

SeAMK

SEINÄJOEN AMMATTIKORKEAKOULU
SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

Digital Manufacturing and Industrial Internet



Digital Manufacturing and Industrial Internet in South Ostrobothnia, Finland

Finland is the digital leader in EU based on the EU Digital Economy and Society Index (DESI) 2020 ranking. As stated in the DESI 2020 country report 'Finland's leading performance is due to its excellence in digital public services and the integration of digital technologies, enabled by active cooperation between public and private sectors and an active start-up scene. Its human capital is one of Finland's strongest competitive advantages'. Despite of the human capital, more than 66% of the firms recruiting ICT specialists had difficulties in doing so. To tackle this challenge, Finland is reforming its training schemes.

On the integration of digital technology by businesses into their activities, Finland ranks second among EU countries. Finnish firms perform well in using electronic information sharing and social media; use of big data analysis; and on-line commerce. Despite the strong support and development in the integration of digital technology, there are challenges, for example, in digitalisation of manufacturing companies. (DESI 2020 Country Report, Finland).

To support local manufacturing companies in their digitalization path, SeAMK offers digital capability measurement and benchmarking workshops to them. The workshops help to locate the biggest gaps between the current capabilities and the strategically reasonable target levels. The tool used in the workshops is customized for the needs of SMEs and the feedback received from the companies have been good. Figure 1 presents the structure of the workshops.

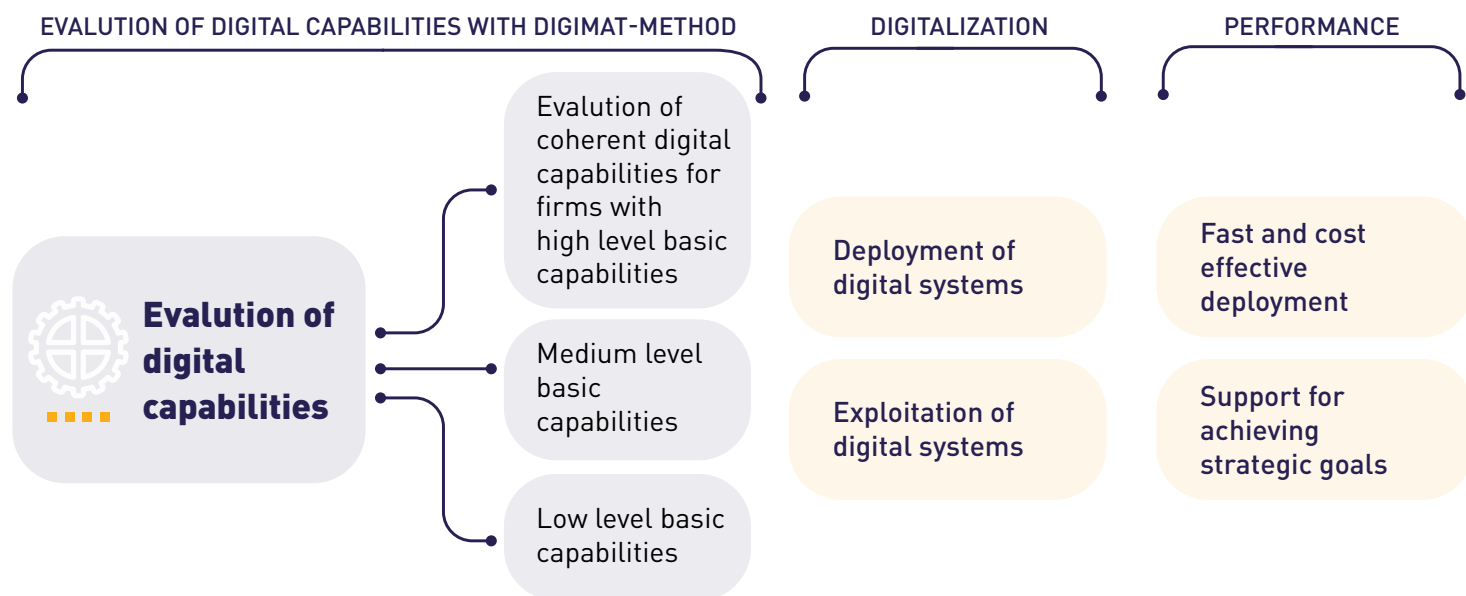


Figure 1. The structure of the method used in the digital capability measurements.

