FACTORY of the FUTURE
innovation program

ROADMAP 2021-2024

innovation program

Content

Factory of the Future

General Introduction

The innovation program 'Factory of the Future' has been created in collaboration with 75 companies, knowledge institutes, educators and sector associations and kicked off in 2018.

The aim of the Program is to lower cost, increase quality and realize a faster time to market, by jointly developing faster and smarter production processes and sharing (innovation) facilities. We focus on the industrialization & manufacturing stage of high tech products & systems (high mix, high complexity, low volume).

Our vision is to stay competitive by **being strongly connected** and to cooperate on smart industry transformations, from both a technology as well as human relations point of view, with a global business driven mindset.

In the Digital Factory of the Future data & raw materials will be converted into high tech, integrated components and systems, fully automated from the engineering stage up to outbound logistics.
Humans and robots jointly control & operate the production equipment in the factory. Manufacturing performance throughout the supply chain, product & process quality, energy use and sustainability impact will be optimized real time by machine learning and artificial intelligence. Human capabilities, creativity and cooperation skills will still be essential to excel.

We welcome you to our home base, Brainport Industries Campus, to meet the teams and experts and join us on this road(map) towards The Factory of the Future !

Michel Weeda
Manager Innovation Program

Steffie van de Vorstenbosch
Manager Marketing & Communication

Innovation Program & Fieldlabs

Activities

We provide & connect facilities (fieldlabs), run state of the art technology projects and give access to experts to accelerate & support your company's innovation needs:

Inspiration	Demonstrations & Showcases
Innovation	Test before Invest – company use cases
Education	Educate & Train (employees, students)
Pilot production	Temporary workspace & Facilities

7.500
visitors

50
developed use cases

800
people have been trained

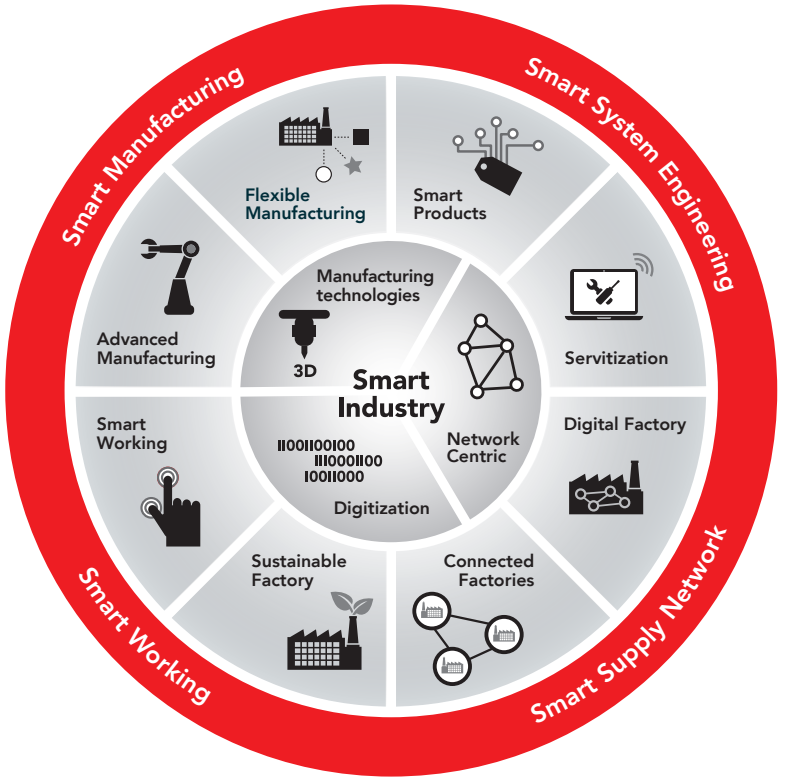
150
companies, educational and knowledge institutes

By the end of 2020, 150 companies, educational and knowledge institutes were participating in the innovation program. About 50 business cases have been developed and 800 people have been trained and educated in the Brainport Industries Campus facilities. Since the opening in summer 2018, around 7.500 visitors have visited the campus and its tenants, ranging from (inter)national delegates to customers.

Smart Industry Transformations

Innovation Domains

Based on the 8 national Smart Industry transformations, the Factory of the Future innovation program focusses on 4 interrelated innovation domains. **Smart System Engineering** covers the complete life cycle of assets, **Smart Manufacturing** deals with all new production technologies in factories. **Smart Supply Network** addresses exchange and handling of data, materials and products between companies in the value chain and **Smart Working** zooms in on the human factor in high tech manufacturing.



