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DIGITALLY INTENSIVE SECTORS IN THE EUROPEAN UNION ECONOMY: STRUCTURAL PATTERNS OF VALUE CREATION AND EMPLOYMENT

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Abstract

This article examines the structural patterns of digitally intensive sectors in the European Union (EU) between 2005 and 2023. Using Organization for Economic Co-operation and Development (OECD) secondary data, the study analyzes changes in the shares of gross value added and employment across sectors classified according to the digital-intensity taxonomy. Structural dynamics are quantified using the Structural Change Index (SCI). The results show that changes in the sectoral distribution of value creation were limited, while employment shifts were more pronounced. Digital transformation, therefore, appears to occur primarily through adjustments within sectors rather than through major structural restructuring.

Keywords

Digital economy; Digital transformation; Labor market; Sectoral dynamics; Structural Change Index.

Introduction

Digital technologies increasingly shape how modern economies create value and organize production. Their diffusion affects business processes, communication systems, and labor allocation across industries (Duarte & Carvalho, 2024; Pinar & Karahsan, 2026). As a result, digital technologies influence not only firm-level performance but also the broader sectoral composition of economic activity. In advanced economies, these technologies are becoming embedded across a wide range of industries, from manufacturing to knowledge-intensive services, thereby contributing to long-term structural transformation (Hernández de Rojas et al., 2024; OECD, 2024). In academic literature, these developments are commonly discussed under the concept of digital transformation. This concept refers to the gradual integration of digital technologies into organizational processes and economic activities, ultimately leading to broader changes in production structures and economic organization (Verhoef et al., 2021; Vial, 2019). Empirical research has examined various consequences of this transformation, including productivity growth, technological innovation, and changes in business models (Li et al., 2018; Nadkarni & Prügl, 2020). Nevertheless, most of this research focuses on firm-level dynamics and technology adoption within individual organizations.

While such studies provide valuable insights into the microeconomic mechanisms of digital transformation, they offer only limited evidence on the broader structural implications of digital technologies at the sectoral or macroeconomic level. In particular, relatively little attention has been devoted to understanding how digitally intensive sectors contribute to the overall

distribution of economic activity and employment within national or regional economies. Existing studies, such as Nucci et al. (2023) and Fernández-Portillo et al. (2020), often focus either on the performance of the Information and Communication Technologies (ICT) sector itself or on firm-level digital adoption, leaving the structural role of digitally intensive sectors within the wider economy insufficiently explored. To address this limitation, the concept of digital intensity provides a useful analytical framework. Developed by the OECD, this taxonomy classifies industries according to the extent to which digital technologies are embedded in their production processes, investment structures, and occupational composition (Calvino et al., 2018; OECD, 2019). By moving beyond a narrow focus on the ICT sector, the concept of digital intensity captures the broader diffusion of digital technologies across economic activities. This perspective enables examining digital transformation as a cross-sectoral phenomenon rather than a development limited to technology-producing industries. Despite this taxonomy, empirical evidence on how digitally intensive sectors shape the structural composition of economic activity remains underexplored. There is a lack of macroeconomic studies examining whether sectoral digital intensity is associated with observable changes in the distribution of value creation or employment across sectors. Understanding these relationships is important, as structural change plays a central role in long-term economic development and competitiveness (Rabadán-Pérez & Muñoz-Céspedes, 2026).

The EU represents a particularly relevant context for such analysis. Digital transformation has become a strategic priority of EU economic policy, reflected in initiatives such as the Digital Single Market and the Digital Decade strategy (European Commission, 2021). These policy frameworks explicitly aim to accelerate the diffusion of technologies across industries and to strengthen the role of digital capabilities within the European economy. Nevertheless, despite the growing literature on digitalization, most studies focus on firm-level digital adoption or the ICT sector itself, while macro-level evidence on the structural role remains underexplored. This article, therefore, contributes to the literature by providing a macro-structural analysis of digitally intensive sectors in the EU and by quantifying a structural change in the value creation and employment using the Structural Change Index (SCI). By combining structural analysis with the OECD digital intensity taxonomy, this study offers novel empirical evidence on how digital technologies relate to the evolving sectoral structure of the EU economy.

