

Challenges & needs of the manufacturing industry Opportunities of Digitization & AI, in practice

Herman Derache, herman.derache@sirris.be

Managing Director Sirris – the collective centre of the Belgian technology industry

Head Innovation Agoria – the federation of the Belgian technology industry

Overview

1. Sirris & Agoria Innovation
2. The challenges for the manufacturing industry
3. The cross-cutting digitization theme
4. What about Data & Analytics?
5. Conclusions

Sirris?

We help companies to
make the right technological choices



and realise their innovation projects
successfully.





COMBINING THE POTENTIAL OF TECHNOLOGY WITH BUSINESS MODEL INNOVATION TO MAKE YOUR BUSINESS FUTUREPROOF



business of the future



HOW TO MAKE YOUR PRODUCT FUTUREPROOF? MAKE IT MICRO, LIGHT, SMART & CONNECTED!



product of the future



HOW WILL DIGITAL MANUFACTURING AND INDUSTRY 4.0 IMPACT YOUR FACTORY IN THE FUTURE?



factory of the future

“Together, we turn innovation into success”



driving industry by technology

Agoria Innovation Expertise Centre

The **Innovation Expertise Centre** answers all the questions submitted by Agoria member companies on **innovation and related topics**

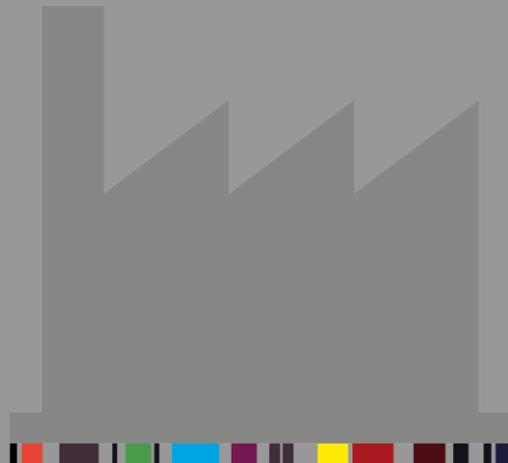
Its experts provide advice and guidance in the **implementation of innovation projects**, from idea to development all the way to implementation

Its experts work closely together with the technological experts of  **sirris**, the collective center of Agoria





The challenges



How to create a **sustainable future**
for **production companies**
in Belgium, given the context of
high costs & global competition ?

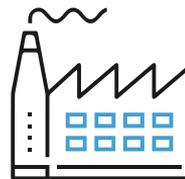
Given the challenges Manufacturing is facing

SOME CHALLENGES...

- Guaranteeing top quality
- High salary costs
- Global competition
- Shift to smaller series of customized products
- Request for short lead times

