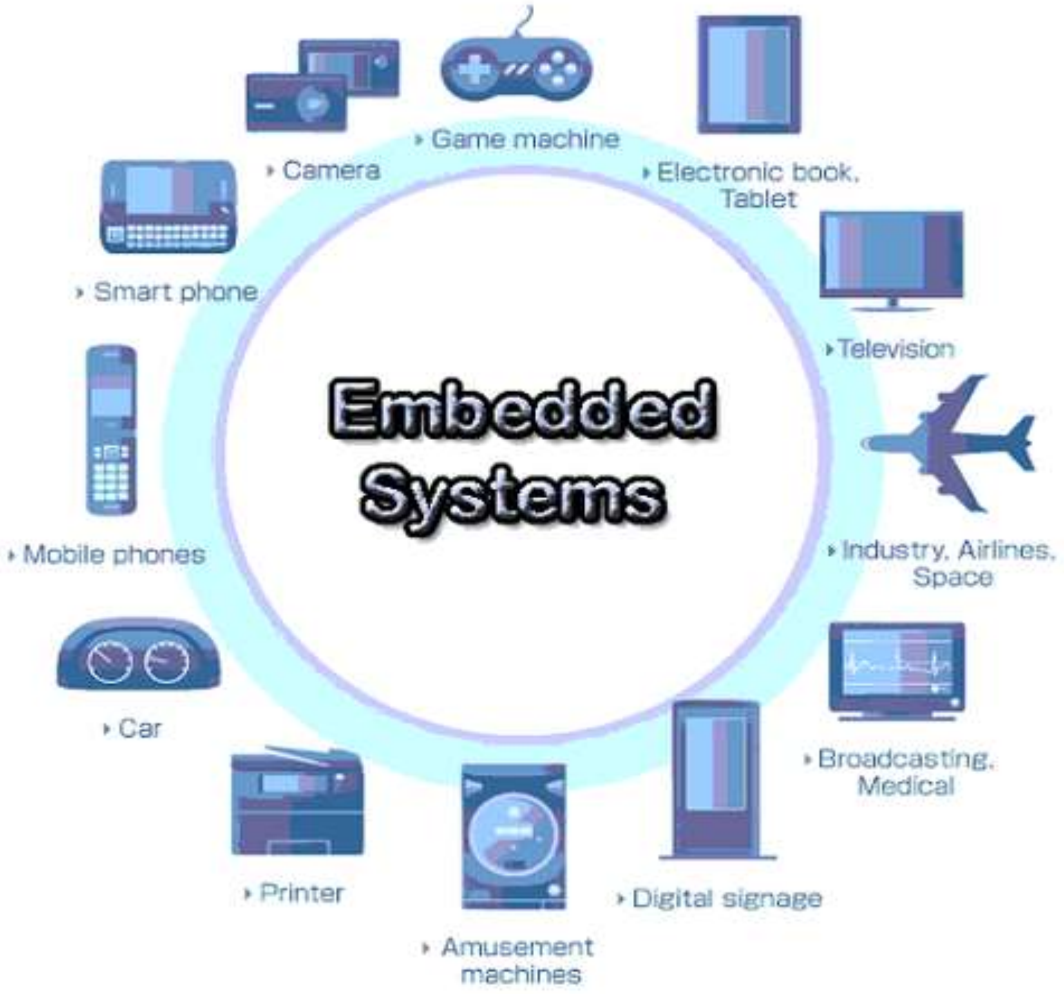
Core element 5: Embedded Systems



...are microprocessor- or microcontroller-based systems of software and hardware **integrated** (= embedded) into a comprehensive technical system (see examples in the figure).

Thus, they perform dedicated functions within a larger mechanical or electrical system and serve the realization of system-specific functional characteristics.

Bauernhansl et al. 2014, p. 15-16; Kagermann et al. 2013, S.85.



https://www.indiamart.com/proddetail/embedded-system-software-6585748473.html

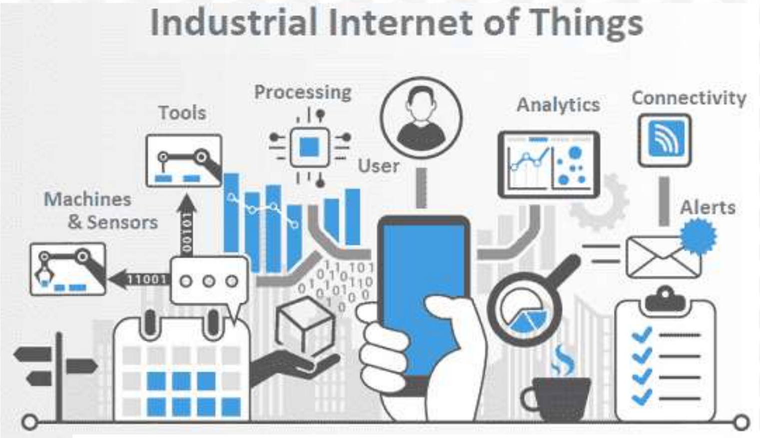
Core element 6: Industrial Internet of Things (IIoT)

...describes things that are equipped with IP addresses (...)

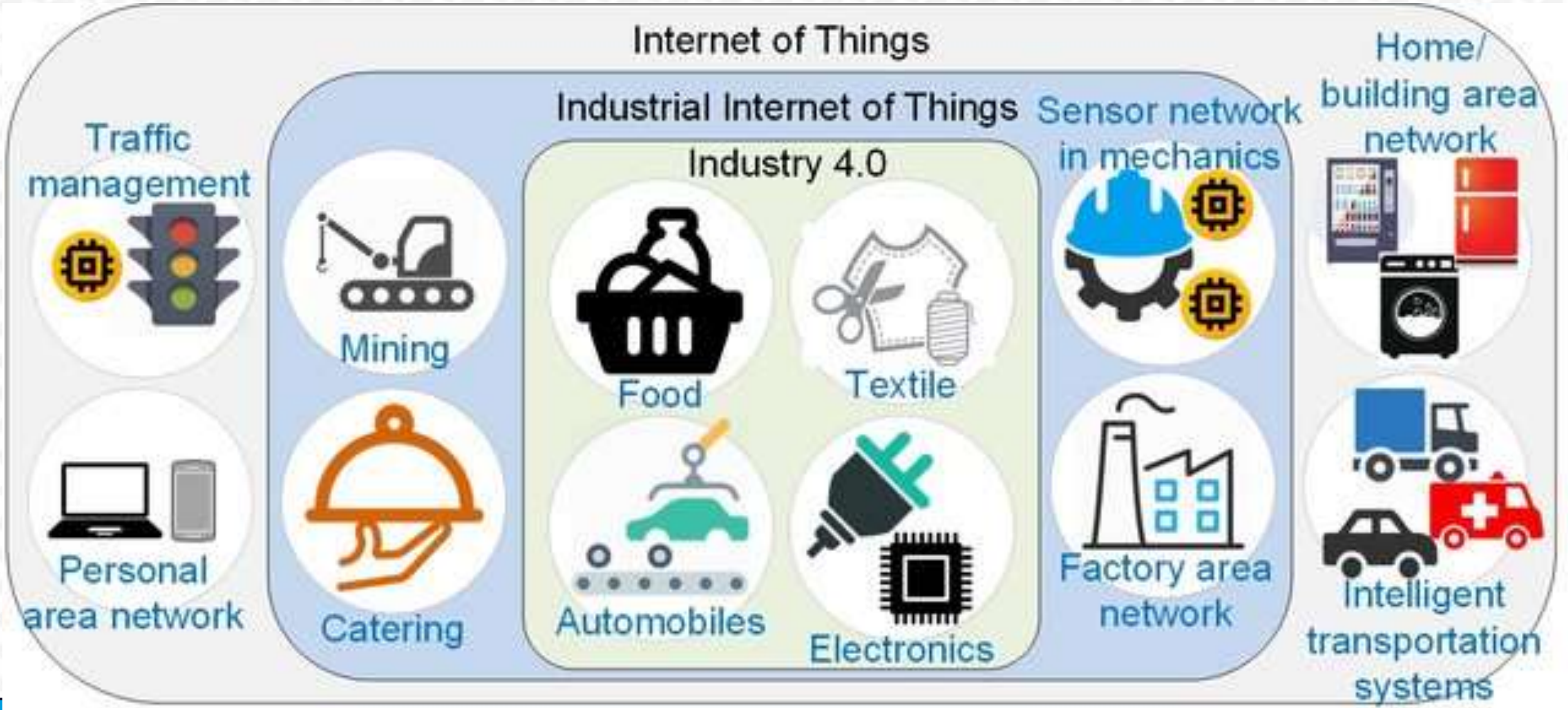
...and are able to exchange information with other objects and IT systems via sensors, microchips and embedded systems and to withdraw and use provided services.