This article is structured as follows. Section 1 discusses digital transformation and structural economic change, with emphasis on digital intensity. Section 2 describes the data sources and analytical approach. Section 3 presents the sectoral distribution of gross value added and employment, structural dynamics, and the relationship between digital intensity and sectoral development. Section 4 interprets the findings and is followed by the Conclusion section with concluding remarks and directions for future research.

1 Literature Review

The diffusion of digital technologies has stimulated extensive academic interest in the economic consequences of digital transformation. In general terms, digital transformation refers to the integration of digital technologies into organizational processes, production systems, and economic activities, leading to broader changes in economic structures (Verhoef et al., 2021; Vial, 2019).

In literature, a distinction is often made between digital transformation, digitalization, and digitization. Verhoef et al. (2021) define digital transformation as a comprehensive change driven by the strategic use of digital technologies, leading to the emergence of new business models and novel ways of creating value. Pagani & Pardo (2017) further argue that this transformation involves reconfiguring value-creation mechanisms and implementing new business logic within firms and industries. In contrast, digitalization refers to the use of digital

technologies to modify or improve existing processes and interactions, such as communication, production, or distribution (Verhoef et al., 2021). At a more fundamental level, digitization describes the technical conversion of analog information into digital form, enabling data to be stored, processed, and transmitted through digital systems (Dougherty & Dunne, 2012). These concepts can therefore be viewed as sequential stages of technological change, where digitization provides the technological foundation for digitalization, which in turn enables broader processes of digital transformation.

While early research primarily examined digital technologies from a firm-level perspective, more recent studies increasingly emphasize their macroeconomic and structural implications. One important stream of literature focuses on the relationship between digital transformation and economic performance. Empirical studies show that digital technologies enhance productivity, innovation capacity, and overall firm performance (Nucci et al., 2023). Similarly, recent research highlights the role of digital transformation in shaping innovation systems and economic competitiveness, particularly within advanced economies (Duarte & Carvalho, 2024). Nonetheless, much of the literature remains focused on microeconomic outcomes, such as firm productivity or technology adoption, while providing relatively little insight into how digitalization influences the broader sectoral composition of economic activity. Another strand of research examines the relationship between digital transformation and structural economic changes. Digital technologies influence the sectoral structure of economies by facilitating the expansion of knowledge-intensive services, digitally enabled business models, and new forms of economic organization. Zhang et al. (2024) suggest that digital transformation often reinforces existing structural trends rather than generating entirely new sectors of economic activity. In this perspective, digital technologies are often conceptualized as enabling or general-purpose technologies that enhance productivity and capabilities across a wide range of industries rather than affecting only a limited set of sectors.

Within this debate, the concept of digital intensity has emerged as an important analytical framework. Developed by the OECD, the taxonomy of digital-intensive sectors classifies industries according to indicators such as ICT investment, digital skills, and the use of digital technologies in production processes (Calvino et al., 2018; OECD, 2019). This framework allows researchers to capture the diffusion of digital technologies across the entire economy and to analyze digital transformation as a cross-sectoral phenomenon rather than as a development limited to the ICT sector. Despite these advances, the literature offers different perspectives on the structural consequences of digital transformation. Some studies, such as Hernández de Rojas et al. (2024) and Bi et al. (2025), argue that digital transformation accelerates structural change by supporting the expansion of digital and knowledge-intensive sectors. Other research suggests that technological change primarily unfolds within existing sectors through productivity improvements and organizational adaptation, leading to relatively gradual structural adjustments (Matthess & Kunkel, 2020; Sojková, 2019). These differing interpretations indicate that the relationship between digital transformation and sectoral structural dynamics remains an open empirical question.

2 Methodology

Against the aforementioned background, this article examines the structural patterns of digitally intensive sectors in the EU and assesses how sectoral digital intensity relates to changes in value creation and employment. To address this objective, the study formulates the following research questions (RQ):

RQ1: How is economic activity distributed across sectors in the EU in terms of gross value added and employment, and how has this structure evolved between 2005 and 2023?

RQ2: What is the magnitude of structural change in the sectoral distribution of value creation and employment during the observed period?

RQ3: Is sectoral digital intensity associated with observable changes in sectoral shares of gross value added and employment?