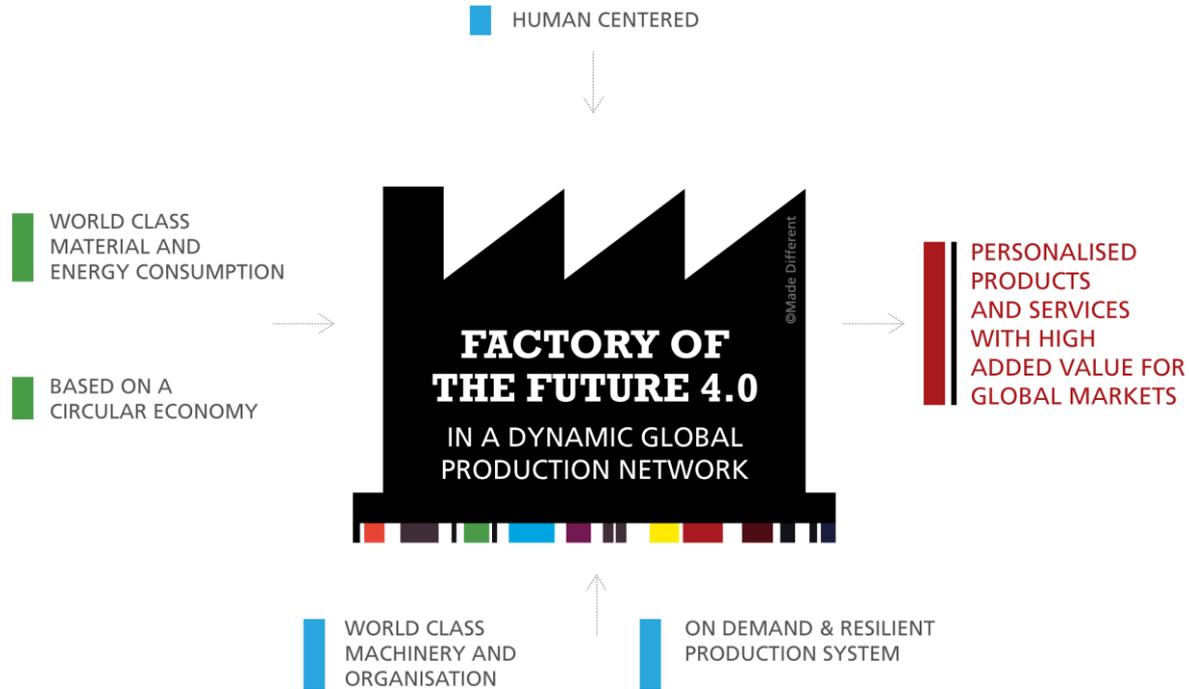
... AND A PLETHORA OF SOLUTIONS

Industry 4.0
CPS
QRM
Factory of the Future

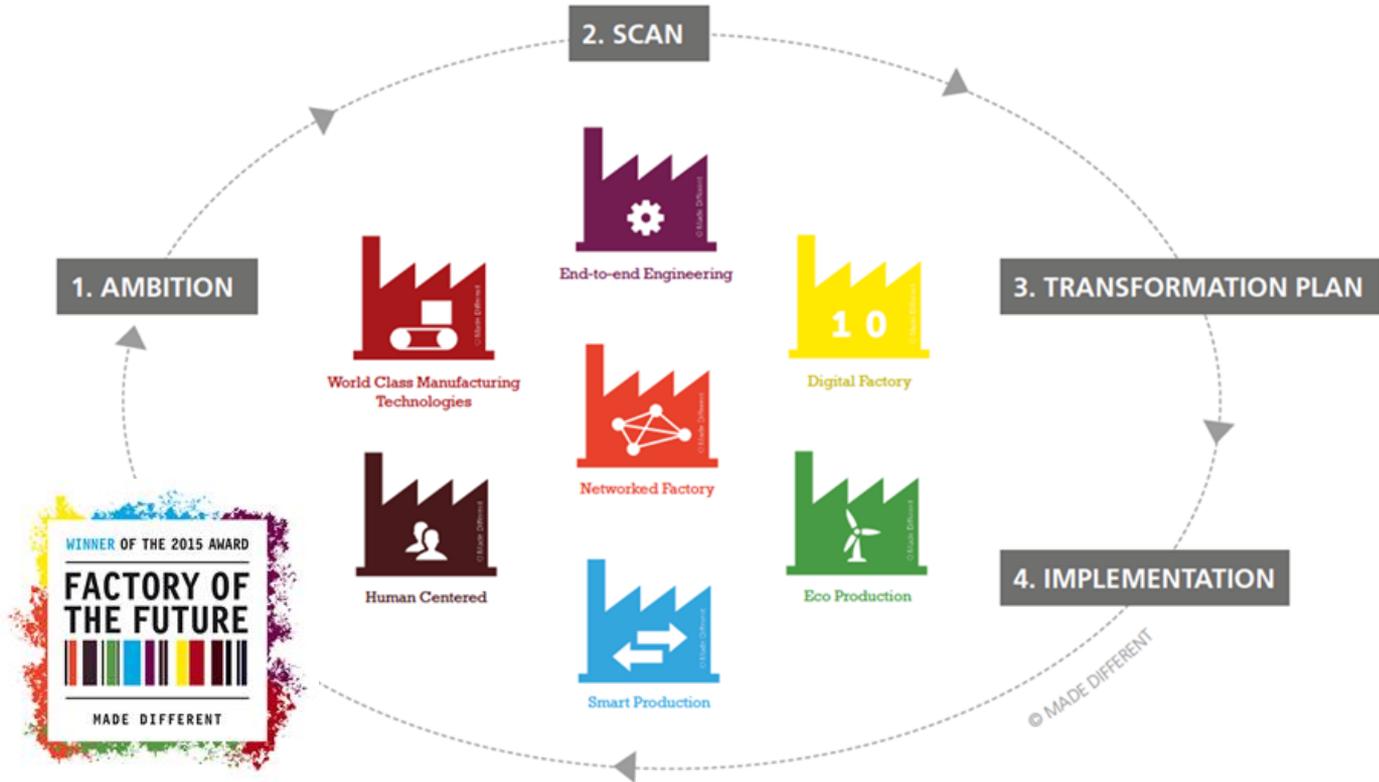


4th industrial revolution
Connected Factory
IoT
Operational excellence

... by turning them into Factories of the Future 4.0 ...



... through support within 7 integrated transformation themes.



