

4.4 DIGITAL FACTORY FOR SMALL- AND MEDIUM-SIZED ADVANCED TRANSPORT COMPANIES

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ABSTRACT

The project develops the concept and implementation of Industry 4.0 for small- and medium-sized companies, which is currently lacking in the industrial sector. The aim is to obtain a methodology or procedure to facilitate the conversion of medium-sized industrial manufacturing companies into “digital factory” working models, in accordance with Industry 4.0.

INTRODUCTION

One of the missions that society entrusts to the university is the transfer of knowledge. The activities in this area include finding answers to the challenges and the needs of the industry. In relation to the above, the objective of this project, called FADIN 4.0, is to help small and medium-sized enterprises (SMEs) in the advanced transport sectors (automotive, naval, aerospace) and their supply chain, machining companies, and their supplementary to integrate into the new concept of digital factory (or Industry 4.0 paradigm). All this is intended to be achieved through the development of the digital factory concept for this type of companies through the transfer of knowledge and the use of existing limited R&D infrastructures.

STATE OF THE ART

The concept of Industry 4.0 is relatively recent and refers to the Fourth Industrial Revolution, which consists of a new way of organizing the means of production and the introduction of digital technologies in the industry. The

main technological premises on which this concept is based are Internet of Things, cyber-physical systems, the “do it yourself” culture, and Factory 4.0. This includes, for example, the robotization of processes (in the Third Industrial Revolution, process automation was a general concept), the use of advanced automation strategies, advanced manufacturing, etc.

As an example of the importance of this industrial revolution, the European Commission has invested €500 million to define a series of Digital Innovation Hubs (DIH) to act as connectors and enablers for European industry to benefit from digital innovations by upgrading products and processes and adapting their business models to digital change (Moreno & García-Álvarez, 2018).

At present, many of the basic principles postulated by Industry 4.0 have yet to be implemented in practice. In the manufacturing industry, which is so conservative when it comes to introducing technological improvements in its processes, the establishment of complete connectivity of all factory equipment (Internet of Things concept) and the development of systems for capturing, processing, and mass analysis of data from this equipment to assist in decision-making (Big Data concept) are still in their infancy.

In this new paradigm, a series of “digital enablers” have been defined, which are the set of technologies that make it possible for this new industry to exploit its full potential. In effect, these allow the hybridization between the physical and digital worlds, such as linking the physical and virtual worlds to make the industry a smart industry.

On the other hand, the European Digital Agenda (Moreno & García-Álvarez, 2018) in its analysis of the industry defines the current context with key data, such as the fact that the most digitized companies are large companies (54%) compared to 17% of SMEs.

Most likely, the sectors to lead this transition will be aerospace, defense, industrial production, and automotive, where people already work alongside smart machines. However, the digitization of industry, or Industry 4.0, encompasses much more than technology. Companies must be prepared to undergo radical changes due to various factors, such as the speed of mass production, the volume and unpredictability of production, the increased fragmentation and reorientation of value chains, the importance of the customer in the production process, and the new relationships between research institutes, higher education and the private sector. All this transition is even more accentuated in SMEs, due to the fact that they neither have the appropriate means and resources nor specialized staff, and, therefore, they face a greater challenge than large companies that do have these resources, which are also specially adapted to them.

However, although the global, national, and regional industries are aware of the need to implement Industry 4.0 technologies in the market to maintain and strengthen its competitiveness, the reality is that there are still no solid solutions that integrate all the technologies of Industry 4.0, so as to respond to many of the challenges posed by the transformation of conventional factories

to the concept of smart factories. This project meets this need for the development and integration of solutions adapted to industrial SMEs through a methodology that supports these companies in their process of hybridization of the physical and digital world, developing a technological platform adapted to the needs of industrial SMEs, setting up two demonstration centers that simulate a real production environment, preserving laboratory attributes that allow modifications at the specimen level, enhancing synergies between technologies, and developing and promoting training programs for those responsible for the digital factory of industrial SMEs, since the key lies in “transformation”. This means that it is not just a matter of incorporating the latest technology but of transforming the business models of these companies through technologies.

CONTRIBUTION

The concepts of Industry 4.0, and all the technology associated with them, originate from their existence as part of a solution to a social and environmental problem. The strategic positioning of the market in the midst of digital factories is aligned with those trends that can have a more significant impact on its business, such as personalization, sustainability, or similar.

The main characteristics of the production model of Industry 4.0 or Digital Factory are flexibility, reconfigurability, and digitalization (Pallarés Martínez, 2018). However, there are two other transversal characteristics that are very relevant to the entire production model based on Industry 4.0 and are closely aligned with sustainability in its economic, social, and environmental aspects:

- People-centered model, regardless of the level of automation.
- Efficient model, ensuring maximum value while using the minimum resources necessary.

FADIN 4.0 covers these characteristics. Mainly, it stands out for being in line with the sectoral and horizontal strategies and policies of the EU. The project contributes to the objectives of the Europe 2020 Strategy to promote smart, sustainable, and inclusive growth, supporting innovation efforts and improving the competitiveness of a strategic sector for Andalusia.

The project aims to improve the current capabilities of industrial SMEs through innovations and technological developments necessary for their digital transformation. Also, it pursues synergies with other programs such as H2020, Shift2Rail, or Clean Sky, which are related to cleaner and more efficient production, with the manufacture of more sustainable and environmentally friendly components and structures. In this way, it can contribute not only to the economic development of the regions but also to the sustainability of

the manufacturing sector associated with advanced transport, as well as to the conservation of resources.

Moreover, FADIN 4.0 and its actions are aimed at enhancing innovation in line with the flagship initiative “Resource Efficient Europe” (European Commission, 2011), which supports the transition to an efficient and low-carbon economy for sustainable growth. Thanks to the implementation of technologies related to Industry 4.0 or Smart Manufacturing, processes will be carried out in a more efficient way, reducing waste production and minimizing raw material consumption. Innovation in this manufacturing sector associated with advanced transport (automotive, naval, aeronautics) directly generates great economic opportunities and improved productivity, reducing costs and increasing the competitiveness of industrial SMEs in the cross-border regions of Andalusia and the European Union.

The project tends to improve investment and innovation security for industrial SMEs and to ensure that all policies take into account resource efficiency in a balanced way. Also, it is planned to contribute, through innovation in industrial SMEs, to the improvement of capacities of Andalusian important transport companies, as well as to enhance employability and economic and social sustainability of areas where there is a high risk of depopulation.

The feasibility of the project is based on the cooperation between companies and research organizations, as well as the training and implementation of innovations from research centers applied to the needs of the market. Therefore, based on the future own resources of the project partners, the results obtained by FADIN 4.0 are planned to be sustainable in the future from the quadruple perspective of research, training, development of improved protocols, and creation of business services.

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WORKS CITED

- European Commission. (2011). Roadmap to a resource efficient Europe. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0571&from=EN>
- Moreno, B., & García-Álvarez, M. T. (2018). Measuring the progress towards a resource-efficient European Union under the Europe 2020 strategy. *Journal of Cleaner Production*, 170(1), 991–1005.
- Pallarés Martínez, V. (2018). *Implementación de la Industria 4.0 en PYMES del Sector Productivo*. Universitat Politècnica de València. [Master Thesis] <http://hdl.handle.net/10251/142963>