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The Netherlands - Transnational Report

Fostering the Adoption of ICT-enabled AMTs by European SMEs

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Introduction

This report presents the good practices of SMEs in the Netherlands in terms of Advance Manufacturing Technologies (AMTs), focusing on the adoption, the use and the benefits of such technologies in the manufacturing sector. AMTs play a crucial role for the production of more innovative products and services using more resource-efficient production processes (less material, less energy and less waste), leading to reductions of production costs, improvement of quality, increased flexibility and production capacity, and better management of resources (Kroll et al., 2016).

As part of the FAME project, the report focuses on four sectors: food and beverages industry, wood industry, metal industry, and the electronic and electronical equipment industry, in accordance with the project objectives set by partners in the beginning of the project.

The findings of this report will be used in a comparative study with utter goal to define the gap between the desire situation ("TO-BE") and the present situation ("AS-IS") concerning the use of ICT-enabled AMTs in European SMEs. Based on the results, training programs and tools will be developed to enhance the skills and strengthen the capacity of SMEs into adopting ICT-enabled AMTs.

The main challenge towards the digital transformation of businesses is to convince them that digitalization is imminent in order to cope with new trends in supply and demand. By raising the awareness that new technologies offer new opportunities for industrial companies to transform their business models and by developing the tools to do so, companies will be at the forefront of the digital revolution and even will define future technological advances.

SMEs in the Netherlands

Small and Medium Sized-Enterprises (SMEs) constitutes 99% of businesses (22.2 million) in Europe, employing more than 64% people (93 million jobs) and generating about €4 trillion of value-added in all non-financial business sectors. In the Netherlands, defining a business as an SME involves two factors: company employment size to be less than 250 employees and either an annual turnover of €40 million or a total value of assets presented in the balance sheet equal to or less than €20 million. Illustrating the definition of SMEs in a better way, Table 1 presents the Netherlands' criteria (Netherlands Chamber of Commerce, 2019).

Table 1: Defining SMEs in the Netherlands

Type	Number of Employees	Net Turnover	Total Assets
Micro	<10	< € 700,000	< € 350,000
Small	10 – 50	€ 700,000 - € 12 million	€ 350,000 - € 6 million
Medium	51 – 250	€ 12 - € 40 million	€ 6 - € 20 million
Large	>250	> € 40 million	> € 20 million

By the end of 2017 there were 1.15 million SMEs in the Netherlands, in non-financial business sectors, with most of them (95.5%) being micro-firms (<10 employees) (SBA Fact Sheet Netherlands, 2018).

These SMEs were responsible for a total of € 212 billion added value, contributing to a 62.9% share of the value added in the non-financial business economy. SMEs have shown healthy growth in recent years and contributed to the Dutch non-financial business economy. Figure 1 visualizes the contribution of SMEs and large businesses in the Netherlands, in terms of number of enterprises, employment and turnover.

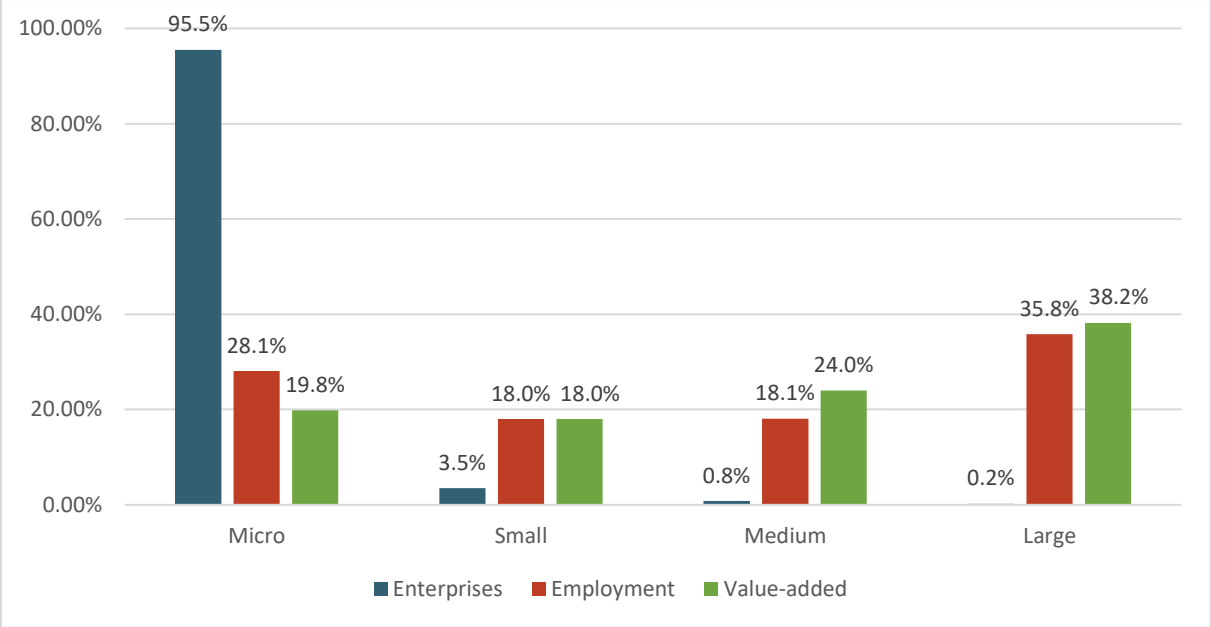

Figure 1 Number of enterprises, employment rate and value-added percentages according to size of businesses in the Netherlands, 2018, (SBA Fact Sheet Netherlands, 2018).

