
# EXTENDED ABSTRACT

**Title: An industry perspective on digital transformation in European Union**

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**Abstract:** *(minimum1500 words)*

During and after the COVID-19 pandemic, digital technologies have become essential in multiple social and economic contexts. Their role has also exposed the weaknesses, vulnerabilities and high-risk dependencies of the digital space. In this context, European Union has stepped up to empower businesses and people in a human-centred, sustainable and more prosperous digital future. For the next years, European Union (EU) pursuits an own digital transformation for achieving a fair and competitive economy, an open, democratic and sustainable society and a technology for people's daily lives (European Commission, 2020). Recently, on 9 March 2021, the European Commission presented a vision for Europe's digital transformation by 2030 through its communication Digital Compass that evolves around skills, business, digitalization of public services and secure and sustainable infrastructures (European Commission, 2021a). The called "Path to the Digital Decade" sets out the concrete digital targets of EU by the end of the decade. To facilitate the digital transition, the European Commission devotes EU funds including 20% percentage of the Recovery and Resilience Facility each EU country (European Commission, 2021b).

One of the targets is the digital transformation of businesses. As part of the Digital Compass, by 2030 this target points out to: (i) 75% of European enterprises have taken up cloud computing services, big data, and artificial intelligence (AI), (ii) more than 90% of SMES have reached, at least, basic level of digital intensity, (iii) the number of European unicorns has doubled.

The process of business digitalisation can be considered as a technology shock with impacts in the main economic aggregates and competitiveness. Digital technologies transform the ways in which firms do business and relate with their customers and suppliers. Since the COVID-19 pandemic, the digitalisation has become a decisive tool to improve the economic resilience of businesses. However, in 2020, only 1% of EU enterprises with at least 10 persons employed presented a very high level of digital intensity while 14% got a high level. The mainstream of enterprises recorded levels low (46%) or very low (39%) (Eurostat, 2021).

Nevertheless, the digital transformation *per se* will not have the expected positive impacts unless it is accompanied by changes in the strategy, business model, organization or culture of the companies. Even though digital technologies have the potential to have a strong positive impact on firm productivity, they endure unevenly implemented across countries and industries (See Bajgar et al., 2019 for an overview of the unveil distribution of the impacts of digitalization in several dimensions as firm productivity growth, business dynamism, industrial concentration, among others). Understanding digital transformation and the channels through which it influences is increasingly relevant. Moreover, digital transformation has received growing attention, with a wide range of topics investigated in the literature (Ismail, Khater and Zaki, 2017). From the industry perspective, the disruptive nature of digital technologies has altered the mode that industries operate changing the way in which production is organised and managed. The take-up of digital technologies and the main obstacles to the adoption of such technologies are different between industries.

This paper presents a novel perspective on the analysis of the impacts of digital transformation of industries. Using the information provided by input–output tables for the European Union and on the basis on some important coefficients, we identify the key sectoral structure by digital intensity. The technical coefficients matrix of an input-output table represents the productive structure of an economy. The technological change supposes a variation in these coefficients. The important coefficients will be those whose modification causes deepen changes in the relevant variables of the economic system.

With this aim, a taxonomy of digital intensity by sectors according to the extent to which they have gone digital is employed (Calvino et al., 2018). The taxonomy considers the development and adoption of the digital technologies not only in the instruments to deal with clients and suppliers but in the in human capital required in the production. The classification of 36 ISIC revision 4 sectors by digital intensity is based on the following indicators: share of ICT tangible and intangible investment; share of purchases of intermediate ICT goods and services; stock of robots per hundreds of employees; share of ICT specialists in total employment; and the share of turnover from online sales).

The use of Input-Output analysis to investigate the impacts generated by the different digital intensity sector is a valuable instrument. The production, the forward and backward linkages are mechanism of technological diffusion in an economy. The study of inter-industrial relationships through technical coefficients provides basic information about technological change. Many innovation studies have then relied on input–output (IO) analysis (see the pioneering works of Terleckyj, 1974, Scherer, 1982, among others). Several papers have approached the economic linkages of the information and communication technologies (ICT) sector using IO tables (Heng &

Mugan, 2013, García-Muñiz and Vicente, 2014, Li et al., 2019, among others) but not at a holistic view of the digital intensity transformation of the sectors.

In the IO model, it is possible to simulate the effects of a final demand change, while technical coefficients are fixed. However, this is one of the major criticisms in the use of input-output models. Its inability to handle technological change in coefficients induced by, among others, innovations. Consideration to modification in coefficients in input-output models has been directed to the issue of the effect of error or changes in individual coefficients on the elements of the associated Leontief inverse matrix (Evans, 1954; Simonovits, 1975; Lahiri and Satchell, 1986). Alternatively, coefficient stability and the effect of coefficient change induced by technology, changing markets, structural change and the general effects of economic growth and development are other issues that can be considered. According to the assumptions of the IO model, as long as prices remain fixed, producers have no incentive to modify the chosen technology and, therefore, the technical coefficient and inverse Leontief coefficient matrices, remain constant. Thus, the economy dynamic is explained by the variations of final demand.

If, on the other hand, it is assumed that final demand remains constant, but some technical coefficient changes, some elements of inverse of Leontief will vary in different proportions due to the complexity of the productive structure, as well as the production vector will change.

Schinkte and Stäglin (1988) propose to simulate the effect on change in technical coefficients given the final demand. Although technical coefficients will support a uniform change, the impact in the production will be different due to indirect paths of connection between sectors. This sensibility analysis allows to identify the important coefficients. A coefficient will be more important if the changes in production are higher in at least one sector. That is, the coefficients that with a small change in their levels has a large impact on the production. This hypothesis makes it possible to classify the set of coefficients according to their potential effects on the economic system (Aroche Reyes, 1996, García-Muñiz, Aroche-Reyes and Carvajal, 2007). The obtained important coefficients are analysed employing graph theoretical techniques for evaluating the complexity of the structure. Empirical results are discussed in terms of the possible implications of the state of the sector digitalisation for getting a competitive economy.

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