FLANDERS MAKE

DRIVING INNOVATION IN MANUFACTURING

TECHNOLOGICAL RESEARCH & INNOVATION FOR A COMPETITIVE INDUSTRY

1

Flanders Make in the SOC world

HOW FLANDERS' 4 STRATEGIC RESEARCH CENTERS KICK-START YOUR R&D SUCCESS

VITO

- **750** experts
- the **world's largest** multidisciplinary research center
- energy, materials, environment

Flanders Make

>550 full-time researchers
- product and production technology and processes

imec

- **3,500** international researchers
- micro- and nanotechnology
- digital technology

VIB

1,470 scientists from **60+** countries
- biotechnology
- life sciences

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THE FLEMISH INDUSTRY

Motor of the economy

FLANDERS MAKE

11.650
companies

35,5 billion
added value

17%
of GDP Flanders

80%
of Flemish export

345.000
direct jobs

300.000
indirect jobs

Key figures in the Flemish manufacturing industry – Agoria

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How technology changes are lives

Speed of transport

Disruptive innovation

Smart mobility

Safety & comfort of driving

6

6

How technology changes are lives

7

7

How technology changes are lives

Modern times **Modern re-make times**

technology, production methodologies, connectivity
complexity, speed of change, and uncertainty

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ANYbotics - ANYmal

9

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Car/Truck safety technology

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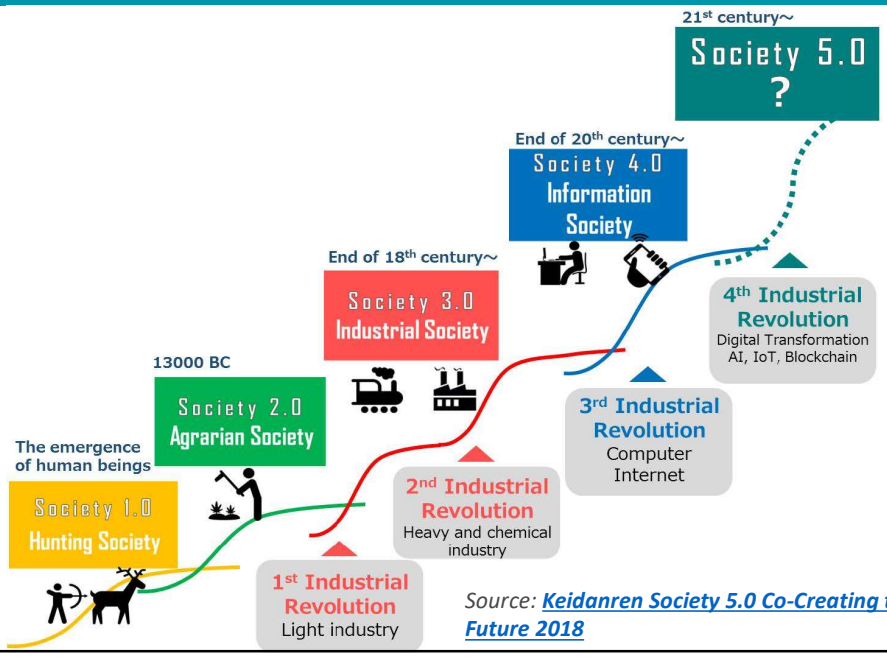
Towards Society 5.0 using Industry 4.0



Source: Keidanren Society 5.0 Co-Creating the Future 2018

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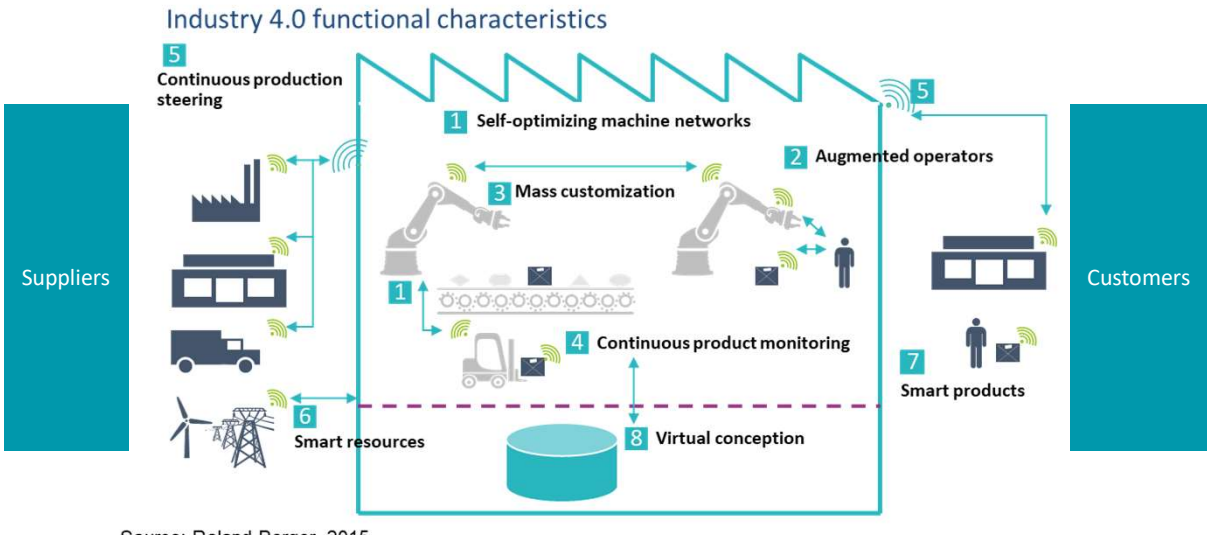
Industry 4.0 is combination of eight distinct functional levers in the manufacturing chain



Source: Roland Berger, 2015

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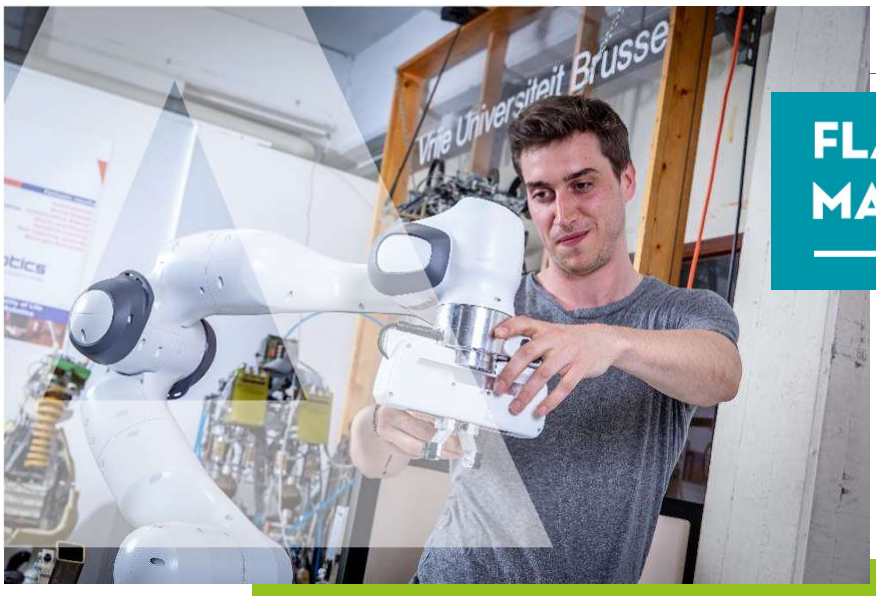
The Industry 4.0 battle area

16



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Top technological research driven by 3 transforming market trends

Smart, interconnected products & production systems

Customised products at the price of serial production

Sustainable, human-centred production

OUR AIM

Boosting the long-term competitiveness of top high-tech companies and other innovation-driven companies

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FLANDERS MAKE MEMBER COMPANY ECOSYSTEM