The empirical analysis consists of several steps. First, the sectoral distribution of gross value added and employment was examined to determine the overall structure of the EU economy. Second, changes in sectoral shares between 2005 and 2023 were calculated to identify heterogeneous patterns of sectoral development. Third, the SCI was applied to quantify the magnitude of structural shifts. Finally, the relationship between digital intensity and sectoral dynamics was explored using scatter plots comparing digital intensity categories with changes in sectoral shares. For visualization purposes, the digital intensity quartiles were coded numerically from 1 (low) to 4 (high), and a small random displacement (jitter) was applied to prevent overlapping observations.

To implement this analytical approach, the study used secondary data from the OECD, which provides gross value added and employment by economic activity. The analysis focused on the EU-27 aggregate, for which the OECD publishes retrospectively harmonized data. This ensures international comparability and avoids structural breaks arising from the United Kingdom's withdrawal in 2020, allowing a consistent examination of structural developments in the EU economy over the observed period. Since the original dataset is reported according to the ISIC Rev. 4 classification, a correspondence mapping was applied to align the data with the NACE Rev. 2 classification used in the EU. The mapping employed is presented in Table 1. The study was conducted at the one-digit NACE level (A–S), which provides an overview of the EU economy's sectoral structure while preserving comparability across sectors.

Tab. 1 *Sectoral classification of digital intensity based on ISIC Rev. 4 and NACE Rev. 2*

Sector (ISIC Rev. 4)	Quartile of digital intensity	NACE Rev. 2
Agriculture, forestry, fishing	Low	A
Mining and quarrying	Low	B
Food products, beverages, and tobacco	Low	C
Textiles, wearing apparel, leather	Medium-low	C
Wood and paper products, and printing	Medium-high	C
Coke and refined petroleum products	Medium-low	C
Chemicals and chemical products	Medium-low	C
Pharmaceutical products	Medium-low	C
Rubber and plastics products	Medium-low	C
Basic metals and fabricated metal products	Medium-low	C
Computer, electronic, optical products	Medium-high	C
Electrical equipment	Medium-high	C
Machinery and equipment n.e.c.	Medium-high	C
Transport equipment	High	C
Furniture; other manufacturing; repairs	Medium-high	C
Electricity, gas, steam, and air conditioning supply	Low	D
Water supply; sewerage, waste management	Low	E
Construction	Low	F
Wholesale and retail trade, repair	Medium-high	G
Transportation and storage	Low	H
Accommodation and food service activities	Low	I
Publishing, audiovisual, and broadcasting	Medium-high	J

Sector (ISIC Rev. 4)	Quartile of digital intensity	NACE Rev. 2
Telecommunications	High	J
IT and other information services	High	J
Finance and insurance	High	K
Real estate	Low	L
Legal and accounting activities, etc.	High	M
Scientific research and development	High	M
Advertising and other business services	High	M
Administrative and support service	High	N
Public administration and defense	Medium-high	O
Education	Medium-low	P
Human health activities	Medium-low	Q
Residential care and social work activities	Medium-low	Q
Arts, entertainment, and recreation	Medium-high	R
Other service activities	High	S

Note: the sectors are ordered according to the NACE Rev. 2 classification.
Source: Own using (Eurostat, 2025; OECD, 2019)

Furthermore, the empirical investigation applied descriptive structural analysis of sectoral economic activity. The structural position of sectors in the EU economy was evaluated using gross value added and employment. Together, these indicators allow the examination of both the production and labor dimensions. To enable comparisons across sectors and over time the analysis was based on sectoral shares calculated by Equation (1)

$$S_{i,t} = \frac{X_{i,t}}{\sum_{i=1}^{n} X_{i,t}}, \quad (1)$$

where $X_{i,t}$ represents the value of the selected indicator for sector i in the year t, and n denotes the number of sectors included in the analysis.

The observation period covered the years 2005–2023. To capture long-term structural developments while limiting the influence of short-term economic fluctuations, the benchmark years of 2005, 2010, 2015, 2020, and 2023 were used. The year 2005 served as the baseline year for the analysis, while subsequent benchmark years allowed for the observation of gradual structural developments over nearly two decades. The year 2023 was used as the endpoint, since data for successive years were not yet available at the time of the study. Such benchmark-year approaches are commonly applied in structural economic analyses to highlight long-term trends while reducing the influence of short-term cyclical fluctuations (Curzio & Scazzieri, 2026; OECD, 2025c).