The workshops have given SeAMK important knowledge of the overall digital capabilities in manufacturing SMEs in South Ostrobothnia that can be utilized in preparing suitable research and development projects that support the regional growth. The workshops have also strengthened the collaboration between the companies and SeAMK. For more information, see e.g. the article [Digital capabilities in manufacturing SMEs.](#)

The effects of digitalization are widespread, and they create new opportunities for business growth and growth strategies. Digitalization is a pre-factor of growth as it creates new markets and opportunities. The firm's digital capability creates new business and growth. Digitalization is visible in the growth process through market penetration, product development, market development and diversification. A firm can continue its growth-oriented development path by investing in digitalization. Digitalization enables firms to response to market changes rapidly.

Competence of SeAMK in Digital Manufacturing and Industrial Internet

Education and Training

SeAMK offers Bachelor's degree programmes (B.Eng. in Automation Engineering, B.Eng. in Mechanical and Production Engineering, B.Eng. in Construction Engineering, and B.Eng. in Information Technology) and Master's degree programmes (M.Eng. in Automation Engineering, M.Eng. in Construction Engineering, and M.Eng. in Technology Competence Management). Digital manufacturing and industrial Internet are present in all the programmes as cross-cutting themes. The award-winning laboratories of SeAMK are widely utilized in teaching and the students can use them independently for their projects. SeAMK collaborates closely with the local manufacturing companies on exercise works, project works, training periods, and thesis works.

Laboratories

ROBOTICS AND MATERIAL TECHNOLOGY laboratory is utilized in the teaching and RDI activities that require collaborative robotics, mobile robotics, computer vision and light-weight industrial robotics. The modern equipment can be employed in various prototyping procedures and projects. The laboratory has also capabilities for basic material studies. See the Thinglink video [here](#).

MECHANICAL ENGINEERING AND MACHINING TECHNOLOGY laboratory contains a comprehensive range of heavy industrial equipment such as flexible manufacturing cell, welding robot, and sheet metal machinery. Students practice, for example, machining, measuring, and edging. Various project work is also possible in the laboratory of machine and production technology. Regional and national companies have given students the opportunity to carry out various project work and thus get a feel for future projects and work tasks in working life. See the Thinglink video [here](#).

SEAMK DIGITAL FACTORY aims to deploy digital manufacturing and industrial internet to the manufacturing industry in the region. It consists of a digital manufacturing learning environment and an industrial internet laboratory. It serves as a learning environment for engineering education and as a Center of Excellence for companies. The environment includes product information and lifecycle management software, an automated production system, and operational and production management software with cloud services. See the presentation video of the laboratory of the industrial internet [here](#).

SeAMK's Industrial Internet RDI Team aims to improve the manageability and predictability of production systems, which enable new business opportunities. The data collected from the production to the cloud service is analyzed and visualized for a better visual experience for the user. Better machine control and tracking make it possible to service traditional equipment sales, creating new business.

In the **PRODUCTION AUTOMATION** laboratory, students learn how to design, program, and implement very versatile machines and equipment. Students design programs that drill, screw, sort, measure, inspect products using machine vision, and move products on the production line.