2014: #56 ← **NUMBER OF MEMBERS** → 2019: #134

20

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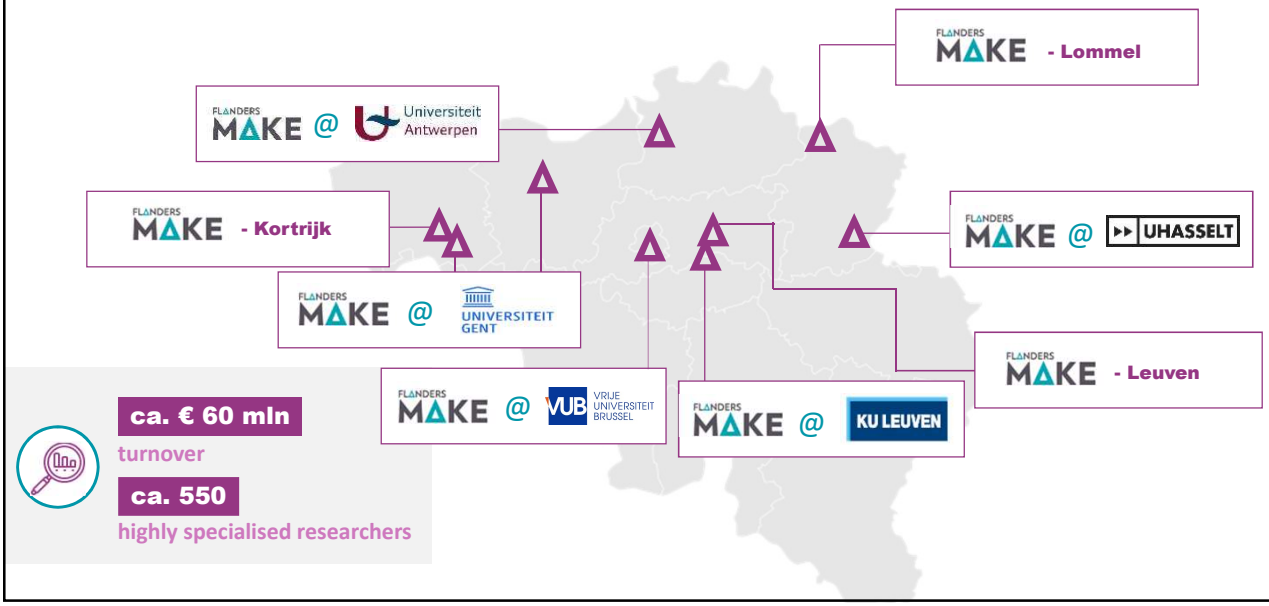
3 co-creation centres and labs at the 5 Flemish Universities



ca. € 60 mln
turnover

ca. 550
highly specialised researchers

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RESEARCH, TEST AND VALIDATION INFRASTRUCTURE

TOP-NOTCH CO-CREATION CENTRES

LOMMEL –
expanding the living labs

4200 m² for vehicle development

LEUVEN –
new labs for mechatronics testing and validation

3500 m² for machine development

KORTRIJK - NEW IN 2021
Industry 4.0 manufacturing facilities

6000 m² for customised production

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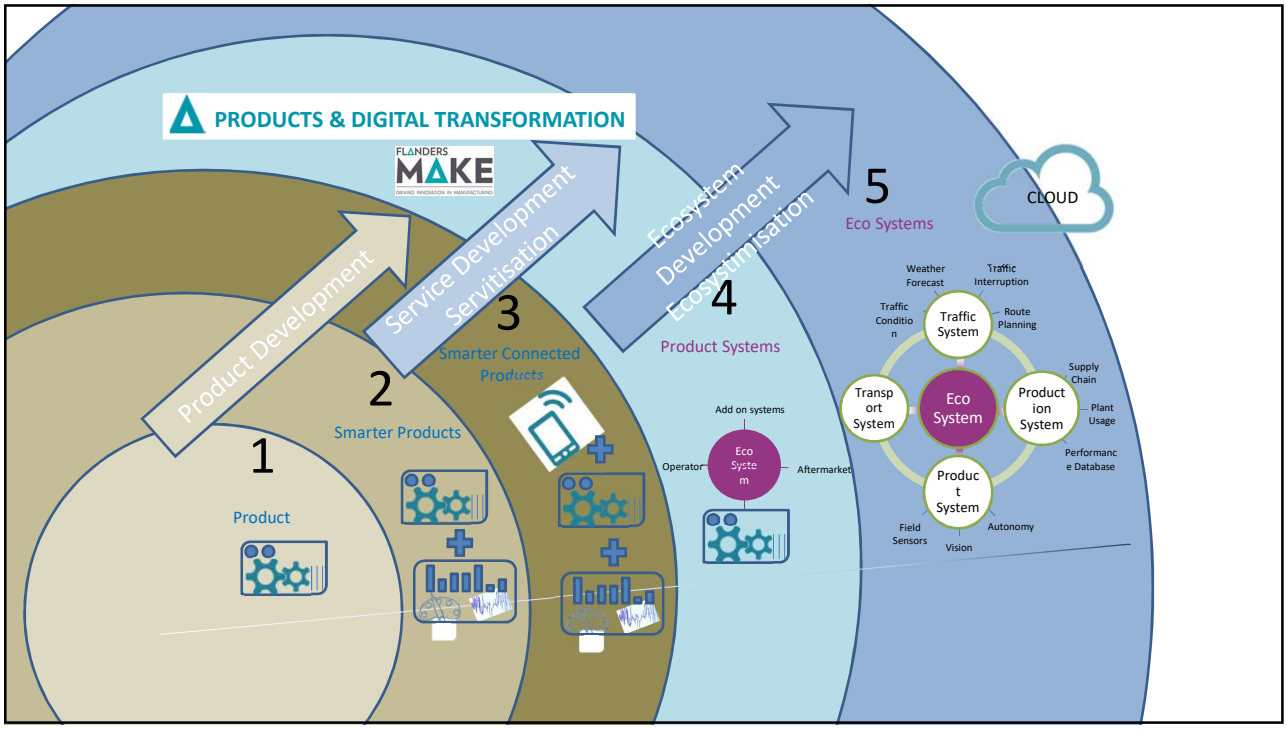

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Research supporting the digitalisation of the manufacturing industry clustered around 4 competences

Decision & Control

Design & optimisation

Motion products

Flexible assembly

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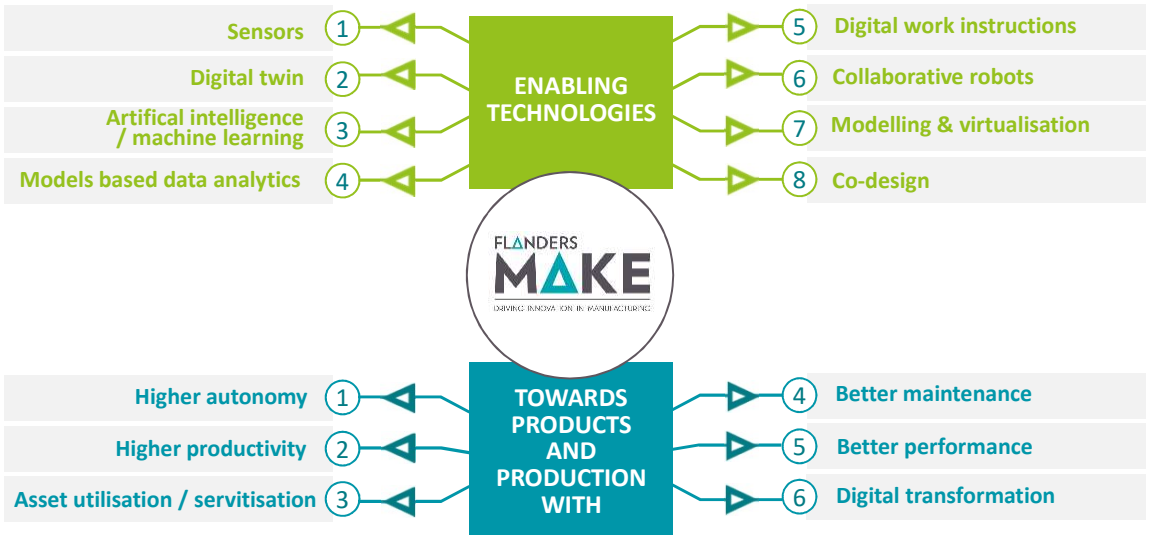