20 factories have received the Factory of the Future Award

2015



2016



2017

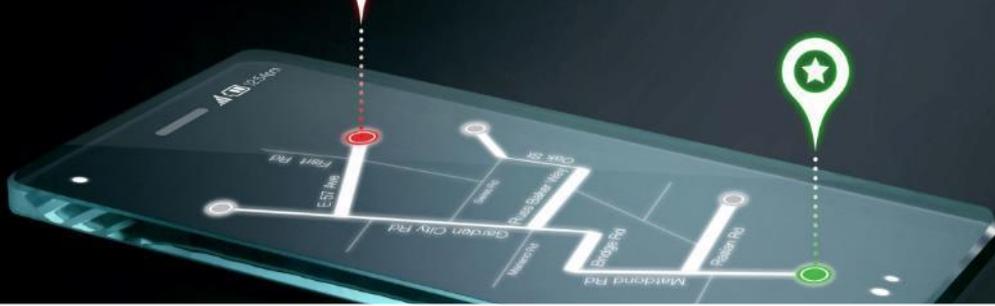


2018



... and they do create jobs!





The Digital challenge /
the Digital promise ...

The Digital Journey Tracker

Why?

- **Companies are increasingly aware of the need to take action on digital transformation**
- **So many different ways to create impact through digital technology and so much information from different viewpoints (*e.g. digital marketing, Industry 4.0, change management, IoT or blockchain or AI or ...*) => companies have enormous difficulties to get an overview and set concrete goals**
- **Companies have difficulty finding the right ICT-partner:**
 - they first need to gain more insight into their own objectives
 - they speak a different language

A wooden signpost stands in a vast, arid desert landscape. The signpost has two directional signs. The top sign is a dark wooden arrow pointing left, with the word "LOST" written in large, bold, yellow letters. The bottom sign is a dark wooden arrow pointing right, with the words "VERY LOST" written in large, bold, yellow letters. In the background, a long, straight road with yellow dashed lines stretches into the distance under a clear sky. The terrain is flat and sandy with some sparse, low-lying vegetation.

LOST

VERY LOST

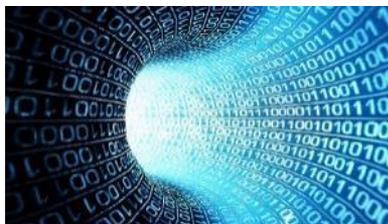
How?



Three types of companies



physical products



digital products



services

Digital Journey Tracker

What is your line of business?

Physical Products

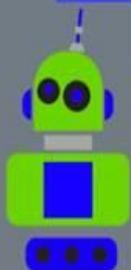
Digital Products

Services

Hi, welcome on your digital journey. I am your digital companion and will guide you on your trip to digitisation:

1. Select your company's line of business above or select a zone of impact on the map
2. Select your most relevant markers on the map for further reading

Have an inspiring journey.