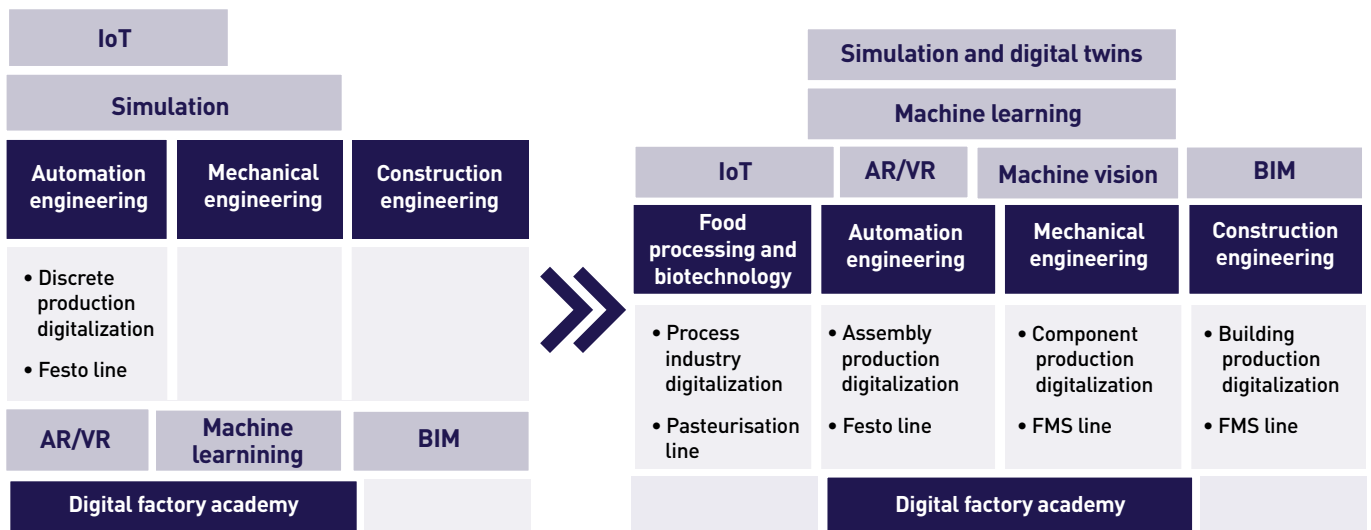
FUTURE VEHICLE TECHNOLOGIES theme explores the development of automotive and work machine technology in a digitalizing and energy-efficient operating environment. Sustainable transport solutions include technologies for passenger and commercial vehicles throughout the life cycle of a vehicle. Intelligence refers to the breakthrough brought by digitalization on various mobile machines. From sustainability point of view, different environmental solutions are considered for the vehicle itself and its possible energy sources. The intelligent mobile machinery contain moving machinery that are used to carry out various work tasks.

SeAMK's Future Vehicle Technology RDI team aims to ensure the South Ostrobothnian know-how in the ongoing vehicle technology revolution. The team has also a vision to become one of the key players in the area of intelligent outdoor robotics in Finland.

RDI

SeAMK School of Technology commenced developing digital solutions for the industry more than 20 years ago. The aim has always been to increase productivity in manufacturing. Digitalisation of product and manufacturing design, concept, analysis, testing and production simulation enhances product lifecycle management and increases productivity.

Digital Factory and related areas



Key Experts

Dr. Juha Hirvonen, Principal Lecturer in Digital Industrialisation, has over nine years of work experience in academic research and more than one year of experience as a software engineer in an international company. He has specialized in computer vision, automation engineering signal processing and measurement technology. In addition, he is also familiar with bio and medical technology research. Current research interests include computer vision, industrial internet of things and digital manufacturing. He has been involved in over 10 nationally and internationally funded research projects. Participated in research exchange in Soochow University, China, and Oldenburg University, Germany, during his PhD studies. Published over 20 articles in international conferences, journals, and e-magazines.

Dr. Pasi Junell, Principal lecturer and the head of the degree program of mechanical engineering at Seinäjoki University of Applied Sciences. The degree program in mechanical engineering also includes automotive engineering education at SeAMK. Pasi's educational background is a D.Sc. (Tech.) with the major in physics and minor in mathematics and M.Sc. (Tech.) from the degree program of electrical engineering. In physics, Pasi's main concentration area has been on surface science. He has been studying previously heterogeneous catalysis (automotive catalyst) and corrosion. Also applied thermal physics and various simulations has interested his attention in the previous studies and research. Pasi has been working since 2005 at SeAMK, and his teaching includes general physics, chemistry, electrical engineering, finite element method simulation and research methodology education. Currently Pasi's main research interest is focused on the future vehicle technologies.

Lic.Eng. Petteri Mäkelä, Principal Lecturer in Computer Science. He has 17 years of work experience in teaching and 9 years of experience in research development in an international high-tech company. He received his MSc in computer science and Licentiate of Technology degree in electrical engineering 1994 and 2008 respectively. He has specialized in satellite navigation systems, industrial internet of things and software engineering. His teaching includes courses in industrial Internet of things, automation technology and computer science. His current research interests include industrial Internet of things, and indoor and satellite navigation systems. He has been involved in various EU funded research and development projects as a researcher and project manager.