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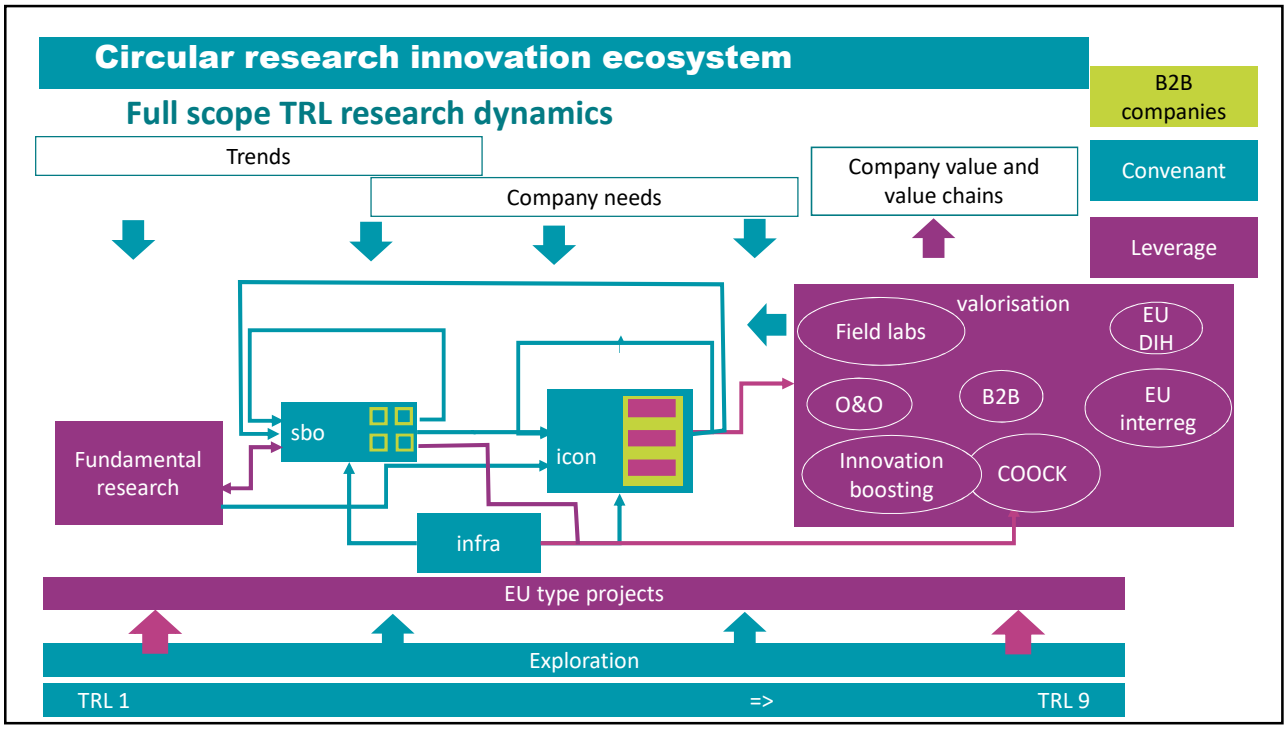
Circular research innovation ecosystem
Full scope TRL research dynamics
Trends
Company needs
Company value and value chains
B2B companies
Convenant
Leverage
valorisation
Field labs
EU DIH
O&O
B2B
EU interreg
Innovation boosting
COOCK
Fundamental research
sbo
icon
infra
EU type projects
Exploration
TRL 1
=>
TRL 9

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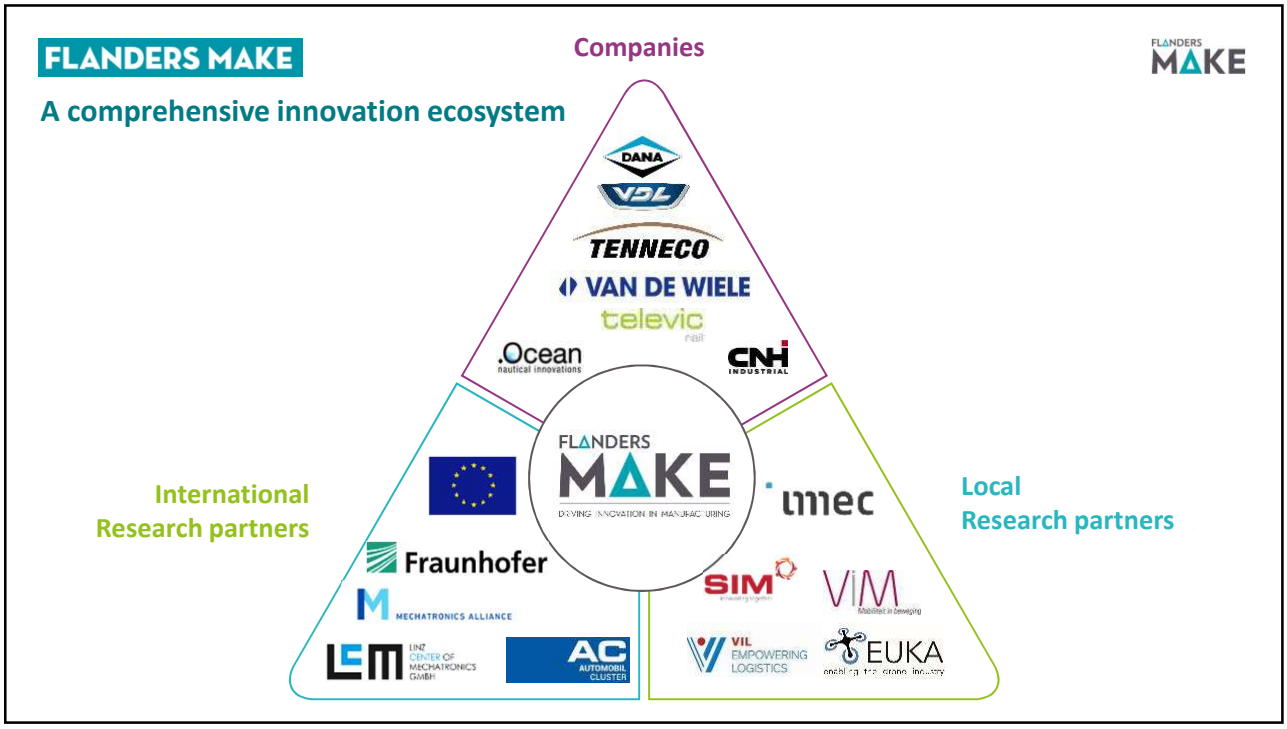
FLANDERS MAKE
A comprehensive innovation ecosystem
Companies
International Research partners
Local Research partners
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DRIVING INNOVATION IN MANUFACTURING
DANA
VDL
TENNECO
VAN DE WIELE
televic
Ocean
CNH INDUSTRIAL
imec
Fraunhofer
MECHATRONICS ALLIANCE
SIM
VIM
VIL EMPOWERING LOGISTICS
EUKA
AC AUTOMOBIL CLUSTER

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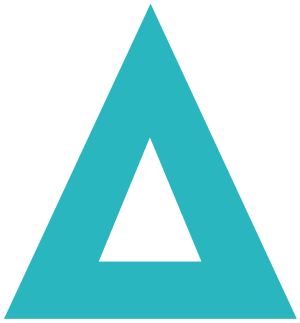
Role of Flanders Make



1. Look forward, follow trends and define research roadmaps
2. Anticipate, help formulate and tackle challenges and opportunities, to inspire companies
3. Strengthen companies' competences through a dynamic, collaborative innovation ecosystem
4. Create & transfer knowledge
5. Connect companies, research institutions and knowledge centres