digitaljourneytracker.be

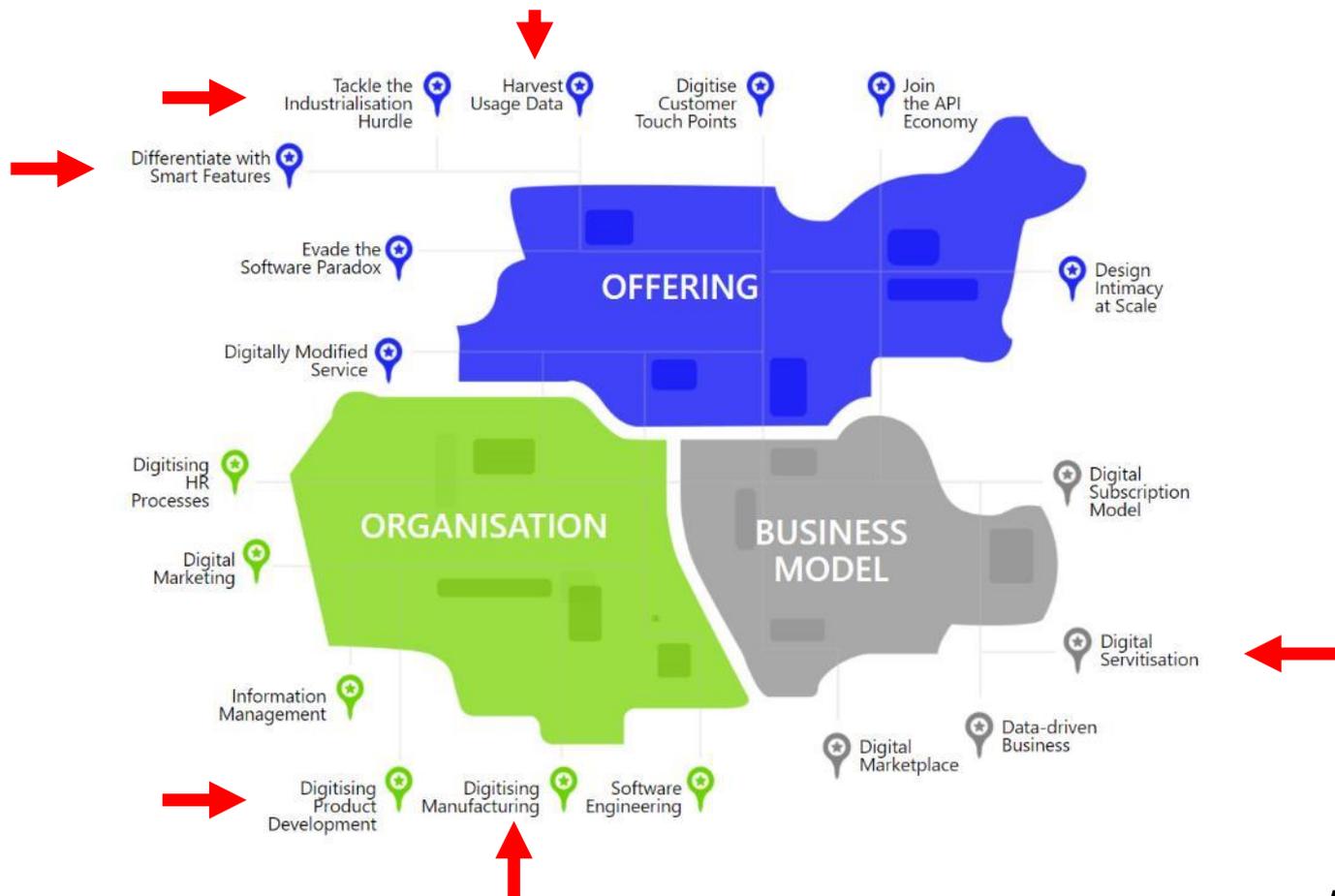


[About us](#) [Contact us](#)



sirris

.AGORIA



The Digital capabilities required by the future “Factories of the Future”

1. Deal with increased complexity
2. Guarantee fast response
3. Support the operators in their tasks
4. Maximize ‘first time right’ manufacturing
5. Create a real-time transparent production floor
6. Set-up a production network

Managing increased complexity

- Lean Product Development
- Advanced engineering tools
- Product visualization techniques
 - modeling,
 - simulation,
 - augmented reality
- Digital co-creation tools
 - Web platforms and technologies
- **Simulating adaptive production systems**
 - fast configuration simulation models
- **Flexible automation**



VAN **H**OECKE®

Enabling fast response

- Lead time reduction in front office
 - ‘smart co-operation’ teams
 - Next level online fast customer response tools
- Lead time reduction in production
 - Self-organizing methods
 - Fast changeover tools
 - Application of production
 - best practices,
 - platforms,
 - industrial internet of things



Newtec

Supporting operators in their tasks

- Increase flexibility of operators
 - Cross training of operators
 - Involvement of operators

- Reduce cognitive & physical operator load
 - Collaboration human/robots
 - Digital operator support



VERANNEMAN
TECHNICAL TEXTILES

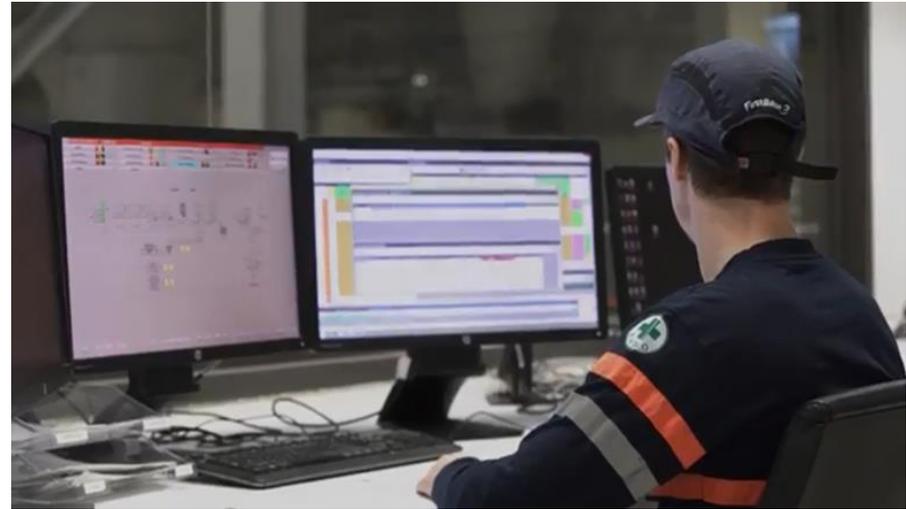
Enabling first time right production

- In line automated quality control
 - Sensors
 - vision
 - 3D measuring
- Adaptive production systems
 - Real-time production monitoring
- Predictive production systems
 - Analyse historical production data
 - Predict and anticipate problems