As a next step, in order to quantify structural dynamics in the EU economy, the analysis also employed the SCI. This indicator measures the magnitude of shifts in sectoral shares between two periods (2005 and 2023) and therefore captures the extent of structural reallocation across sectors. The index was calculated by Equation (2)

$$SCI = \frac{1}{2}\sum_{i=1}^{n}|\Delta S_i| = \frac{1}{2}\sum_{i=1}^{n}\left|S_{i,t} - S_{i,t-1}\right| \quad (2)$$

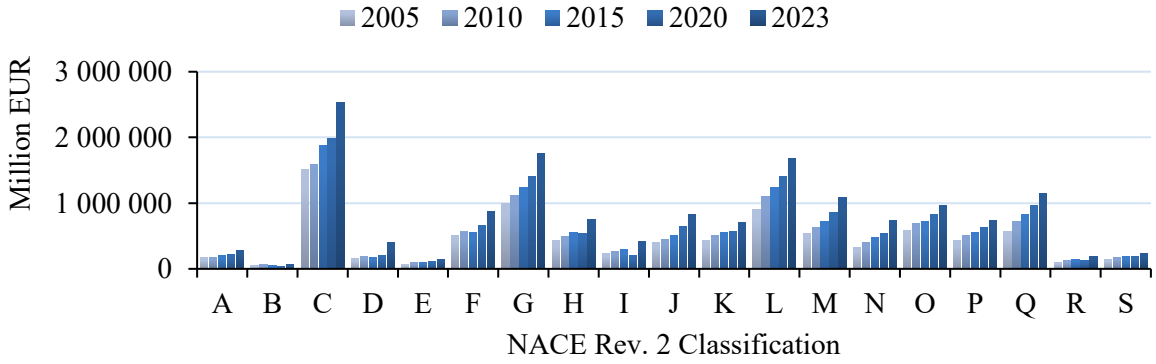
where $S_{i,t}$ denotes the share of sector i in total economic activity in year t.

The division by two corrects for double-counting, since an increase in the share of one sector necessarily corresponds to a decrease in the share of another sector. The resulting value,

therefore, represents the proportion of economic activity that has been reallocated across sectors between the two periods.

3 Results

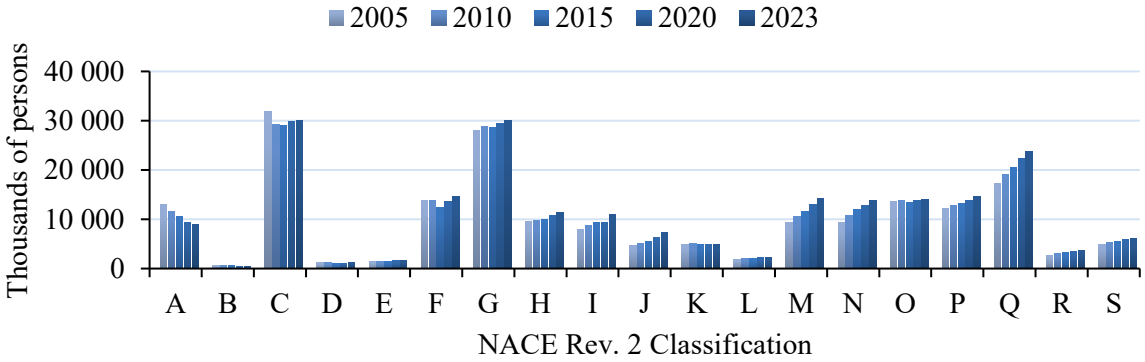
Figure 1 presents the distribution of gross value added across NACE sectors in the EU between 2005 and 2023. Manufacturing (C) remained the largest contributor throughout the observed period, increasing from approximately EUR 1.59 trillion in 2005 to EUR 2.54 trillion in 2023. Several service sectors also represent major sources of value creation, particularly wholesale and retail trade (G), real estate activities (L), and professional, scientific, and technical activities (M), all of which recorded substantial growth over time. However, primary sectors such as agriculture, forestry, and fishing (A) and mining and quarrying (B) remained relatively small contributors to total gross value added.



Source: Own using (OECD, 2025a)

Fig. 1: *Gross value added by NACE Rev. 2 sector in the EU economy (2005–2023 in current prices)*

In addition, Figure 2 illustrates the distribution of employment across NACE sectors in the EU between 2005 and 2023. The largest employers observed include wholesale and retail trade (G) and manufacturing (C), which employed approximately 30 million persons each in 2023. Human health and social work activities (Q) also constituted a major source of employment, accounting for more than 23 million workers in 2023. Additional large employers included education (P) and construction (F), each employing around 14 million persons. Conversely, sectors such as mining and quarrying (B) and electricity and gas supply (D) accounted for only a small proportion of total employment.