Dr. Ari Sivula is a Research and Development Manager in the School of Technology at the Seinäjoki University of Applied Sciences, Finland. Prior to his current position, he was acting as a University Lecturer, Head of the Master's Programme and Head of Industrial Management Department in the School of Technology and Innovations at the University of Vaasa, Finland. He received his MS in Computer Science from the University of Vaasa in 2011 and his PhD in Industrial Management from the University of Vaasa in 2016. He is holding several professional certifications and is experienced in software engineering, project, and portfolio management, six sigma, regional and business development, innovation management and innovation ecosystems. He has been working in the public and private sectors in various roles. He has managed multiple projects and has an extensive knowledge of different EU funding programs (e.g. ERDF, ESF, Horizon 2020 and Interreg). He has published in several international scientific journals, conferences and book chapters (e.g. International Journal of Innovation and Learning, Management, International Journal of Advanced Logistics, ISPIIM, Palgrave Macmillan, Springer and CRC Press) and his current research interests include innovation management, new product and service development, platform economy, and several other contemporary topics like blockchain and servitization.

Relevant Publications

Hirvonen, J., Hakalahti, H. and Ylihäsälä, M. (2020). Testing ERP and MES with digital twins, The 61st SIMS Conference on Modelling and Simulation, 22.–24.9.2020.

Hirvonen, J. and Majuri, M. (2020). Digital capabilities in manufacturing SMEs, Procedia Manufacturing, 51, 1283–1289.

Ylihäsälä, M. and Hirvonen, J. (2021) Grid Shape Descriptor using path integrals for measuring sheet metal parts similarity, CAD'21, International CAD Conference, July 5.–7.7.2021 (accepted)

Sivula, A., Shamsuzzoha, A. & Helo, P. (2021). Requirements for Blockchains in Supply Chain Management: An Exploratory Case Study, Operations and Supply Chain Management: An International Journal, 14(1), pp. 39-50

Kantola, J. & Sivula, A. (2018). Macroergonomics: An overview. In Samman, S. (ed). Human Factors and Ergonomics for the Gulf Cooperation Council: Processes, Technologies, and Practices. Boca Raton: CRC Press.

Sivula, A. & Kantola, J. (2014). Combining Crowdsourcing and Porter's Value Chain. International Journal of Advanced Logistics 3(1-2), pp. 17-26.

Sivula, A., Shamsuzzoha, A., Ndzibah, E. & Timilsina, B. (2021). Industry 4.0 End-to-End Servitization Model, Management and Production Engineering Review, Submitted.

Examples of Relevant Previous/On-going Projects

Source of Funding	Timing	Name of the Project and Grant Agreement Number	Beneficiary / Lead Partner
Erasmus+	1.9.2020-31.8.2023	Competence Development in Collaborative Industrial Internet of Things (Collaborative IoT)	Seinäjäki University of Applied Sciences
Erasmus+	1.9.2019-31.8.2022	Intelligent E-Learning Systems in Robotics/Mechatronics	Tallinn University of Technology
	1.9.2019-31.8.2022	Intelligent E-Learning Systems in Robotics/Mechatronics	Tallinn University of Technology
ESF	1.3.2021-30.4.2023	Training 4.0: XR	Seinäjäki University of Applied Sciences
ESF	1.9.2020-28.2.2023	Development of quality in micro companies and SMEs via competitive products and services	Seinäjäki University of Applied Sciences
ERDF	1.9.2020-31.12.2022	Competitiveness Through Quality with Machine Vision	Seinäjäki University of Applied Sciences
ERDF	1.4.2021-30.6.2022	Digital Business Lab (DBL)	Seinäjäki University of Applied Sciences
ERDF	1.9.2020-31.8.2022	Logistics and resource management of the future via ubiquitous precision positioning methods	University of Vaasa
Interreg Europe	1.6.2018-30.1.2022	Digital tech SMEs at the service of Regional Smart Specialisation Strategies (DEVISE) A73978	ERNACT
ERDF	1.8.2019-31.1.2021	Enterprise Digital Twin Platform	Seinäjäki University of Applied Sciences
Interreg BSR	1.1.2019-30.6.2021	Industry4: transforming innovation ecosystem through better capacity of public enablers (InnoCAPE) #R086	Sunrise Vallet Science and Technology Park
Finnish Ministry of Education and Culture	1.10.2018-31.5.2021	More start-ups and Growth through Digitalisation and Artificial Intelligence	Seinäjäki University of Applied Sciences

Possible Roles of SeAMK in Horizon Europe Calls

We collaborate with more than 50 industrial companies, most of them SMEs, each year and coordinate IoT Compass Hub DIH. This means that we are especially strong partner in piloting and bringing developed methods to practice. Moreover, we are interested in several technological themes, including but not limited to, digital twins, XR, machine vision, blockchains and product development.

Contacts

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Cooperate with us:
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