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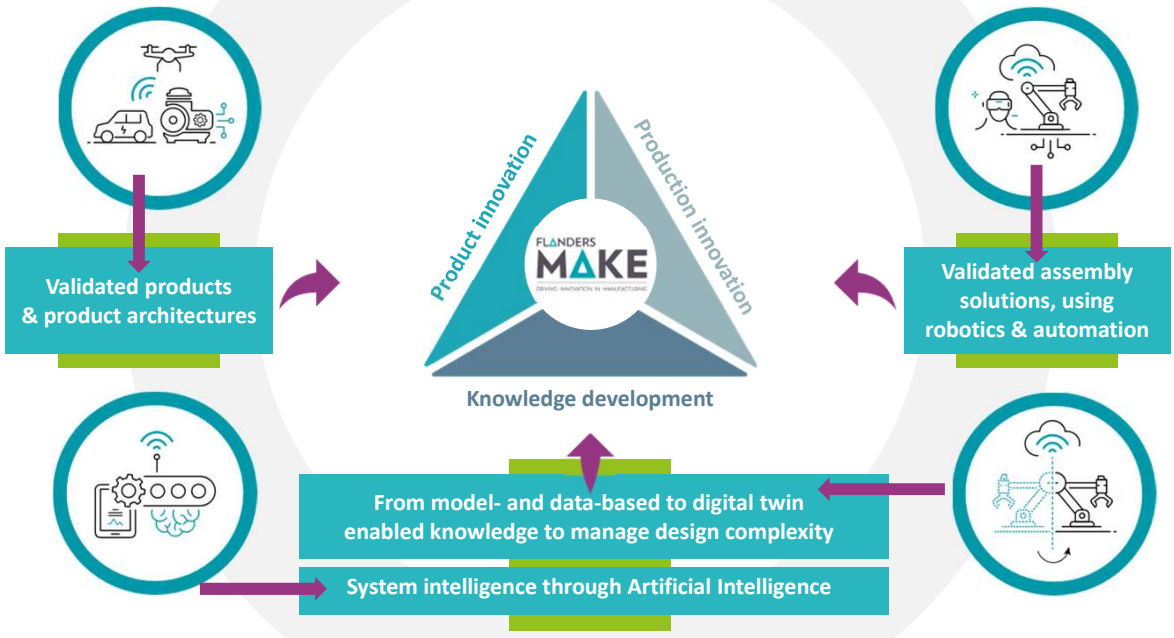
OBJECTIVE: DIGITALISATION OF MANUFACTURING TECHNOLOGY



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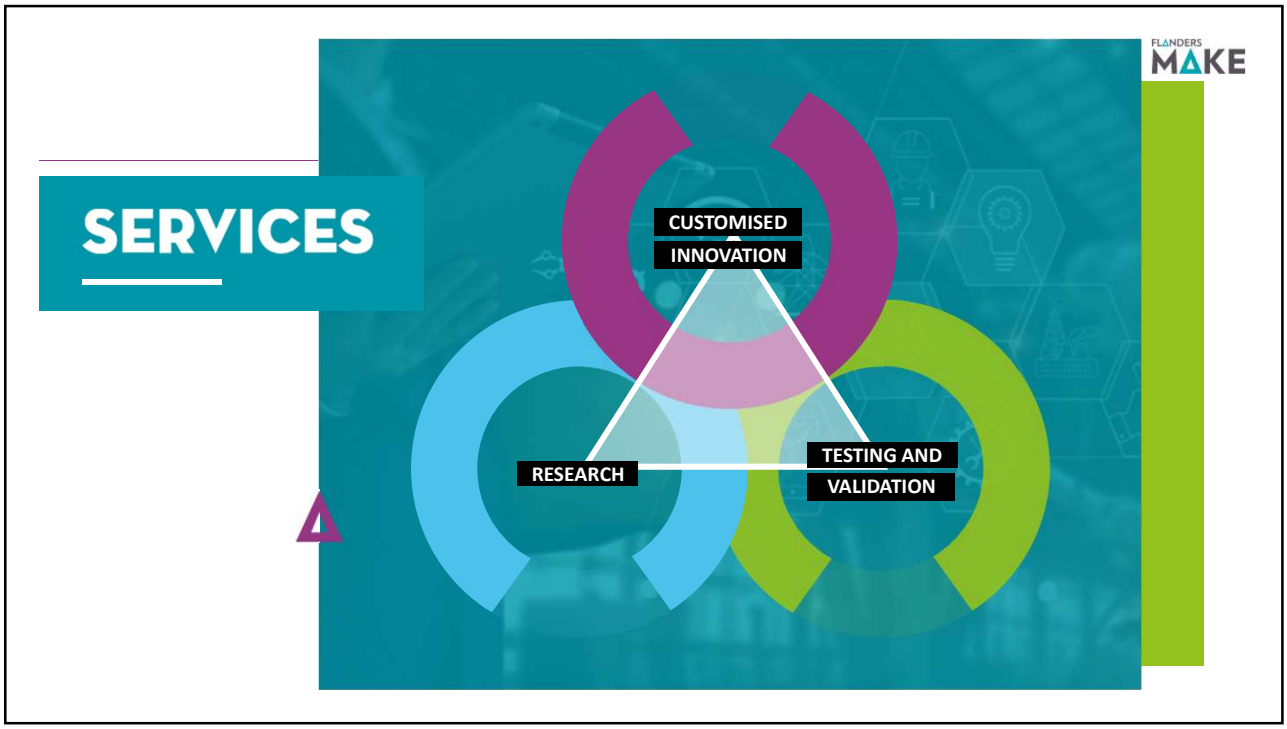

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FLANDERS MAKE **INDUSTRIAL TESTIMONIAL**

Motion Products

Tenneco Automotive

How to convert released kinetic energy into usable energy in a semi-active shock absorber?

Outcome

To evaluate different concepts, a model-based tool was developed to dimension the energy conversion and the energy storage in the shock absorber.

Prototype testing: 48% increase in efficiency

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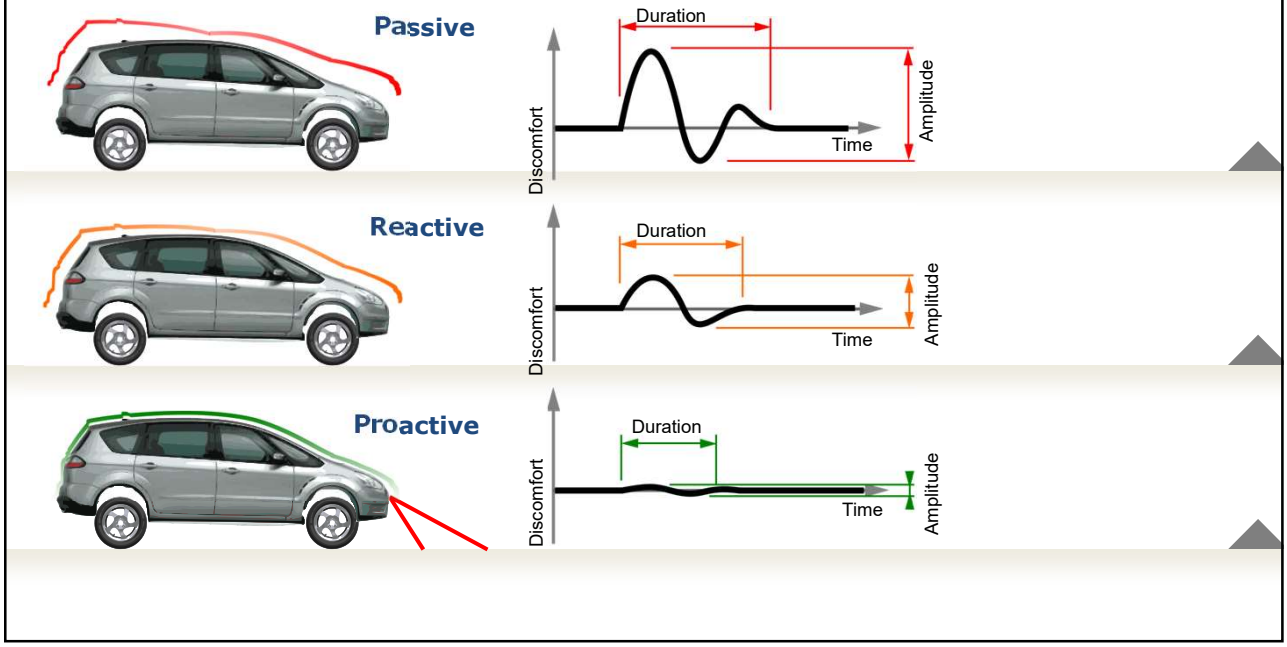
Steps to pro- active suspension control