...describes the integration of IoT technologies within the industrial value chain. The aim is to enable fully digitalised, self-controlling and decentralised industrial value chains.

Müller/Voigt 2018, p. 659; Lee/Zhang 2017, p. 335.



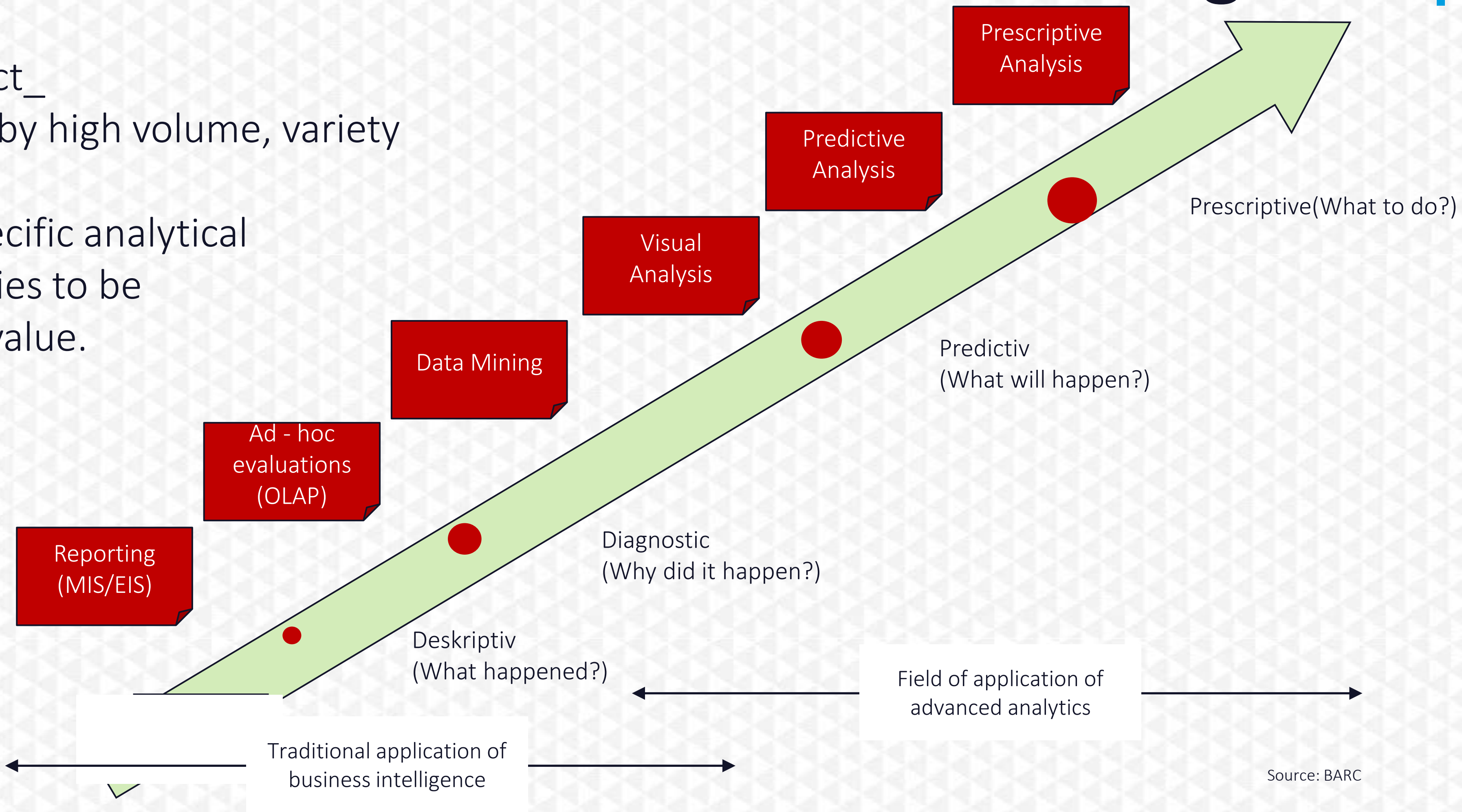
http://www.concsystems.in/Industrial%20IoT(IIoT).html



https://www.researchgate.net/publication/326359269_Deploying_Fog_Computing_in_Industrial_Internet_of_Things_and_Industry_40/figures?lo=1

Core element 7: Big Data

...is an information object_
_which is characterized by high volume, variety and speed,
_and which requires specific analytical methods and technologies to be converted into benefit/value.