Factory of the Future

Overview

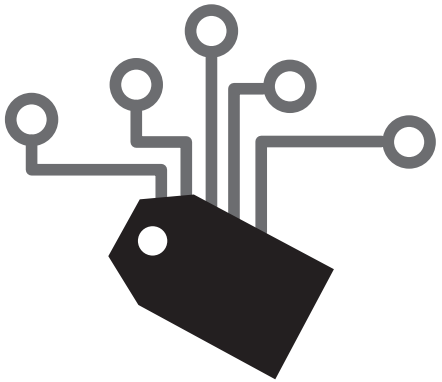
FIELDLABS / PROJECTS	INNOVATION DOMAIN	INNOVATION FOCUS
High Tech Software Cluster	Smart System Engineering	Life Cycle Evolution & Sustainability
		Model Driven Engineering
Fieldlab Flexible Manufacturing	Smart Manufacturing	Smart Production Technologies
K3D-AddFab / Industrial 3D Metal		
Fieldlab Multi Material 3D		Smart Assembly & Robotisation
Fieldlab Smart Connected Supplier Network	Smart Supply Network	Smart Connected Supplier Network
Fieldlab Advanced Manufacturing Logistics		Smart Factory Logistics
FutureTec / Education4.0	Smart Working	Decision Making Support Systems
Digital Factory		Training & Education

Marc Hendrikse / Executive chairman Holland High Tech, Top Team HTSM NL

"This roadmap covers all relevant topics for companies in the value chain to explore in order to continue to excel. I encourage further cooperation, both on national as well as EU level, and invite new companies to join the projects. Cooperation is a Dutch key success factor to stay competitive whilst delivering smart solutions for the global challenges."

Frank Mulders / Managing Director and CEO AAE Holding BV

"This Factory of the Future roadmap covers all necessary technologies, but above all, it entails Social Innovation. With transparency as the new norm of the industry 4.0 revolution, hierarchical structures become obsolete or even counterproductive. Make investments to prepare all employees, especially management, to be ready for their new roles and new means of cooperation."



Smart System Engineering
Life Cycle Evolution & Sustainability

Goal
Enable continuous system optimizations through digitization & automation of the system Engineering process

How and focus technology areas

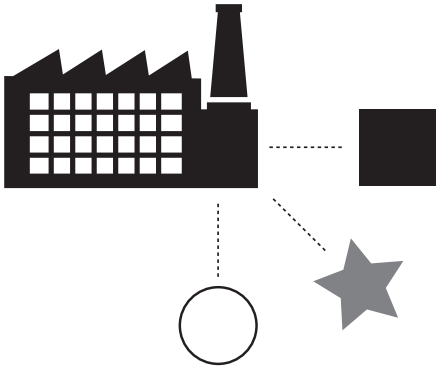
1. Integrate connectivity in system design, to enable cyber secure and continuous future updates of products, processes & factory performance
2. Use of simulation/digital twinning including AR/VR for optimization in design & engineering, production, operations and maintenance phases (life cycle approach)
3. Learning from systems by data collecting & analytics, machine learning / AI and automate the system software upgrade process for sustainability impact & performance optimization of products, systems & factory

Smart System Engineering
Model Driven Engineering

Goal
Deployment of flawless system & software updates

How and focus technology areas

1. Use of low-code platforms & model driven engineering combined with validation & verification techniques and simulation & digital twinning
2. Specification and lifecycle management, e.g. Model Based Definition & compliant with international standards, to enable change agility
3. Use of Continuous Integration, Delivery & Deployment (CI/CD) automated development proces



Smart Manufacturing
Smart Production Technologies

Goal
Develop new applications with emerging production technologies

How and focus technology areas

1. Demonstrate and innovate on existing production technologies with focus on industrializing Additive Manufacturing technologies and including (future integration) Electronics & Materials
2. Develop & implement Augmented Reality standards to support Production, Assembly and Logistics
3. Implement real time machine performance optimization and improve process automation of raw materials, finished products and tooling changes.

Smart Manufacturing
Smart Assembly & Robotization

Goal
Implement flexible automation and robotization for high mix low volume assembly to increase production efficiency

How and focus technology areas

1. Innovate in fieldlabs and implement Human/Robot collaboration in companies
2. Develop standards to enable Modular Manufacturing in the supply network
3. Apply Digital Twinning of Manufacturing and Assembly on machine and factory level

Martijn van Gruijthuijsen / Council Member of the Province of Noord-Brabant

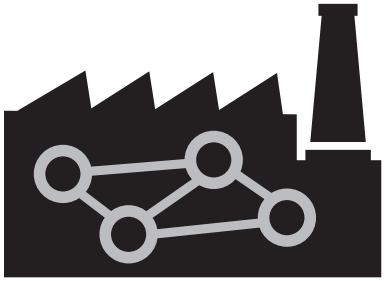
"Brabant is the home of innovative solutions to the societal challenges of tomorrow. At Brainport Industries Campus, and with the help of the Factory of the Future, we're working on the future of high-tech manufacturing. By supporting this innovation program, we are able to unlock the acquired knowledge and latest innovations for the manufacturing industry in the province of Noord-Brabant. By doing so we strengthen the competitiveness of this sector in a national, European and even global setting."