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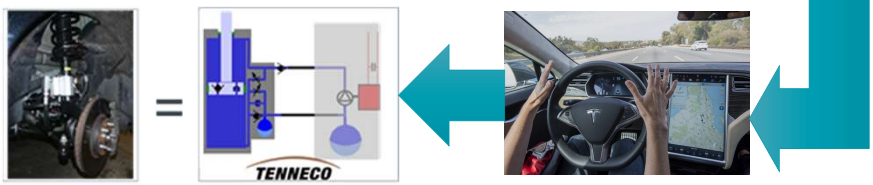
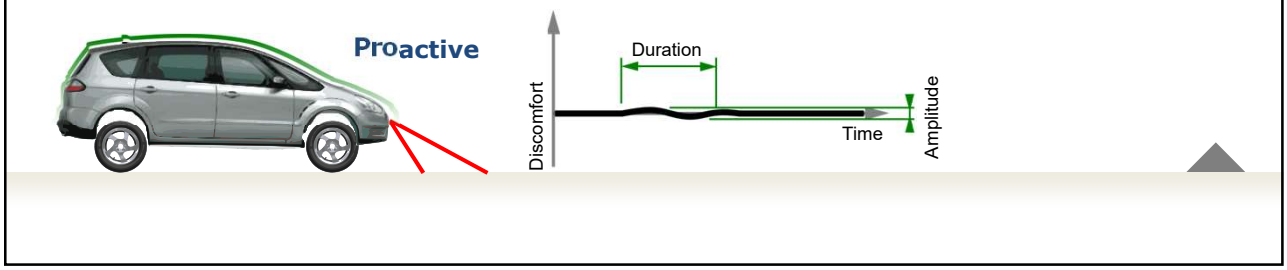
Smart Business - Car Sharing
Smart system - autonomous vehicle
Smart module – suspension system





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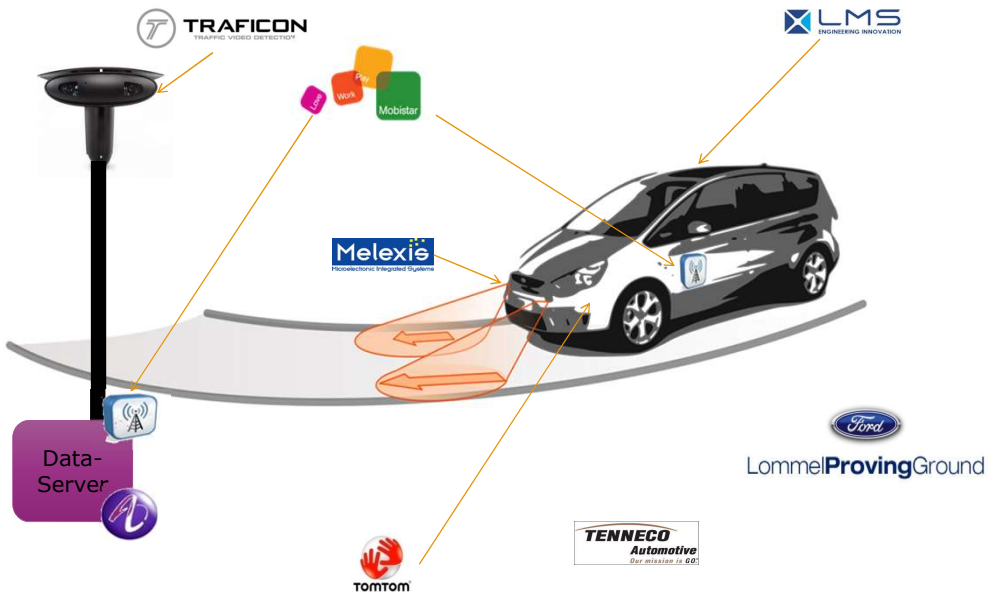
Intelligent Driver and Traffic Systems



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FLANDERS MAKE **INDUSTRIAL TESTIMONIAL**

Decision & Control

Octinion

How can a strawberry picking-robot operate more efficiently?

Outcome

A map of the 3D-world surrounding the robot was needed, such that it could remember where the ripe strawberries are hanging. The research built on a previous project involving accurate positioning systems that are equally accurate but cheaper and can also work indoors.

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Industry 4.0 : Smart, Interconnected Products

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Smart clamping tool

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Drone research @ Flanders Make

More and more projects related to drone technology

Strategy:

Bringing autonomous vehicle technology towards application domain of drones

Use Artificial intelligence expertise to develop smart drones

Indoor drones for logistics and inspection

- **Challenges:**
  - Indoor localisation
  - Object recognition
  - Optimal path planning strategies

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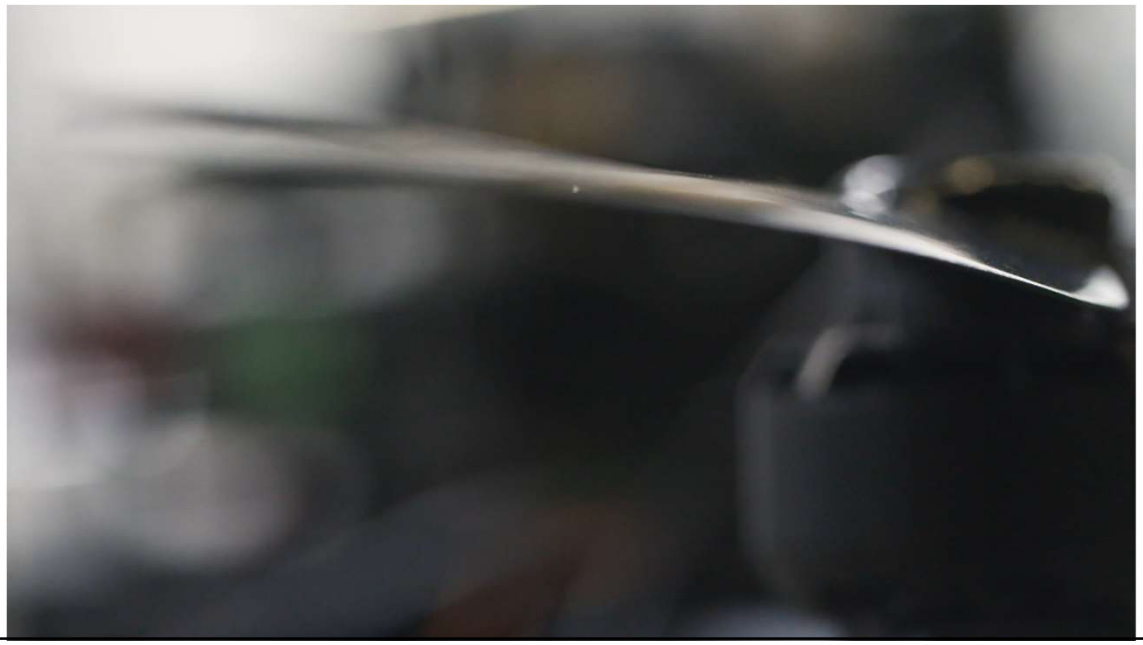
Dronelab



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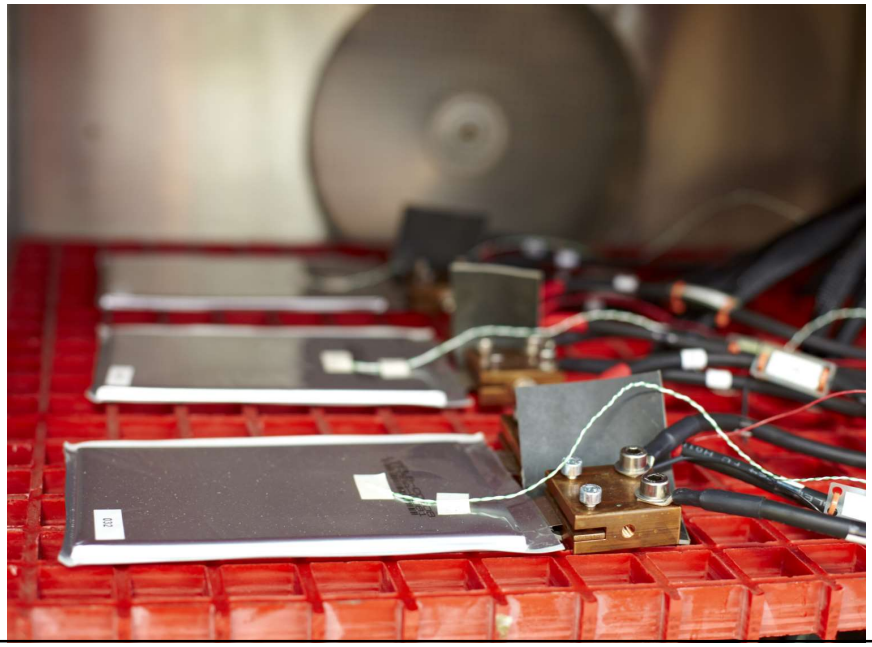
Battery Research