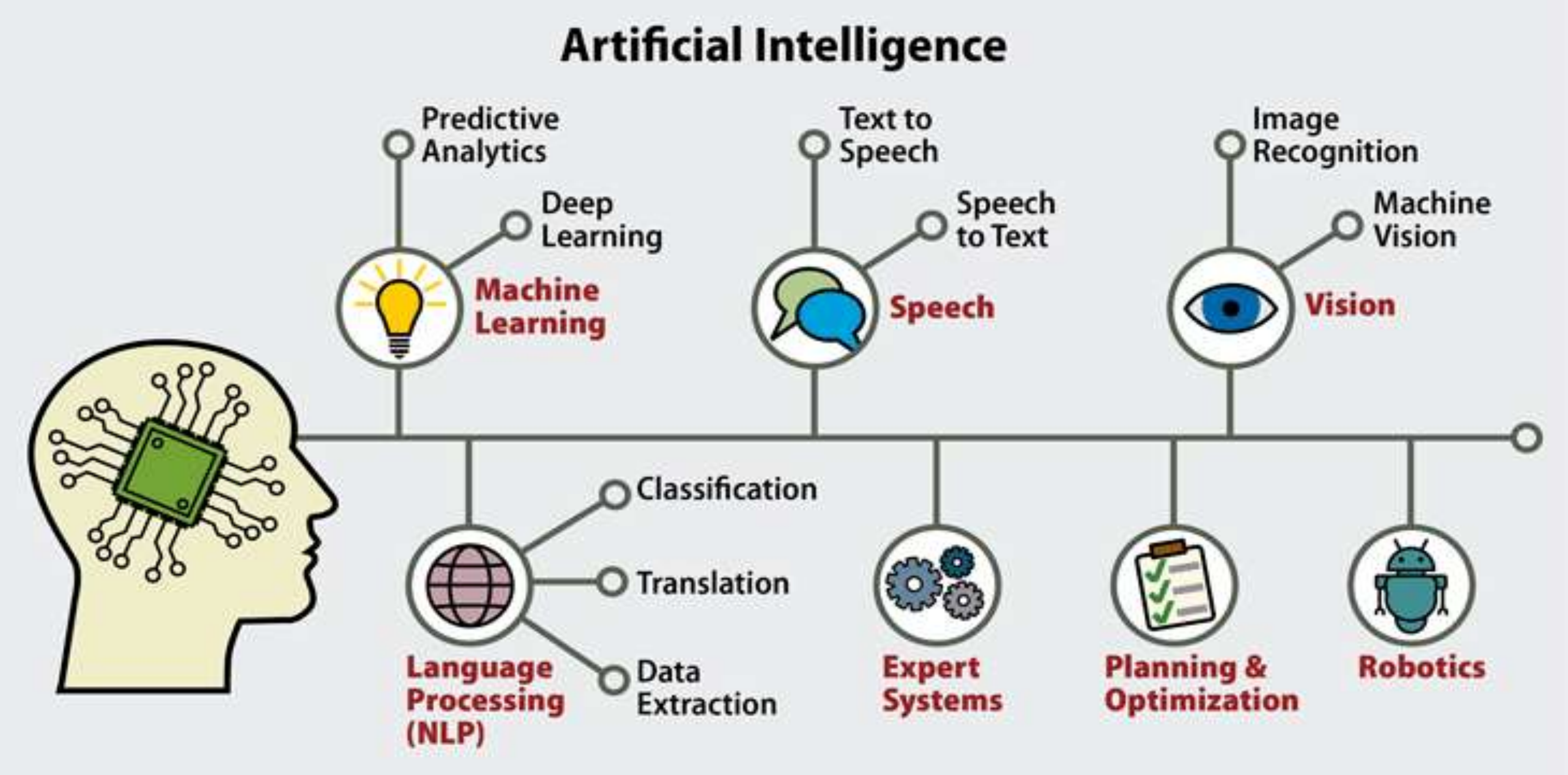
Source: BARC

Core element 8: Artificial Intelligence

… is the study of how to make computers do things at which, at the moment, people are better.

It is the technology that allows machines to interact with humans, data, and the entire ecosystem and learn from this such that they can perform more than what either humans od machines can do on their own.

Rich 1983; Ertel 2011; Maheshwari 2019; Neugebauer 2018.



https://www.hsc-global.my/current-trends-in-computer-science/

Core element 9: Augmented Reality (AR)

... is a combination of the reality that is perceived and a reality that is generated by the computer.

AR offers the user in addition to his real perceptions further information that is directly related to the perceptions.

Roth 2016. p. 261; Mayer/Pantförder 2014, p. 486-487; Craig 2013, p. 1-2.

https://www.techrepublic.com/article/augmented-reality-for-business-cheat-sheet/

https://www.produktion.de/technik/wie-bmw-augmented-reality-in-der-produktion-einsetzt-297.html

Example: Display of additional virtual information via the camera of a mobile device (data glasses, smartphone).

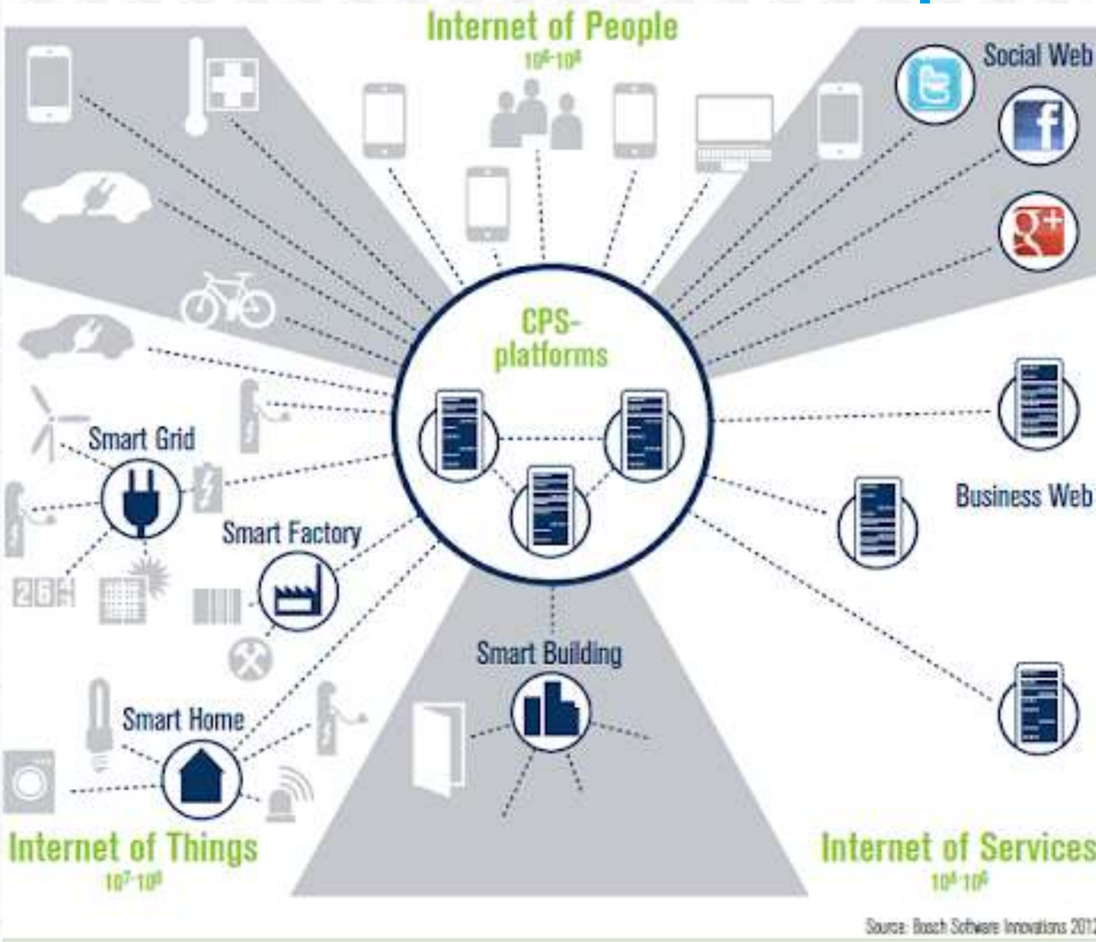
https://youtu.be/0m67O1Em7dY

Core elements 10: Cyber-Physical Systems (CPS) as technological enablers and Economical Drivers of I4.0

... define a fusion of physical and digital systems using **actuators** to directly influence and **sensors** to monitor and capture the physical environment.