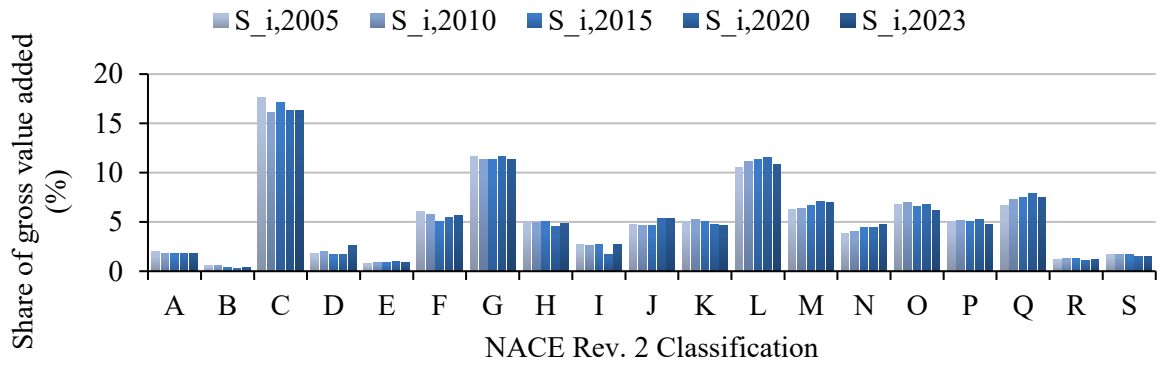
Source: Own using (OECD, 2025b)

Fig. 2: *Employment by NACE Rev. 2 sector in the EU economy (2005–2023)*

The findings reflect the typical structure of advanced economies, in which manufacturing and service sectors dominate both value creation and employment. At the same time, primary and capital-intensive industries play a limited role.

3.1 Sectoral Structure of Gross Value Added

The sectoral distribution of gross value added, illustrated in Figure 3, indicates that the overall structure of the EU economy remained relatively stable over the observed period. Although several sectors experienced moderate changes in their relative importance, the general composition of economic activity did not undergo major structural shifts between 2005 and 2023.



Source: Own using (OECD, 2025a)

Fig. 3: *Sectoral composition of gross value added in the EU economy (2005–2023)*

As can be observed in Figure 3, manufacturing (C) remains the largest contributor to gross value added throughout the entire period. Its share declined moderately from 17.67% in 2005 to 16.31% in 2023, indicating a gradual reduction in its relative weight rather than a fundamental structural transformation. Despite this decline, manufacturing remains the dominant sector of the EU economy. Moreover, several knowledge-intensive service sectors expanded their contribution to value creation. Professional, scientific, and technical activities (M) increased from 6.24% to 7.02%, while administrative and support services activities (N) rose from 3.78% to 4.71%. These developments point to a gradual strengthening of business-oriented services within the EU's economic structure. A similar upward trajectory is visible in information and communication activities (J), whose share rose from 4.77% to 5.31%. This development reflects the growing economic relevance of digital infrastructure, communication services, and information technologies. Human health and social work activities (Q) also experienced sustained growth, rising from 6.71% to 7.44%, which likely reflects demographic trends and increasing demand for healthcare services. By contrast, several sectors experienced a gradual decline in their relative importance. Mining and quarrying (B) recorded the most pronounced contraction, with its share falling from 0.57% to 0.38%. Construction (F) and financial and insurance activities (K) also displayed a moderate decrease, indicating a slight reduction in their contribution to total value added over the observed period. Other sectors remained comparatively stable. Wholesale and retail trade (G), one of the largest sectors of the EU economy, maintained a share close to 11% throughout the period. Similarly, public administration (O) and education (P) exhibited only limited fluctuations, suggesting a relatively stable role of public services within the economic structure.

3.2 Structural Change in the Sectoral Distribution of Gross Value Added

The aforementioned sectoral shares were further used to derive changes in the distribution of gross value added between 2005 and 2023. The resulting changes in sectoral shares are reported in Table 2.