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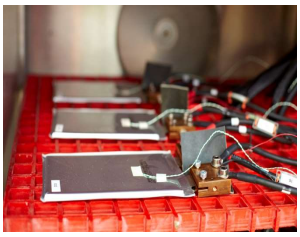
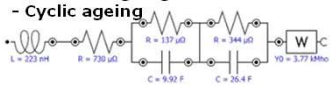
Energy storage

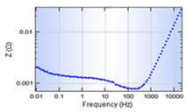
Cell characterization

Performance testing
- **Electrical characterization**
- **Different climatic conditions**

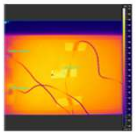


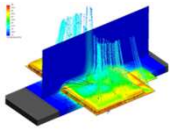
Battery ageing research
- **Calendar ageing**
- **Cyclic ageing**

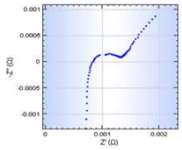


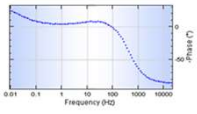


Thermal behaviour
- **Tests performed with IR imaging**
- **Different climatic conditions**









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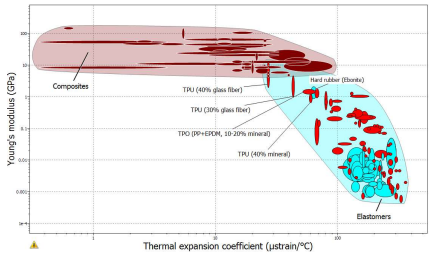
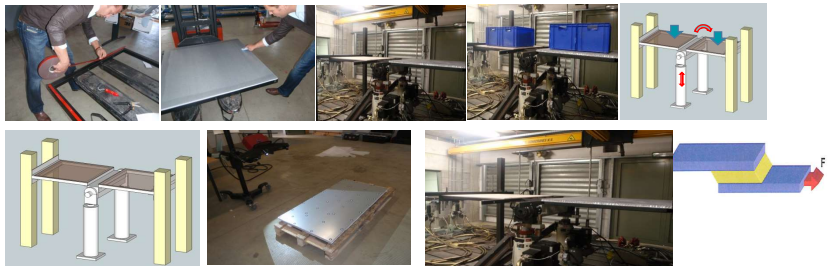
Lightweight Solutions





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Lightweight Solutions

Current door interior

LWD interior: weight reduction -20%

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Big data and Artificial intelligence

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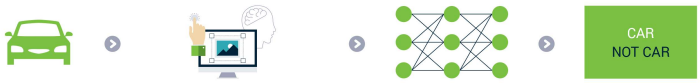
Big data and Artificial intelligence

Machine Learning



Input — Feature extraction — Classification — Output

Deep Learning

Input — Feature extraction + Classification — Output

Machine Learning

- ⊕ Good results with small data sets
- ⊕ Quick to train a model
- ⊖ Need to try different features and classifiers to achieve best results
- ⊖ Accuracy plateaus

Deep Learning

- ⊖ Requires very large data sets
- ⊖ Computationally intensive
- ⊕ Learns features and classifiers automatically
- ⊕ Accuracy is unlimited

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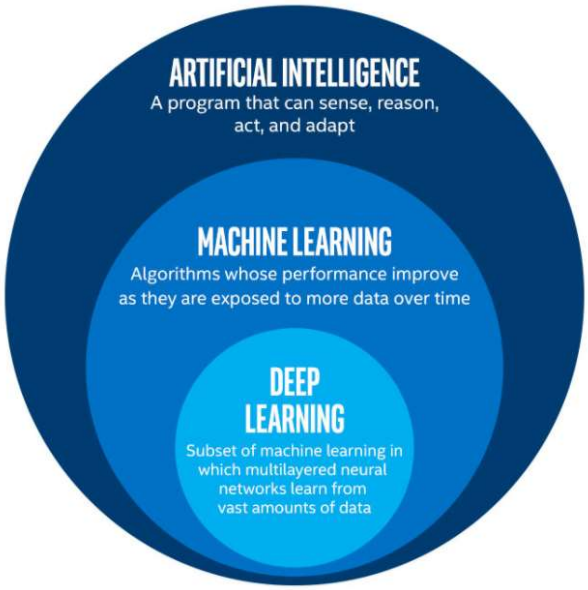
Big data and Artificial intelligence



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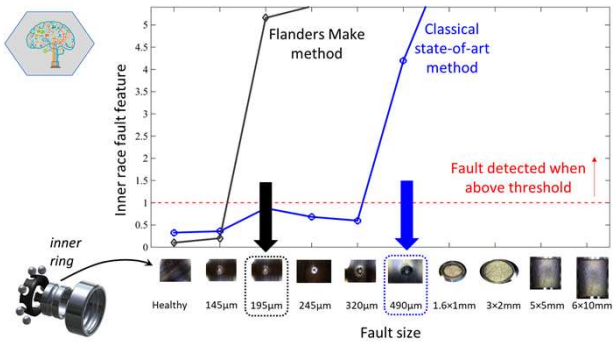
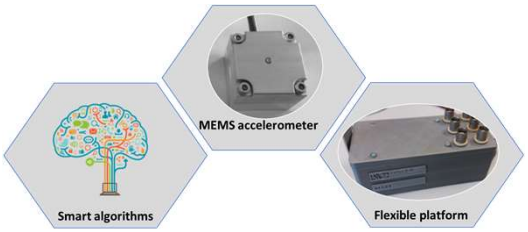
Predictive maintenance with vibration monitoring system

Detection 3 weeks before the failure



Algorithm diagnostic performance

Building blocks



- Low cost sensor
- Simple hardware for data exchange
- Robust smart algorithm to match performance of high-end system

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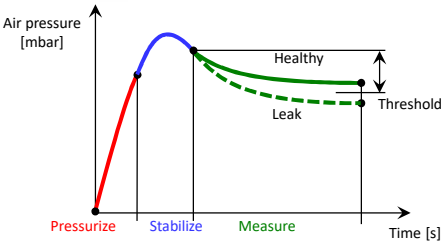
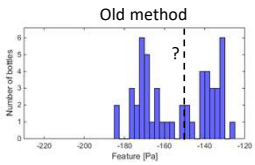
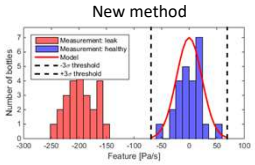
Predictive systems, no added sensors!

Leakage prediction based on big data analysis





No clear classification
(simple feature + manually set threshold)



Clear classification
(advanced feature + trained threshold)

- 15 to 30% shorter cycle time
- Simplified commissioning from 7 to 4 parameters
- Minor hardware changes needed

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Challenges of the manufacturing industry

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FLANDERS MAKE **INDUSTRIAL TESTIMONIAL**

Flexible Assembly

CNHi

How to respond to market demands and customer requirements, by delivering machine-specific information to the right operator at the right time?

Outcome

In a pilot project in the pre-assembly line of the engine, operator-specific instructions are supplied via tablets or Google Glasses.

This supports the operator more effectively and reduces cases of human error, and allows to implement design modifications faster.