Objects, buildings, equipment and production facilities contain logistics components and are equipped with embedded systems that enable them to communicate via the Internet.

CPS combine different engineering approaches from the fields of mechanics, electronics, IT, control engineering, thermodynamics and materials engineering.



http://tadviser.com/index.php/Article:Cyberphysical_systems_(Cyber-Physical_System,_CPS)

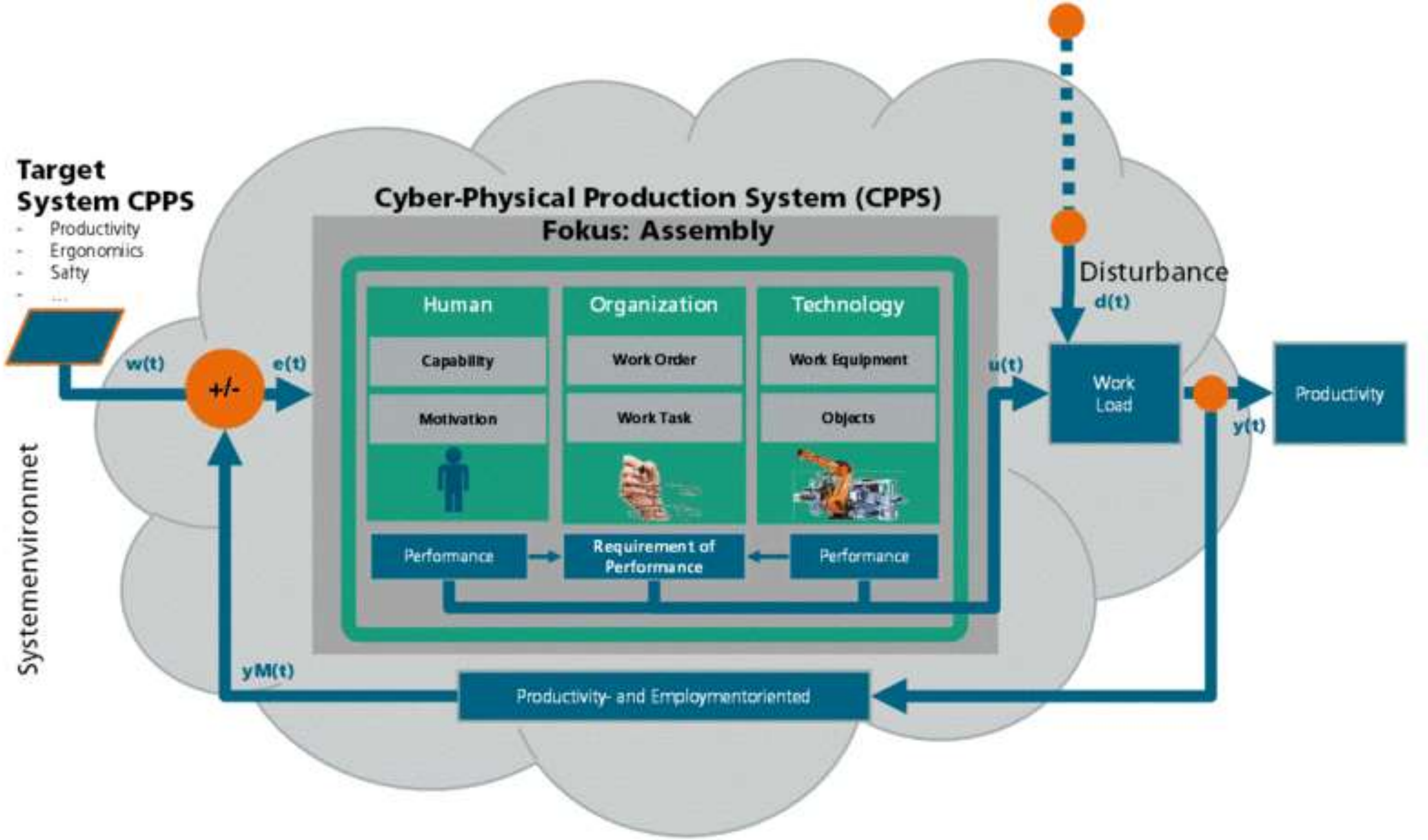
Paetzold 2017, p. 28; Bondavalli 2016, p. VII; Bauernhansl 2014, p. 15; Geisber
84; Spath et al. 2013; VDI 2013, p. 3.

Core element 10: Cyber-Physical Production

… are cyber-physical systems used in the manufacturing industry, which enable a continuous contemplation of products, means of production and production systems under consideration of changing processes.

CPPS promote new production processes to reduce time-to-market and optimize quality and costs.

Wiesner/Thoben 2017, p.63; Siepmann 2016, p. 29; Vogel-Heuser 2014, p. 39-40; Kagermann et al. 2013, p. 84.



dc-cpps.tuwien.ac.at/dissertation_subjects/productivity_and_employment_oriented_working_system_design_in_cpps/

Core element 11: Enterprise Resource Planning (ERP)

- Resource planning software
- operational data and processes can be managed in a database
- Almost all of a company's processes can be brought together and linked with ERP
- Digital Twin
    - connects different plants and production facilities
    - Operational resources e.g. Production materials, personnel or capital can be managed better, more resource-efficiently, more efficiently and more cost-effectively.