SMEs represent over 99% of all business in the Netherlands, accounting for 64% of employment and 61% of value-added. This shows the importance of SMEs for the country's economy. Out of this 99% of SMEs, only 1% of them belong to the manufacturing sector. The ratio between micro, small and medium-sized, and large enterprises in the manufacturing industry is 15%:53%:32%. At 32%, the Netherlands has relatively fewer people working in large enterprises compared to the EU average of 40% and especially Germany at 52% (Eurostat). The main manufacturing industries in the Netherlands are chemical and pharmaceuticals, food and beverages, healthcare and life science, metals and alloys, tools and equipment, and IT and software.

Technology in focus

As mentioned in the beginning, the report will focus on good practices concerning the food, agriculture, metal, and electronics industries. Although it can be argued that ICT-enabled AMTs include a vast amount of technologies, the main focus will be on the following:

- Virtual reality (VR) and simulation in production and product design,
- Supply chain management
- Data management systems (PLMs & PDMs)
- Enterprise resource planning management (ERP),
- Additive manufacturing (3D printing)
- Cyber-physical production systems, and finally,
- Cloud manufacturing

Smart Industry in the Netherlands

Before going into more specific information about industries and technologies, it important to establish the context of the Dutch digital evolution. The Netherlands ranks 4th out of the 28 EU Member States in the Smart Industry. It ranks 1st in connectivity with an excellent digital infrastructure which boosts the growth of the Dutch digital economy and society (Larosse, 2017). The integration of Digital Technology, rank 6, represents the relatively weakest performance of the country, although businesses are making progress but at a somewhat slower pace than other EU Member States. According to the Europe's Digital Progress Report (EDPR) issued by the European Commission, the Netherlands also experienced a significant increase in the deployment of cloud solutions between 2015 and 2017. Finally, the Netherlands continues to be among the EU's frontrunners in terms of overall intensity of the use of digital by enterprises, according to the Commission's 2016 Digital Scoreboard. In this regard, it is particularly noteworthy that it ranks 1st among EU Member States in terms of enterprises analyzing big data from any source (19.1%). At the same time, the below EU-average use of RFID technology and the flattening in the percentage of SMEs selling online to below EU-average levels could be areas for some concern, especially in the light of the finding of a 2015 Smart Industry survey that Dutch entrepreneurs remain relatively uninformed about the digital revolution and its implications for their business (EDPR, 2017).

Advanced manufacturing and Industry 4.0 in the Netherlands

As defined by Davis et al. (2012), advanced manufacturing "refers to a family of activities that depend on the use and coordination of information, automation, computation, software, sensing and networking. This involves both new ways to manufacture products, and especially the manufacture of new products emerging from new advanced technologies".

Research has shown that implementing advanced manufacturing technologies and ICT-enabled tools is strictly limited to large multinational companies due to high costs involved. Bughin et al., (2015), conclude that the high cost and limited value added mainly stem from problems aligning the organization, limited interoperability and cybersecurity risks. This partly explains why SMEs, also in the Dutch industry, are not implementing advanced manufacturing despite the potential benefits.

On the other hand, there are plenty of projects, currently active in the Netherlands, that are specifically designed to assist SMEs into embracing and implementing advanced manufacturing technologies, and more specifically the tools and concepts included in Industry 4.0. Some of these ongoing projects are (Huizinga et al., 2018):

- **Roadmap 3D Printing**, or Additive Manufacturing Technology with applications on metal, ceramic or organic materials,
- **Limburg Makers**, provides comprehensive incentives and support programs for Dutch SMEs in the manufacturing sector to improve their competitiveness by embracing Industry 4.0 tools and concepts,
- **Coordinated Advanced Maintenance & Logistics Planning**, refers to the process industry in which Big Data analytics will enable *preventive maintenance* to machines and facilities,
- **Region of Smart Factories**, is an extensive network of companies and institutions that has taken initiative to develop new techniques that can significantly improve productivity in the manufacturing industry,
- **Smart Dairy Farming**, through sensors, indicators, decision models and advisory products, farmers can make the right choices in the care of their animals,
- **PLM in the Value Chain**, spearheaded by the Brainport Industries along with 85 high-tech suppliers, is an initiative to create a future-proof manufacturing industry by developing a Product Life-cycle Management (PLM) system that aligns all life-cycle processes optimally, and thereby optimize the net proceeds of a product throughout its life-cycle,
- **Flora Fluids**, referring to the agro-food sector, where innovative SMEs share technology and market intelligence into the creation of Plant Robots that are used for extracting plant fluids in a more productive way, speeding up the time to market, and finally
- **Smart Industry Fieldlabs launch**, are practical environments within which Smart Industry solutions are developed, tested and implemented, and also allow people to learn how to apply them to their business or work. Currently there are 32 Fieldlabs all over the Netherlands in which 300 businesses and various knowledge institutions and government authorities are participating.