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Augmented / informed reality

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Impact of digital instructon on the workfloor

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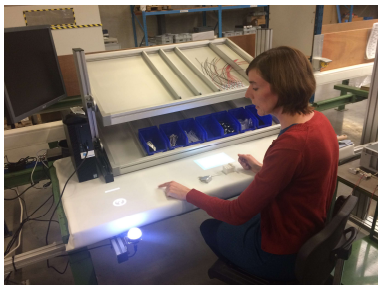
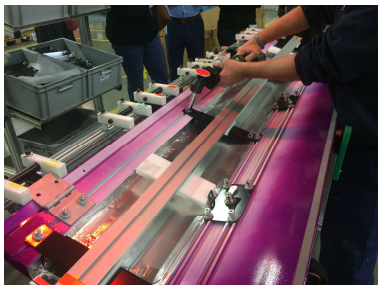
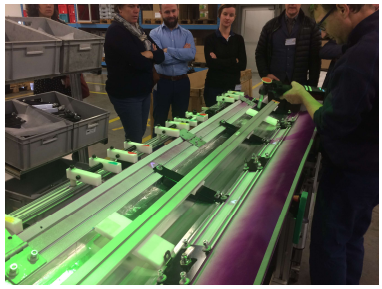
Social entrepreneurship : making use of technology

Augmented reality for operator support

Better workplace: more abilities by technology
Organisational: productivity & efficiency
Customer intimacy: quality, reliability, trust

→ Sustainable employment

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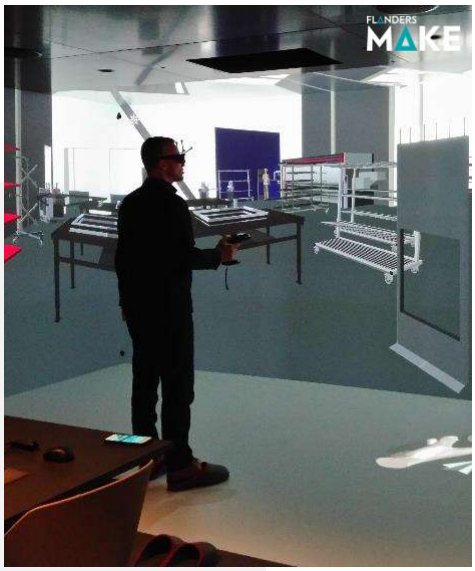
FLANDERS MAKE **INDUSTRIAL TESTIMONIAL**

Design & Optimisation



Reynaers aluminium

How to support manufacturers in optimising the production and assembly processes?

Outcome

A software tool was developed to help manufacturers design the ideal machine portfolio for a specific customer request.

Manufacturers now have accurate and reliable insight into their production data for each project, achieving time and cost savings.

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FLANDERS MAKE **SHOWCASE**

Flexible Assembly Flanders Make

Robot programming with Virtual Reality

Increase production efficiency by enabling a non-robotic expert to specify in an intuitive way a robot's trajectory.

Why

The manufacturing of low-volume, high-variety products requires frequent changeovers. Conventional robot programming can only be done by experts and is hence too costly.

Outcome

In the Flanders Make Joining & Materials Lab, a robot's trajectory for applying glue can be programmed and simulated in VR, before being compiled automatically by the cobot.

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Virtual reality preparation and reality execution

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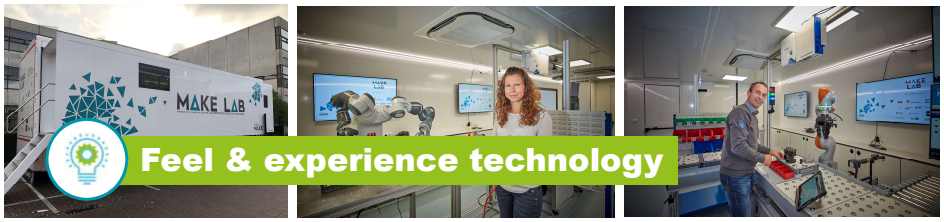
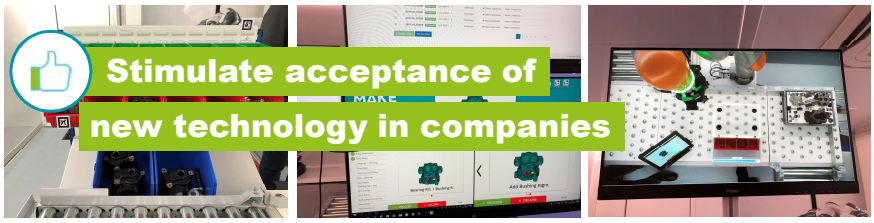
Acceptance of technology on the workfloor

Mobile Make Lab



Feel & experience technology



Stimulate acceptance of new technology in companies

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Make Lab

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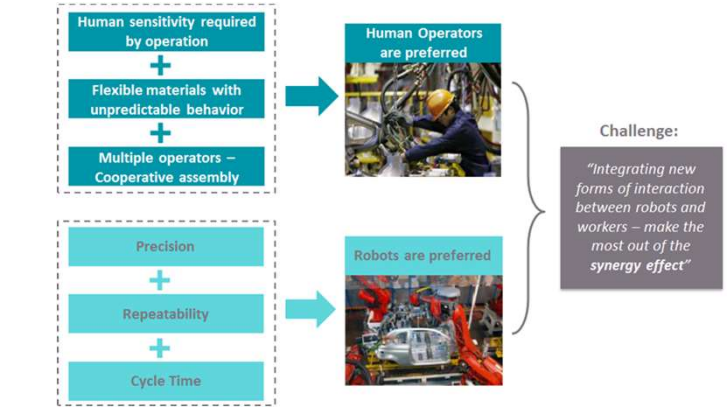
Flanders make focus: assembly of complex products

Creating flexibility, agility



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Man – Machine : Physical @ Audi @ Picanol

Ergoskeleton is especially useful when lifting and carrying heavy boxes.

Audi is applying the exoskeleton to prevent backache and injuries.

Testing of exoskeletons @ Picanol

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BMW: LEANER, FASTER, MORE STABLE

Industry 4.0 won't replace people. Human beings will remain the pivotal success factor.

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FLANDERS MAKE SHOWCASE

Flexible Assembly Flanders Make@KULeuven

Rapid Deployment of Learnable Robotic Skills

Expedite the deployment of complex robotic tasks by combining knowledge generalised from demonstration and information intuitively modeled as constraints.

Why

Robot (re)programming takes a large part of the overall robot deployment cost due to:

- Long programming time
- High level of robotic expertise required

Outcome

Non-expert users can easily and rapidly deploy (< 30 min!) robotic applications such as solenoid assembly and bin-picking.

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Collaborative workcell: proeftuin VLAIO

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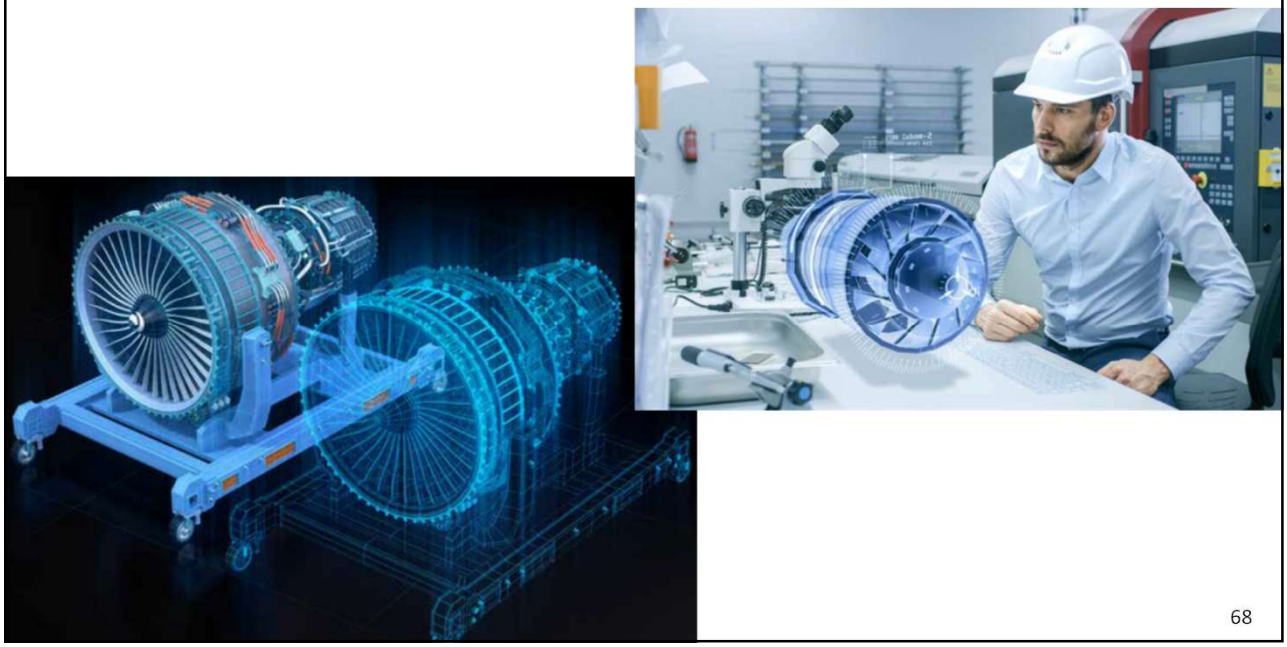
Digital Twin