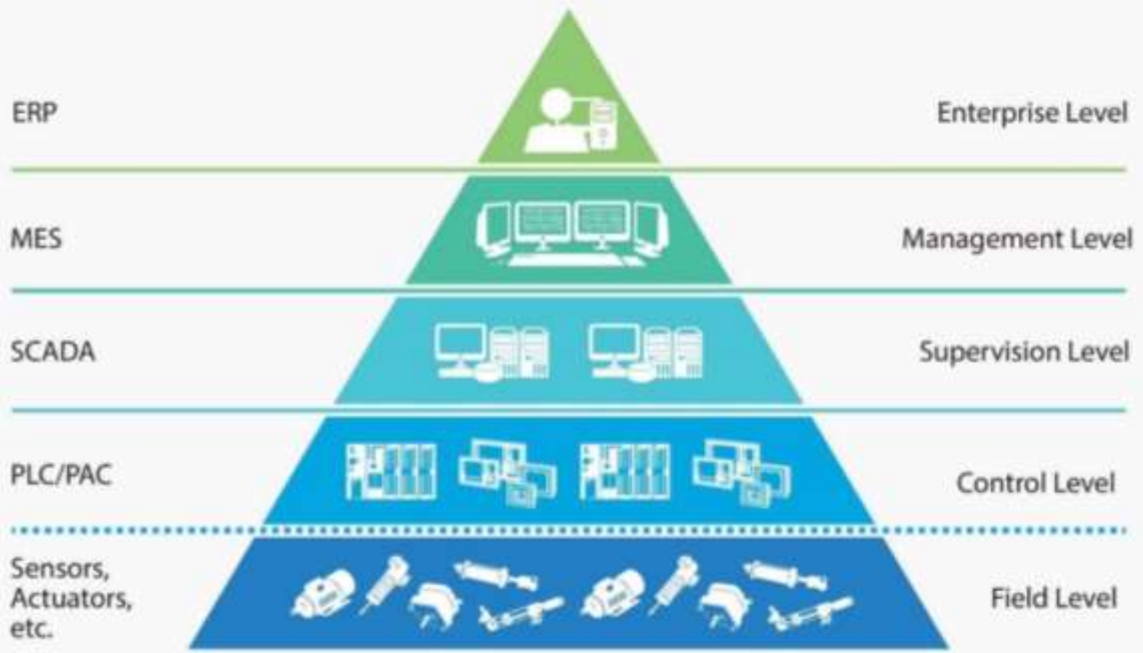
ERP solutions include corporate areas such as	
Purchasing / procurement	Human Resources
Materials management	Sales & marketing
Production	Finance & accounting / Controlling

shtglobal.net/smart-services/ERP-Management.html

erp.com.de/

Core element 12: Manufacturing Execution Systems (MES)

- is part of a production management system and is responsible for production control
- It is directly connected to the operating processes and enables production control in real time.
- Integrated, receiving the latest data from robots, machine monitors and employees
- It collects data from manufacturing processes, which can be used to optimize the processes and identify errors in the process.



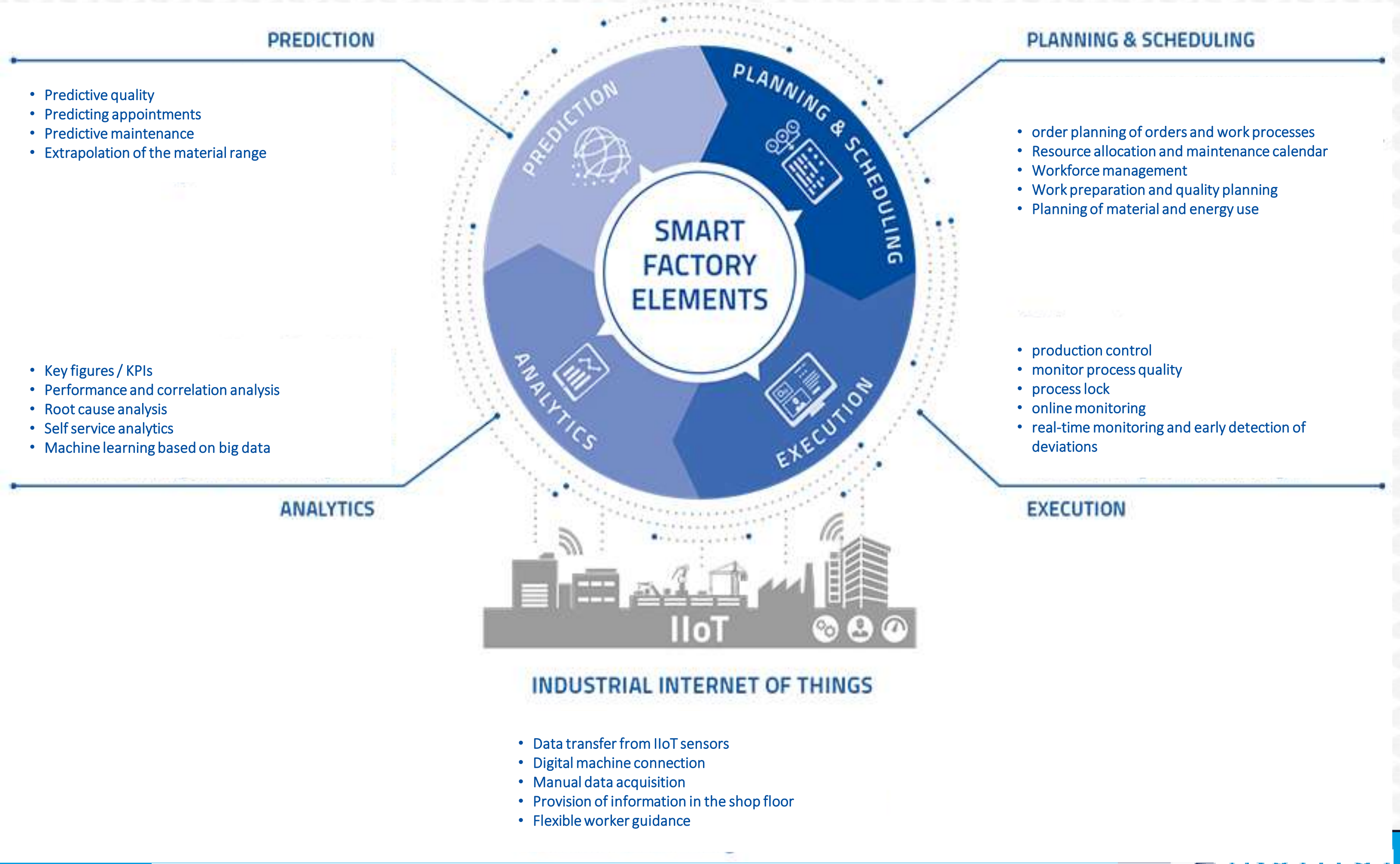
miac-automation.com/mes-oee-track-and-trace/

Core element 13: Smart Factory

Individual companies or groups of companies use ICT (Information and Communication Techno-logies) for product development, production, logistics and interface coordination with customers in order to be able to respond more flexibly to incoming inquiries.