Tab. 2 *Sectoral changes in gross value added shares in the EU economy (2005–2023)*

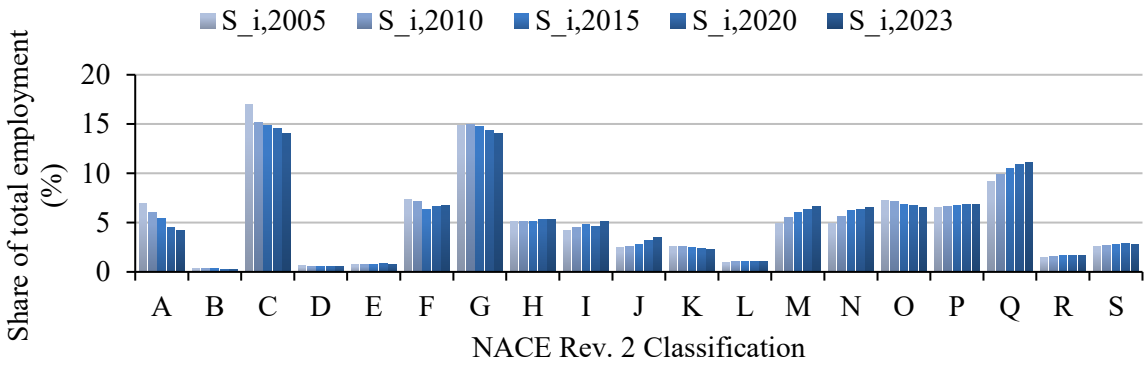
NACE Rev. 2	$S_{i,2005}$	$S_{i,2023}$	ΔS_i	$\lvert\Delta S_i\rvert$
A	1.96	1.81	–0.15	0.15
B	0.57	0.38	–0.19	0.19
C	17.67	16.31	–1.36	1.36
D	1.76	2.56	–0.80	0.80
E	0.83	0.94	0.11	0.11
F	6.02	5.63	–0.39	0.39
G	11.66	11.30	–0.36	0.36
H	4.97	4.80	–0.17	0.17
I	2.71	2.71	0.00	0.00
J	4.77	5.31	0.54	0.54
K	5.05	4.59	–0.46	0.46
L	10.55	10.81	0.26	0.26
M	6.24	7.02	0.78	0.78
N	3.78	4.71	0.93	0.93
O	6.78	6.20	–0.58	0.58
P	5.03	4.77	–0.26	0.26
Q	6.71	7.44	0.73	0.73
R	1.20	1.22	0.02	0.02
S	1.74	1.49	–0.25	0.25

Source: Own using (OECD, 2025a)

The calculated SCI for gross value added reached 4.17, indicating that only a limited proportion of economic activity was reallocated across sectors during the observed period. Most sectors, therefore, maintained relatively stable positions within the value-creation structure. Despite the relatively small magnitude of structural change, sectoral developments were heterogeneous. The largest increase occurred in administrative and support service activities (N), professional, scientific and technical activities (M), and human health and social work activities (Q). At the same time, the most pronounced decline was recorded in manufacturing (C). These findings indicate a gradual strengthening of service-oriented and knowledge-intensive activities rather than a major restructuring of the sectoral distribution of value creation within the EU economy.

3.3 Sectoral Structure of Employment

The sectoral allocation of employment shown in Figure 4 suggests that the overall structure of the EU labor market evolved gradually over the observed period. Although several sectors experienced noticeable changes in their employment shares, the overall employment composition remained relatively stable between 2005 and 2023.



Source: Own using (OECD, 2025b)

Fig. 4: *Sectoral composition of total employment in the EU economy (2005–2023)*

As illustrated in Figure 4, manufacturing (C) remained the largest employer in the EU economy throughout the observed period, despite a gradual decline in its employment share from 16.94% in 2005 to 14.06% in 2023. A similar downward pattern was observed in agriculture, forestry, and fishing (A), whose share decreased substantially from 6.89% to 4.19%, reflecting the long-term decline of primary-sector employment in advanced economies. At the same time, several service sectors experienced steady increases in their employment shares. The largest increase occurred in human health and social work activities (Q), where the employment share rose from 9.16% to 11.11%, making it one of the largest employment sectors in the EU economy by the end of the observed period. This development reflects demographic trends, increasing demand for healthcare services, and the expansion of welfare-related activities. A comparable upward trend can be observed in professional, scientific, and technical activities (M) and administrative and support service activities (N). Employment in these sectors rose from 4.93% to 6.64% and from 4.96% to 6.49%, respectively. These developments indicate a growing role for business-oriented, knowledge-intensive services in the EU labor market. Information and communication activities (J) also recorded a noticeable expansion, with their employment share rising from 2.50% to 3.46%, reflecting the increasing importance of digital and information-based activities. In addition, other service sectors experienced moderate but consistent growth. Employment in accommodation and food services (I) increased from 4.19% to 5.09%, while arts, entertainment, and recreation (R) and other service activities (S) recorded smaller but steady increases. These trends highlight the gradual expansion of consumer-oriented services within the EU.