Ella Hueting / Director Fontys School of Engineering

"The collaboration with the Innovation Program gives our students, teachers and researchers the opportunity to experience and create a hybrid learning environment. Our practical research and projects together with companies on the topics Adaptive Robotics, Additive Manufacturing and Digital Factory in the fieldlabs, ensure that education and research keep their relevance in the coming years and contribute to the Roadmap of the Innovation Program."

Erik Veurink / Managing Director Brainport Industries Campus

"At Brainport Industries Campus, the central belief is that combining knowledge, skills and experience in the high-tech manufacturing industry leads to a competitive advantage, enabled by an efficient supply chain. The Innovation Program is one of the pillars of our eco-system and this roadmap enables us to become the international hotspot for the manufacturing industry."

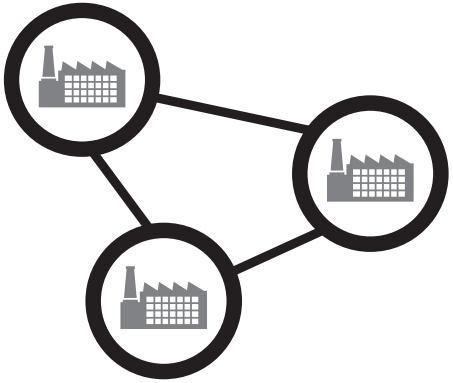


Smart Supply Network
Smart Factory Logistics

Goal
Implement digitization and AI to optimize factory operations

How and focus technology areas

1. Develop advanced Planning & Scheduling to support Build to Order (self configuring production model)
2. Accelerate Industrialization to assure first time right and shorten time to market
3. Implement Mobile robots for factory logistics (materials, products, tooling)



Smart Supply Network
Smart Connected Supplier Network

Goal
Create an agile, global, secure and connected supply network to shorten time to market

How and focus technology areas

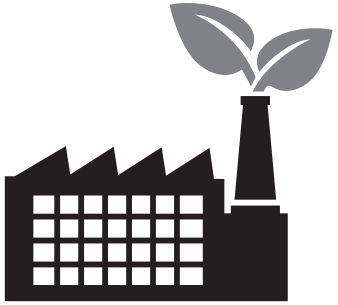
1. Develop International Standards for supply network communication to optimize planning & scheduling (EU/global), compliant with latest cyber security protocols
2. Apply Visualization and Simulation to optimize the Supply Network performance
3. Develop & Implement Model Based Definition solutions / Product and Manufacturing Information (PMI) to optimize Machine, Factory & Network performance

Smart Working
Decision Making Support System

Goal
Optimize end-to-end production and supply chain work flows via digitization

How and focus technology areas

1. Implement and use digitization for production optimization and assembly simulation techniques to create best in class Operator working conditions
2. Develop and apply AI based technologies for real time Operator & Robot/Cobot decision support
3. Apply Smart Data Assistants (based on AI and machine learning) and other support platforms for monitoring, analytics and business decision making



Smart Working
Training & Education

Goal
Deploy smart industry related skills and competences (lifelong learning) to adopt new technologies

How and focus technology areas

1. Use of AR & VR for engineers & operators training and instructions, including the design-, engineering-, commissioning-, production- and maintenance phases (life cycle approach)
2. Develop a Toolbox for (human) Operator 4.0 and explore needs, roles & tools for the I4.0 operation (including digitization skills, human-robot cooperation, factory automation)
3. Deploy Sustainability & Circular Design thinking for engineers & operators

Outlook 2021-2024

Horizon

The Innovation Program Factory of the Future is part of a larger ambition to improve the innovative and competitive advantage of the Dutch manufacturing industry. Brainport Industries - one of the drivers behind the innovation program - is strongly connected with other initiatives, such as the Dutch National Smart Industry program, the National AI coalition and the Holland High Tech HTSM roadmaps. The markets and presence of the manufacturing industry do not limit themselves to the Netherlands; many companies operate on a global scale. That is why we actively expand our collaborations with European initiatives, programs and networking organizations in the areas of manufacturing and digitalization. Currently, we are involved in Smart Factory EU and Horizon 2020 projects such as AI Regio, DimoFac and Market 4.0, and we are preparing together with our regional and (inter)national partners for GAIA-X, European Digital Innovation Hub and more.

These collaborations enable us to verify (and focus on) the relevant topics in our Innovation Program, share our findings with our international partners and implement best practices elsewhere created. We need to be smart on a European scale in order to keep our manufacturing industry in competition with the rest of the world. Next to the latest technology, the key ingredients for success are trust, an open mind and investing in human capital. We will continue to combine these elements in our innovation program in the coming future, guided by this roadmap 2021 – 2024. We look forward to continuing our journey together with you!

John Blankendaal
Managing Director Brainport Industries

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Provincie Noord-Brabant

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