Making the shop floor transparent

- Create bridges between production modules
 - M2M communication
 - communication protocols
 - semantics
 - network communication
 - data security
- Monitor and visualize production
- **Intelligently use production data**
 - Condition monitoring
 - operation optimisation
 - maintenance

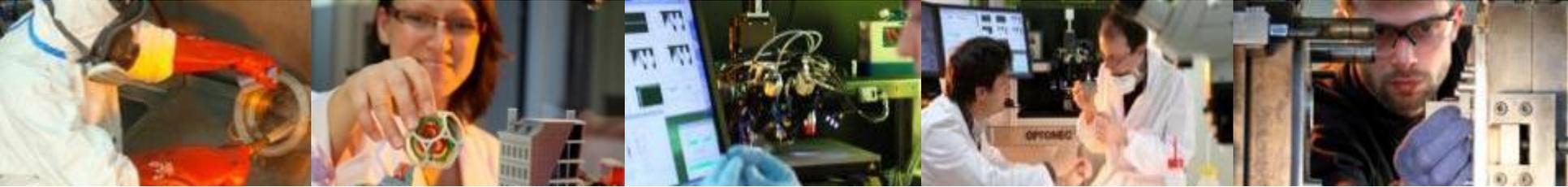


Creating a manufacturing network

- Linking different production units within the same manufacturing company
 - standards
 - cyber security
 - cloud technology
 - uniform policy on data management and sharing between different sites
- Linking companies throughout the entire industrial value chain
 - for a better, more personal service towards customers
 - partnership driven innovation (see final slide)

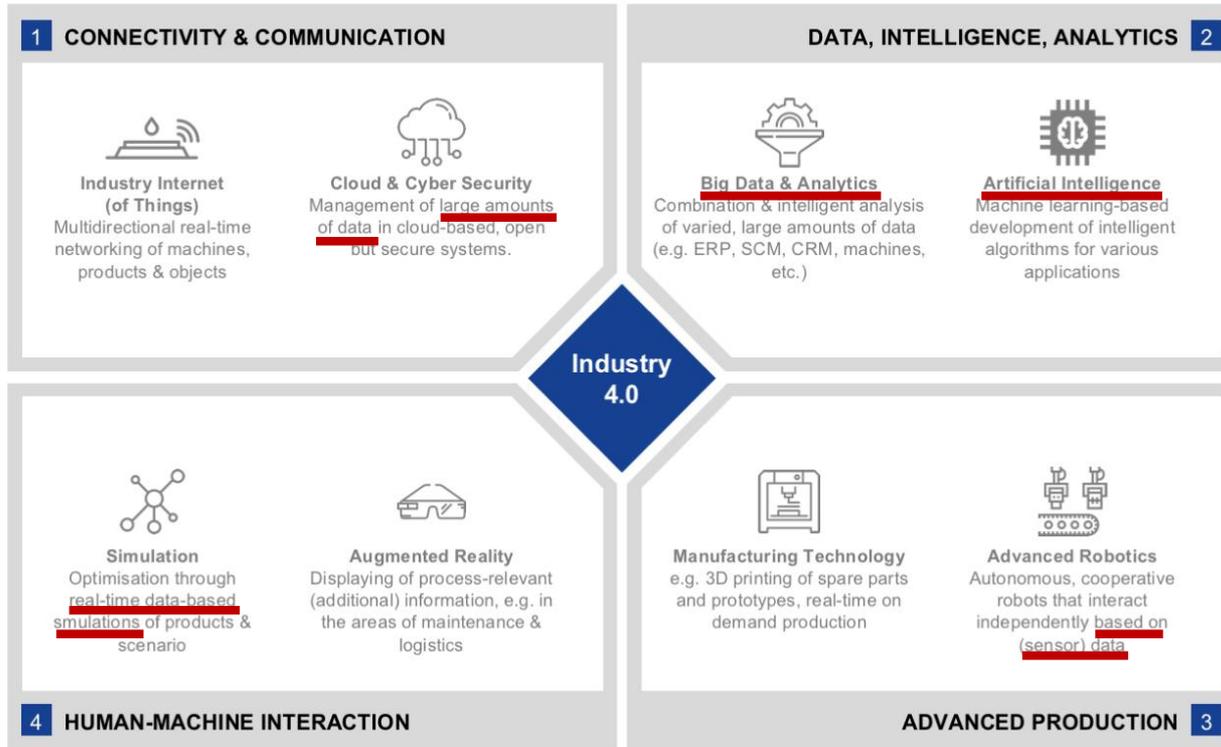


SIEMENS



What about data and analytics?

Data and analytics are key



Luckily, data analytics is easy!

Why IBM predictive analytics?