ICT-enabled AMTs in Dutch SMEs

There are examples of Dutch SMEs that have taken the step towards the implementation of AMTs and ICT-enabled tools and have succeeded on the process. This section presents the most notable cases of ICT-enabled AMTs adoption in SMEs. As defined by the project scope, the sectors in focus are the metal, wood, food and electronic industries. However, this section present examples of only the metal and electronics sector since the adoption of AMTs is higher in these industries.

Metal industry

247 Tailor Steel

247 Tailor Steel, founded in 2007, developed a fully automated process for laser cutting metal sheet and tube. At the very heart of this process lies a uniquely designed software suite, named after the founder's daughter Sophia and an acronym for SOPHisticated Intelligent Analyzer. This software enables customers to upload their drawings directly through a web-based portal. The software provides the customer in turn with a quotation and expected delivery time. The process of laser cutting is also controlled from Sophia, eliminating the need for a front and back office. The result: lower cost and shorter lead times leading to better market chances (Peters, 2015).

HGG Profiling Specialists

The HGG Profiling Specialists, apart from being an ordinary metal manufacturer, it also develops robotised machines for the automated cutting of pipes, beams, ducts and other profile steel, including the underlying software and user interfaces. By taking advantage of the *Internet of Things* and embracing Big Data analytics, they are able to implement predictive maintenance for their machines in the production floor, and through their global service network information and data are easier tranfered and handled. Nowadays, the company is working closely with other SMEs, specializing in robotic welding technology, looking at how they can make their machines can communicate in a more efficient way, which will lead them eventually to cloud computing and cloud robotics solutions (Peters, 2018).

Smart Robotics

Founded in 2015, the company is considered to be the leader in flexible manufacturing and automation within the Dutch market. They manufacture smart, flexible, safe and user-friendly robot solutions within packaging and logistics. By using their Smart Reasoning Software, Advanced Motion Planning and by using 3D-vision feedback they make the robot 'smart'. The robot can adjust its movements to changes in the environment, for example in situations where products are placed differently or change shape. In fact, they teach the robot to correct itself and to handle unpredictability, just like people do (Huizinga et al., 2018).

RAMLAB Fieldlab

Together with Damen Shipyards, PRomain, Autodesk and Bureau Veritas, the RAMLAB Fieldlab developed the WAAMpeller: the world's first 3D-printed and certified ship's propeller, which weighs 200 kilos, has a diameter of 1.35 metres and has been fabricated from a bronze alloy. The propeller was printed by a welding robot of Valk Welding using Wire Arc Additive Manufacturing (WAAM) technology (Huizinga et al., 2018).

Electronics & electronical equipment industry

Brainport Industries

Brainport Industries designs, develops and manufactures leading advanced, precise, and intelligent high tech equipment for the semiconductor, analytical, medical, printing and pv market. They utilize technologies such as additive manufacturing, smart sensors, collaborative robots, and they have developed a production management system which is run using mobile robots (Brainport Industries, 2018).

Other industries

The VanRiet standard 4.0

VanRiet developed the VanRiet Standard 4.0, a 3D visualization and development environment which enables to simultaneously design and calculate material-handling projects, in much less time than a conventional approach. The software can design a complete material-handling system with the entered components and parameters. For instance, it calculates all hardware components required to construct the project, speeding up the cost calculation. During the tender phase, the project can be simulated in 3D. In the project engineering phase, the system takes it one step further and, through emulation, visualizes and tests the system and the entire operation at PLC level. After installation, the user will be able to monitor his complete material handling system on his own computer through 3D real-time visualizations (VanRiet, 2018).

Conclusion

Dutch companies, institutions and government agencies have taken steps towards the digitalization era. The benefits and challenges that comes with Industry 4.0 and ICT-enabled technologies are well-known and have been considered by both SMEs and large companies. The Netherlands should be considered as one of the leaders in the technological revolution and one of the pioneers in the ICT sector, however there were not a lot of research studies proving the actual implementation of these technologies, especially in the industry sectors that FAME wants to address. Micro businesses and SMEs lack, in this regard, the funding and guidance. Continued support to allow innovative ICT start-

ups to successfully scale-up - which has for example been undertaken through so-called ICT breakthrough projects - is another important element to achieving an improved integration of digital technology in the wider industry.

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