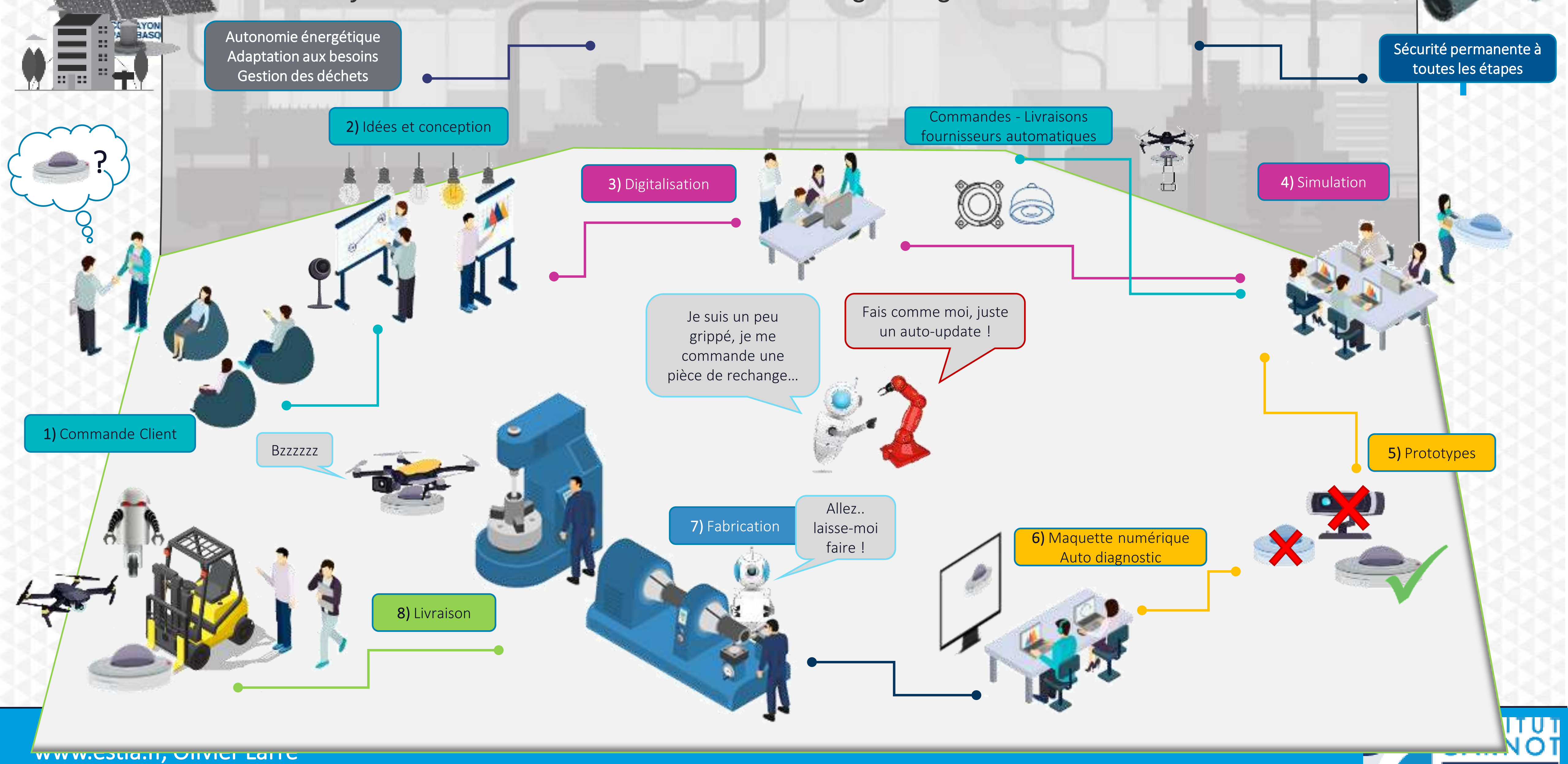
A Smart Factory is able to master complexity, is more fail-safe and enables a more efficient production. Communication between people, machines and resources is a matter of course and comparable to a social network.

Roth 2016. p. 265; Bauernhansl 2014; Kagermann et al. 2013; Heng 2014, p. 4-5.l



https://www.mpdv.com/de/innovation-vision/mes-industrie-40/smart-factory-elements/

Ecosystème et interconnexion des technologies digitales - usine du futur.



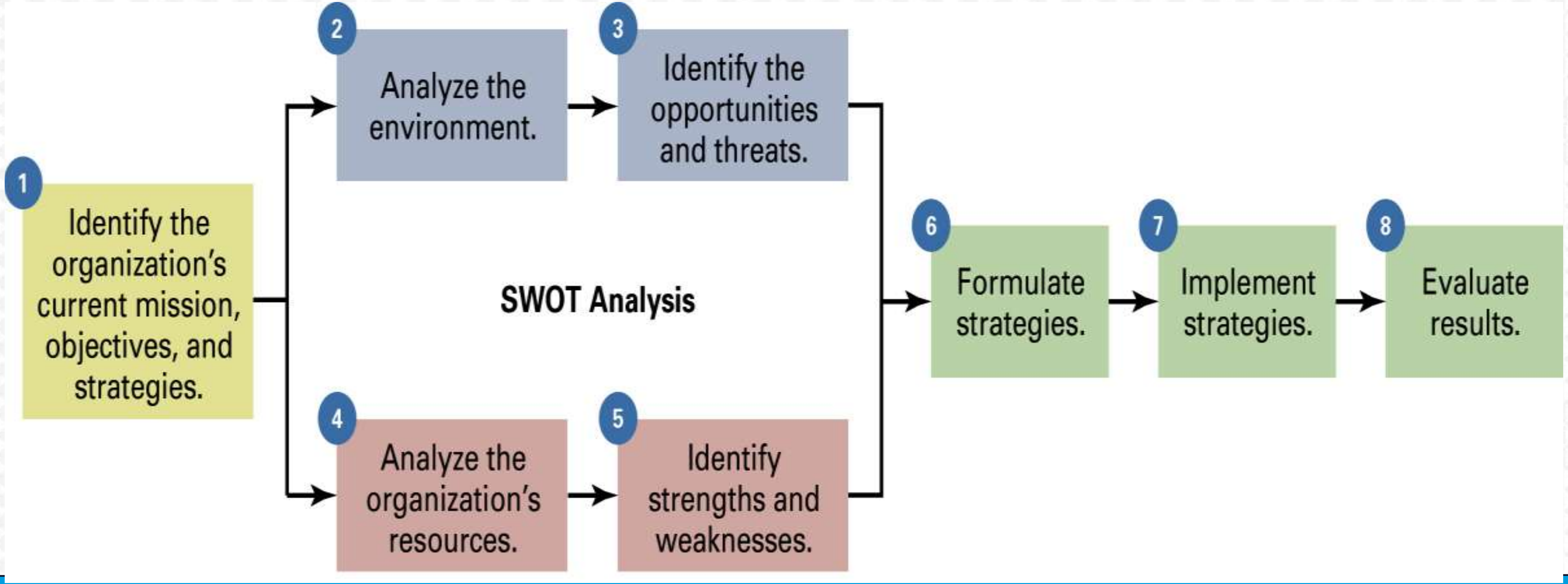
Limits of traditional management

- Stress and burn-out…
- Impacting people…
- … and the whole company

New types of management

- The « freedom-form » company

Towards new business processes



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Usine du futur

USINE DU FUTUR

Programme USINE DU FUTUR

Réunion territoriale du 14/04/2022
Pyrénées-Atlantiques

L'Industrie 4.0 en Nouvelle-Aquitaine
Le Diagnostic UDF

Lancé en 2014

La Région Nouvelle-Aquitaine,
pionnière de la dynamique « Nouvelle France Industrielle »,
lance son Programme **Usine du Futur**

Financé à 100% par la Région et l'Etat

Objectifs

- **Redonner des marges de manœuvre** aux entreprises en les accompagnant vers l'excellence industrielle
- **Soutenir leur transition** vers l'usine numérique et connectée plus agile et plus durable
- **Valoriser l'humain au centre de l'usine**

Les 6 thématiques du diagnostic 360

Stratégie Globale

« Challenger le modèle d'affaire et la chaîne de valeur en maximisant la valeur pour le client »

opeo

Stratégie Numérique

« Accélérer la transformation grâce aux nouvelles possibilités offertes par le numérique »