A platform which is flexible and scalable for one to many analytics



Easy to use predictive analytics

Intuitive, cost effective and scalable



Comprehensive predictive analytics capabilities

With Predix Platform analytics and machine learning, industrial companies can:



Choose from pre-built industrial analytics tested by GE domain experts across our industrial businesses.



Easily build, test, and deploy machine learning models.



Leverage in-house expertise as well as open source algorithms and tools.



Deploy self-learning analytics to automate processes at the edge or in the cloud.

Related Azure services and Microsoft products



HDInsight

Provision cloud Hadoop, Spark, R Server, HBase, and Storm clusters



Data Lake Analytics

Distributed analytics service that makes big data easy



Machine Learning Studio

Easily build, deploy, and manage predictive analytics solutions

Deep learning makes it even easier!

☰ FORTUNE

WHY DEEP LEARNING IS SUDDENLY CHANGING YOUR LIFE

Decades-old discoveries are now electrifying the computing industry and will soon transform corporate America.

DeepMind's latest AI breakthrough is its most significant yet

Google-owned DeepMind's Go-playing artificial intelligence can now learn without human help... or data

The Microsoft Cognitive Toolkit

A free, easy-to-use, open-source, commercial-grade toolkit that trains deep learning algorithms to learn like the human brain.

GET STARTED >



driving industry by technology

Is it?

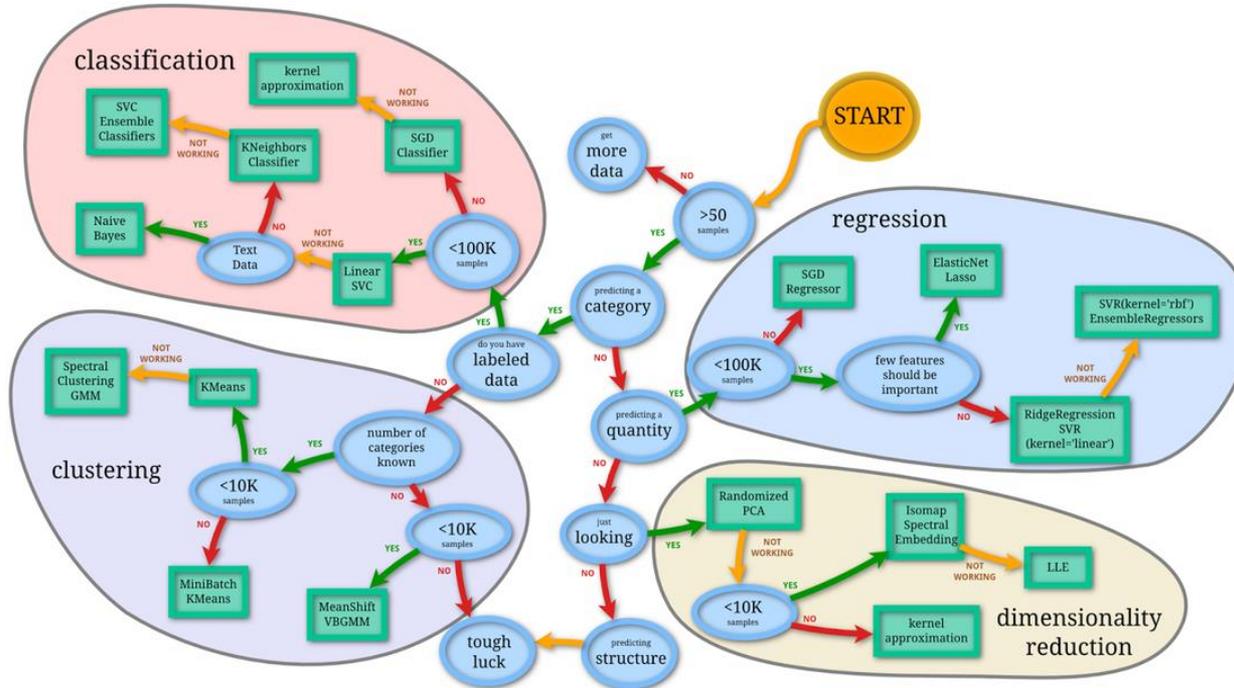
However ...

... the hype around Big Data and Artificial Intelligence hampers the wide understanding of the *true potential* of data science technologies *and their limitations*

Common solution platforms vs. unique data science challenges

- Each data science challenge is **unique**
 - Different context, different datasets, different data/model requirements, ...
 - However, there are only a handful of underlying **fundamental tasks**
 - Data science methodology
 - **Decompose** the challenge into subtasks
 - **Identify** unique subtasks and corresponding data science tasks
 - **Recompose** solutions to the subtasks to obtain the overall solution
- Decomposing the challenge and identifying the right tasks is an essential **data science skill**

Fundamental data science tasks



Representative examples show that

- What seemed a **relatively simple** data–science challenge
 - ‘recommendation out of the box’
- turns out to be **quite complex**
 - no off–the–shelf solution exists
- and requires substantial **creative thinking** to reach a **unique** solution

Thus ...