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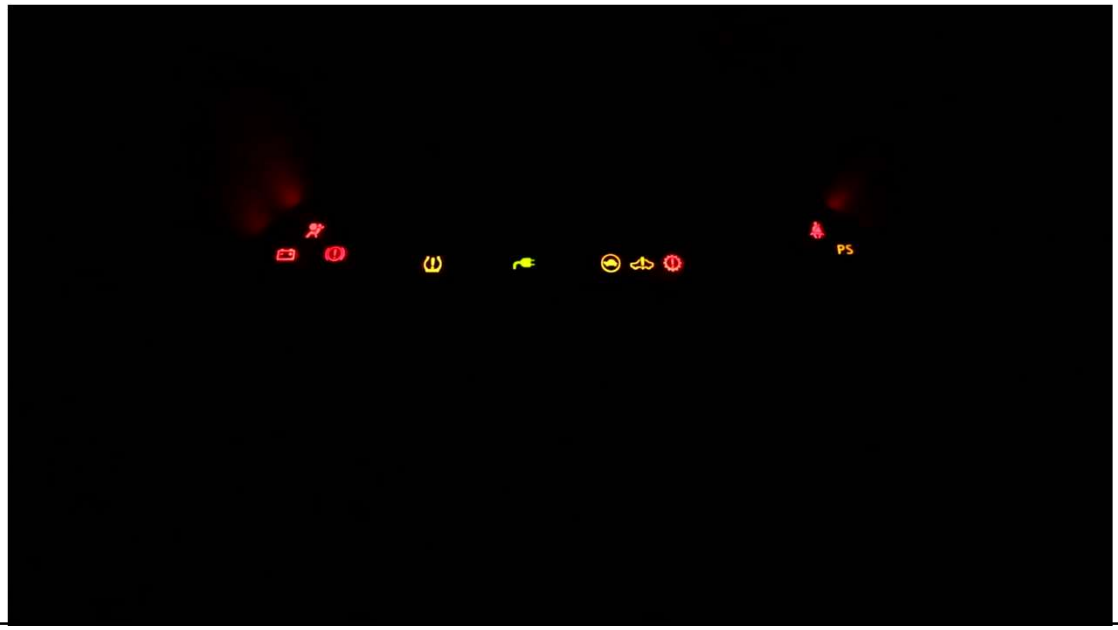
High Technology infrastructure



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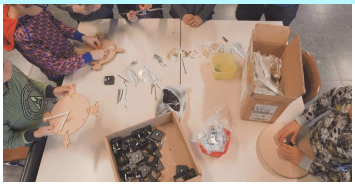
STEM : discovering/motivating talents

Reach : >3000 childeren from >200 classes in Flanders



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STEM : discovering/motivating talents

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Industry 4.0 : Servitisation, Product as a service

Atlas Copco

airLET, a new pay-as-you-go compressed air scheme

Rolls Royce

PROACTIVE MAINTENANCE FROM ROLLS ROYCE

Condition Monitoring, Proactive Maintenance, „Power-by-the-hour", as-a-service Business Model – Pay per flight-hour

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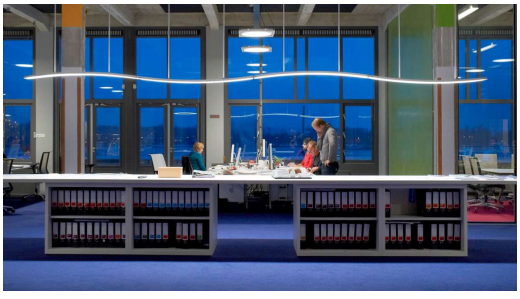
Signify (ex Philips) & Turnhout

Selling light as a service

Pay-per-lux: a whole new way to deliver light



Corona direct

Pay only the miles you drive

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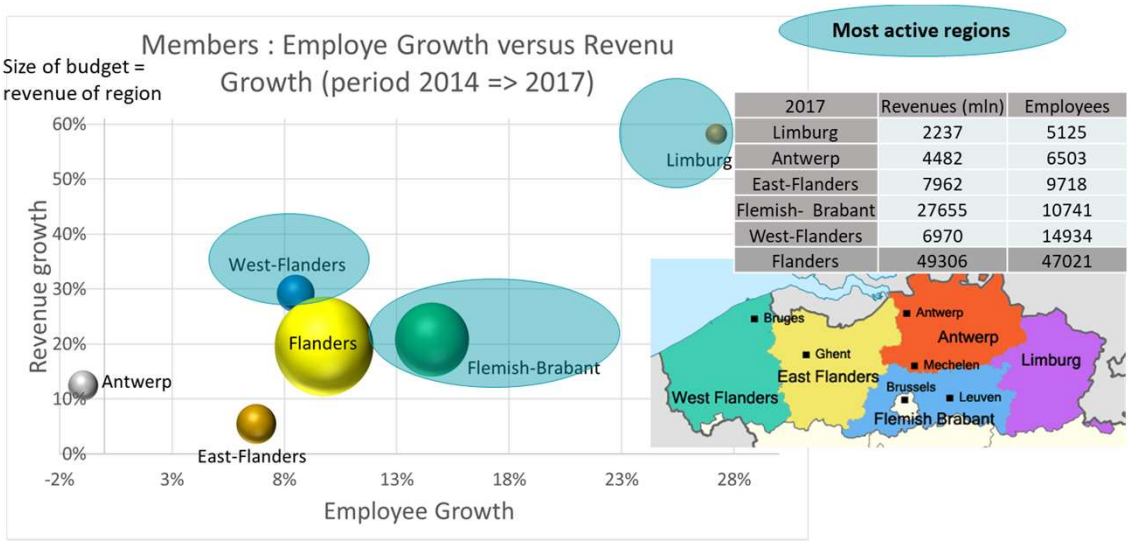
Our ecosystem and region results from member companies

DRIVEN BY IMPACT !!



Most active regions

2017	Revenues (mln)	Employees
Limburg	2237	5125
Antwerp	4482	6503
East-Flanders	7962	9718
Flemish- Brabant	27655	10741
West-Flanders	6970	14934
Flanders	49306	47021

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Conclusion

Let's MAKE it happen

- The Discrete Manufacturing Industry in Flanders Is reporting strong results
- Innovation pays of
- Internal and external collaboration is key
- Government support enables innovation, derisks digital transformation and stimulates collaboration

⇒ Great products made by great production resulting in great industry leading to welfare for our society

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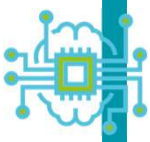
FLANDERS MAKE
DRIVING INNOVATION IN MANUFACTURING



Industry 4.0 is becoming reality, need for boosting implementations

Collaboration is key for executing the digital transformation

People unlock the digital transformation

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Video links

https://www.youtube.com/watch?v=Unrk-vTVGOY&t=28s

https://www.youtube.com/watch?v=Hd2YRgwcNeA

https://www.youtube.com/watch?v=Rv1ynbcTc-0&t=25s

https://www.youtube.com/watch?v=EBsW6bQsyNY

https://www.youtube.com/watch?v=7Qf_ui9wmBo

https://www.youtube.com/watch?v=gw5iREfYLA0

https://www.youtube.com/watch?v=9OqRuOp8MBk

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MAKE
DRIVING INNOVATION IN MANUFACTURING
SYMPOSIUM: DISCOVER THE FUTURE OF THE
MANUFACTURING INDUSTRY
November 26th, 2019, Antwerp Expo, Belgium
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