DIGITALL ou inetum. consulting

1 ou 2 jours

Organisation Agile

opeo

« Faire évoluer les pratiques opérationnelles et managériales pour catalyser l'amélioration continue »

Homme et compétences

opeo

2 jours

« Mettre l'homme au cœur de l'usine en développant les compétences, la complémentarité homme-machine et les comportements 4.0 »

Usine Durable

« S'intégrer dans son territoire de façon responsable, respecter l'environnement et attirer les talents »

APESA ou oid

0,5 ou 1 ou 1,5 jours

Technologies du futur

AM VALOR

« Garantir la bonne intégration des briques technologiques du 4.0 pour créer de la valeur de bout en bout et maximiser l'efficience de chaque métier »

1 ou 2 jours

Détail de chaque thématique

AXES DU CCTP	Stratégie globale	Organisation industrielle & Facteur Humain	Usine Durable	Stratégie Numérique	Technologies du Futur
DIMENSIONS PAR AXE	Evolution de l'entreprise	Gestion des flux	Stratégie RSE	Stratégie numérique	Outil de production avancé
	Evolution du modèle d'affaire	Pratiques opérationnelles "Lean"	Approche site	Pilotage des projets numériques	Procédés de fabrication innovants
	Evolution des ressources de l'entreprise	Management & Organisation	Gestion des ressources	Culture et management adapté au numérique	Robotique/Cobotique/Automatisation
	Accélérateurs du changement	Vision & Motivation	Approche produit	Compétences et RH au service du numérique	Machines intelligentes et communicantes
		Gestion des compétences	Relations avec le territoire	Gestion de la donnée	Ingénierie numérique des produits et des procédés
		Sécurité & QVT		Marketing digital	Assistance physique et cognitive
				Outils et dispositifs techniques	

Présentation des Parcours opérés par la CCINA pour accompagner les entreprises industrielles dans leurs mutations vers l'Usine Du Futur

Parcours Fabrication Additive (Fanaboost)

Parcours Organisation Industrielle et Management (POIM)

Parcours Robotique- Cobotique- Automatisme (Robotboost)

Parcours Valorisation des données du process industriel (DATABOOST)

La structure partenariale

Fondateurs

Gouvernance

PROPULS – Plateforme d'accélération – USINE DU FUTUR

AAP de l'Etat

Dossier sélectionné le 27/05/2021

Financement acté le 16/06/2021

Association partenariale

créée le 27/04/2021

Lieu site métropole

Pessac Bersol

5 Collèges

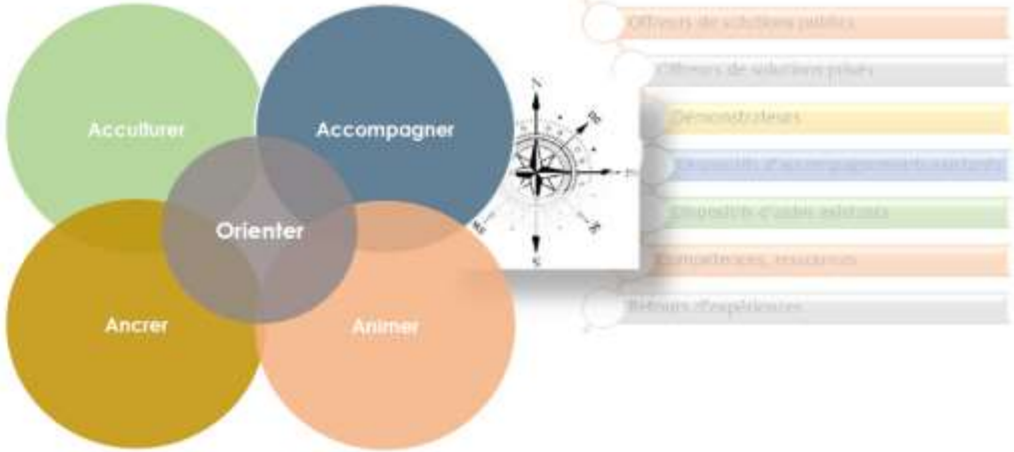
- Partenaire technologique
- Partenaire socio-économique
- Formation et enseignement supérieur
- Collectivités territoriales et établissements publics de coopération intercommunale
- Entreprises et offreurs de solutions

Relais antennes sur le territoire

Son positionnement

L'entreprise industrielle
Le référent UdF

L'offre UdF du territoire



AGENDA

- ~~Présentation de l'Estia~~
- ~~Présentation du projet CHAIN~~
- ~~Introduction à l'industrie 4.0~~
- ~~Les programmes d'accompagnement en Nouvelle-Aquitaine~~
- Exemples d'application

Example

- BOSCH

  https://youtu.be/DrE0FShBfF4

- LEGRAND

  https://youtu.be/CUFoH7nUXI0

Example

- CHAMATEX et ASF 4.0
  https://www.youtube.com/watch

Example

- FASHIONCUBE

  https://youtu.be/49EWo51n7MU

L'usine sera en mesure de fabriquer des jeans dont les prix seront compris entre 40 et 60 euros, et s'ouvrira aussi à d'autres articles et accessoires utilisant la toile bleue. Un "Fab Lab" sera mis à disposition des marques afin qu'elles mettent au point sur place leurs nouveaux modèles.

De plus, le site "fonctionnera en circuit court et en semi-automatisation avec un procédé économe en eau, qui divisera sa consommation par six lors du délavage", précise FashionCube, ajoutant que le traitement des pièces sera principalement réalisé à l'ozone et au laser. 50 machines sont prévues (matériel en provenance d'Europe), tandis que la ligne de coupe est française.

From a local clothing recycling workshop to a regional I4.0 regional textile recycling centre