... the **bright future of Industry 4.0 applications** will not be realized by simply collecting a lot of production data and applying intelligent algorithms out of the box

Data analytics is not just data crunching

- Even the most intelligent algorithm will be useless without **prior knowledge** of the application domain and **the right data** to analyze
- Business understanding
 - What is the business problem that you want to solve?
 - What data is available and is this sufficient to address the problem?
 - What domain knowledge is relevant and do we need to understand?
 - What is (are) the corresponding data science task(s)?
 - ...?

Data analytics is not just about volume

- Even relatively small datasets can be **very complex** to understand and handle
- Having access to the **right data** with the **right quality** is essential
 - Is all the data **relevant** to the problem?
 - Does the data contain a **sufficiently large number of cases** of the phenomenon under study?
 - E.g. in a production line, the defective goods will be only a small fraction
 - Is the data **quality** sufficient?
 - Are (most of) the **influencing factors** represented in the data?
 - Is **ground truth** available?
 - ...?

Data analytics is not just about installing & configuring platforms

- Few (if any) complex data challenges will be solved with off-the-shelf platforms and IT generalists
- Data analytics is a **trial-and-error** process, requiring a **handcrafted** approach for solving the **unique** data science challenge at hand
- Data analytics is more of **an art** than a science
 - Asking the right questions, gathering the right data, identifying the relevant patterns, extracting the right features, choosing the right algorithm(s), ...
- Data analytics requires **cross-disciplinary expertise** rarely found in a single person
 - Analytical skills & system architecture expertise & domain knowledge & non-technical competences (privacy & legislation) & visualization & ...

The Data and AI related challenges in practice

- Lack of **data standardization**
 - Each asset might report and log operational data in a different and potentially incompatible format
- No **ground truth**
 - Most of the industrial datasets do not contain clear indication of normal vs. abnormal behavior or actual failures
- Poor **data quality & representativeness**
 - Real-world data contains missing values, outliers, noise, ...
- Data **redundancy vs. relevance**
 - An industrial asset can sometimes report more than 1000 warnings, alarms, statuses, failures, ... per day during several weeks
- Lack of sufficient **domain knowledge**
 - A lot of influencing factors to take into account e.g. environmental conditions, which are not always known
- **Time synchronization** is necessary but sometimes just not possible
 - Different datasets might be captured in different time zones, with different sampling intervals, covering different time periods, ...



MISSION

to stimulate and support the realization of product and service innovation in industry by facilitating the exploitation of real-world data by means of data science and AI

KEY CHARACTERISTICS

- Focus on complex and rich data → beyond the "big data" hype
- Domain-agnostic → energy, manufacturing, mobility, ...
- Problem-oriented and practical → no technology push

APPROACH

- Living lab offering services and tools tailored to industrial needs
- Repository of reference implementations of real-world cases
- R&D incubation and technology transfer towards industry

Core application and research themes at Sirris

FLEET-BASED ANALYTICS

Intelligent leverage and exploitation of fleet-based data to benchmark performance, detect anomalies and develop scalable fleet models

PRODUCT-USAGE ANALYTICS

Advanced analysis of in-the-field usage data to characterize product performance and reliability, validate design hypotheses and improve future product design

SMART ENVIRONMENTS ANALYTICS

Complement wearable with contextual data sources to construct reliable user profiles, derive high-level activities, provide pro-active recommendation and user guidance

HYBRID/HYPER MODELLING

Realization of richer and more scalable predictive models via the hierarchical integration of data-driven and physics-based models

KNOWLEDGE PROPAGATION

Data enrichment and transfer learning techniques enabling sharing of labels, features, etc. across users, assets and application contexts

DATA FUSION

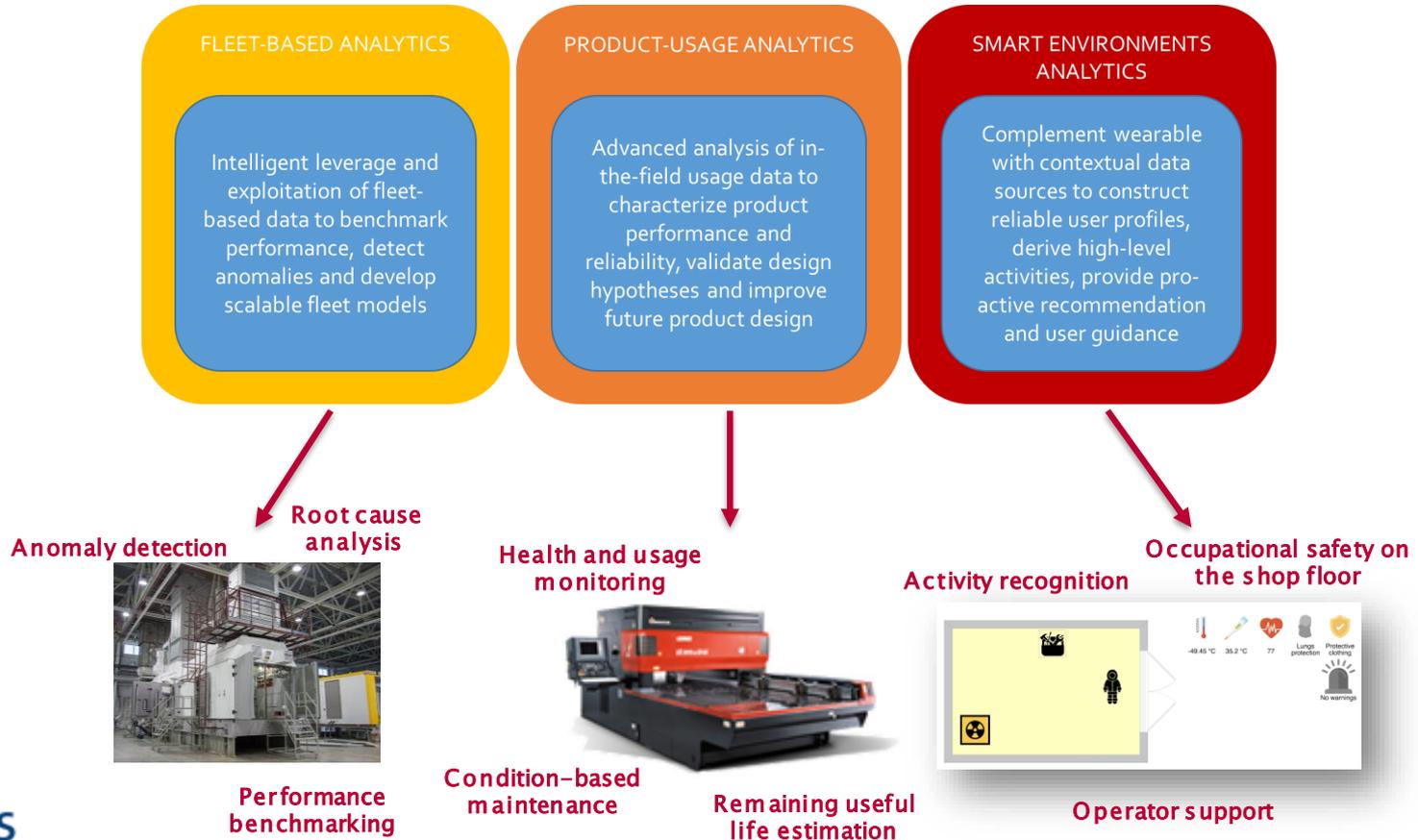
Robust integration of diverse data sources with the aim to achieve increased reliability and accuracy in comparison to individual sources

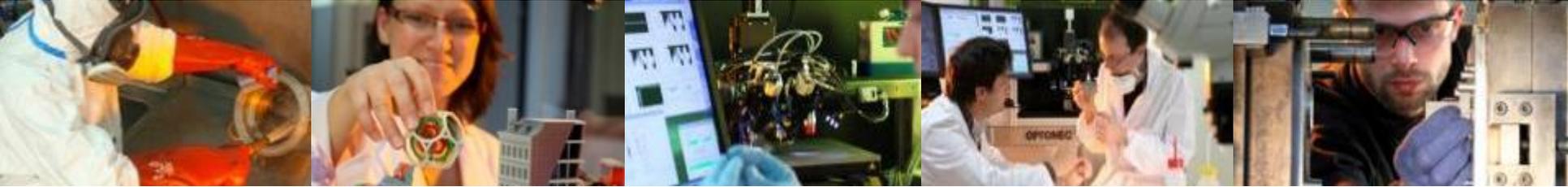
FINGERPRINTING

Derivation of unique user/asset identifiers via intelligent feature engineering to empower model construction, maintenance and reuse

Emerging application and research topics @ Sirris

Instantiation for manufacturing environments





Conclusions

Digitisation and also AI are an opportunity for the manufacturing industry

... but the **bright future of Industry 4.0 applications** will not be realized by

- simply collecting diverse production data and applying intelligent algorithms out of the box

but it will require

- availability of **representative historical data** curated by domain experts
- creativity to derive additional insights about manufacturing processes by **linking different data sources**
- acquisition of a **new technical skillset** enabling the identification of the right data-driven business question in a given context