1 manager
10 persons in reintegration
5 volunteers

A manual process

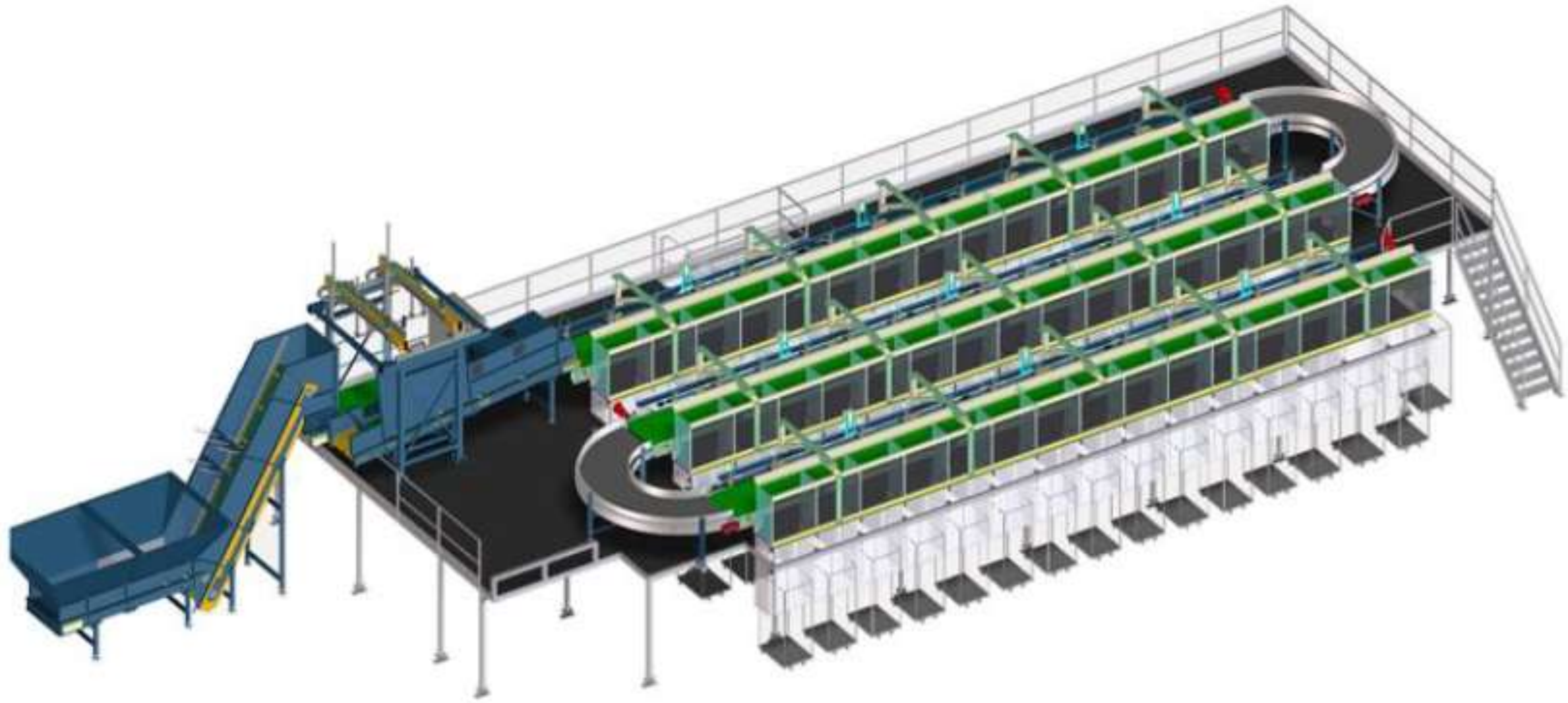
- Local network
- A lot of waste

Proposals

- State of the art : identify new types of « products » from non-reusable clothes => new business model and less waste
- Decisions :
  - A regional network for clothes collection
  - An automated process for textile sorting
  - Propose a «new product » spools of textile threads
  - Developing web services and marketing plan for custome
- Action plan :
  - A new workshop layout plan
  - A list of equipments for sorting then production
  - A list of skills, then of people required profiles
  - An evaluation of costs and benefits

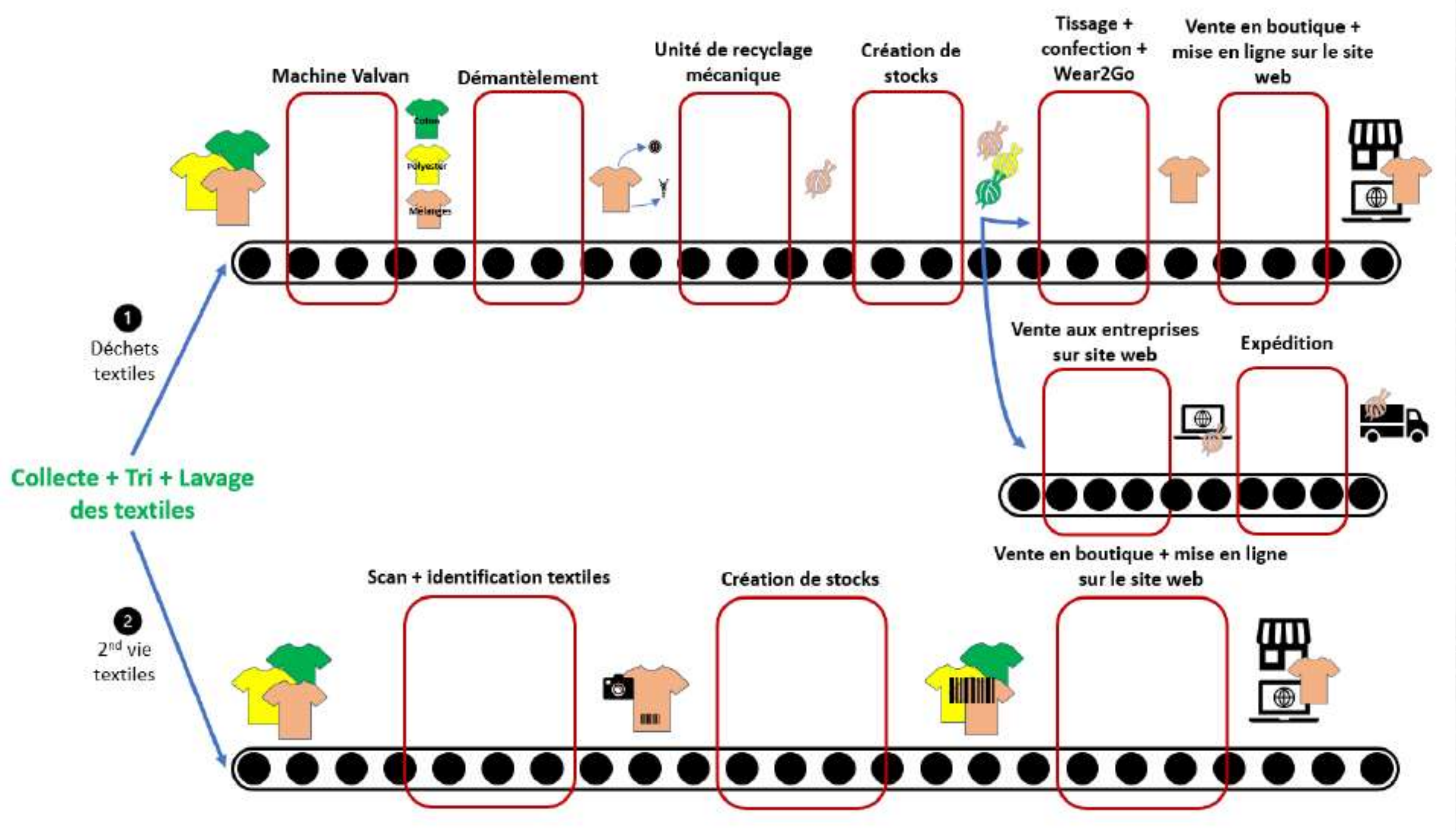
Finally

- Sorting clothes



Finally

- Sorting and producing spools



Organisational and financial aspects

- Human needs : 17 persons
- Clothes collection : 96 m3 / month -> 528 m3, i.e. 237 tons
- Textile threads produced : 142 tons
- Financial balance :
  - Annual turnover 4 M€
  - Annual (human) expenses 325 k€
  - Total costs for equipments and workshop 2,3 M€