On the other hand, several sectors experienced modest declines in their employment shares. Financial and insurance activities (K) decreased slightly from 2.56% to 2.29%, while public administration (O) fell from 7.25% to 6.53%. Some sectors, such as wholesale and retail (G) and transportation and storage (H), remained relatively stable over the period, maintaining similar shares of total employment. This relative stability reflects their fundamental role in the distribution and logistics of goods and services, which generates persistent labor demand across economic cycles.

3.4 Structural Change in the Sectoral Distribution of Employment

The aforementioned sectoral shares of employment were further used to determine changes in the distribution of employment between 2005 and 2023. The resulting changes are reported in Table 3.

Tab. 3 *Sectoral changes in employment shares in the EU economy (2005–2023)*

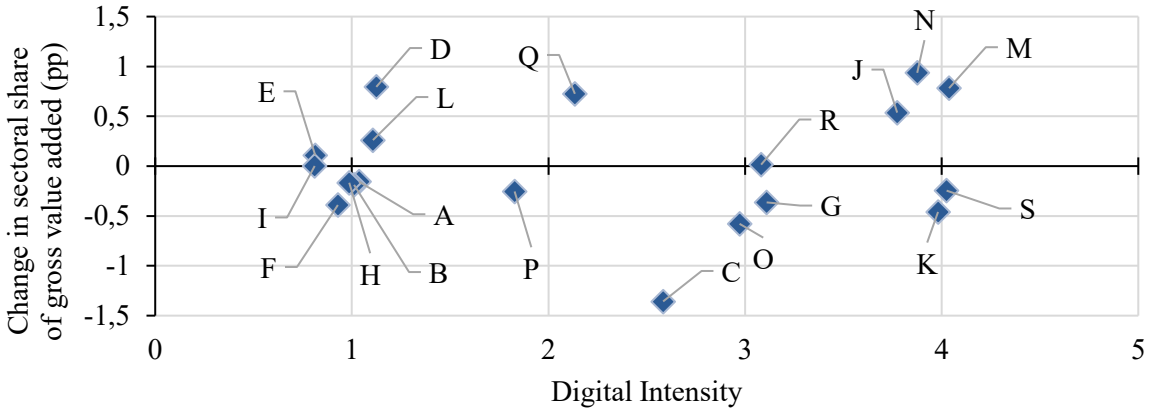
NACE Rev. 2	$S_{i,2005}$	$S_{i,2023}$	ΔS_i	$\lvert\Delta S_i\rvert$
A	6.89	4.19	–2.70	2.70
B	0.37	0.21	–0.16	0.16
C	16.94	14.06	–2.88	2.88
D	0.63	0.56	–0.07	0.07
E	0.72	0.80	0.08	0.08
F	7.37	6.78	–0.59	0.59
G	14.86	14.04	–0.82	0.82
H	5.09	5.30	0.21	0.21
I	4.19	5.09	0.90	0.90
J	2.50	3.46	0.96	0.96
K	2.56	2.29	–0.27	0.27
L	1.00	1.09	0.09	0.09
M	4.93	6.64	1.71	1.71
N	4.96	6.49	1.53	1.53
O	7.25	6.53	–0.72	0.72
P	6.51	6.85	0.34	0.34
Q	9.16	11.11	1.95	1.95
R	1.45	1.71	0.26	0.26
S	2.59	2.82	0.23	0.23

Source: Own using (OECD, 2025b)

The calculated SCI for employment reached 8.21 suggesting a more substantial reallocation of labor across sectors compared to the changes observed in value creation. This indicates that structural adjustments in the EU economy were reflected more strongly in the distribution of employment than in the distribution of gross value added. Despite the moderate magnitude of overall structural change, sectoral developments revealed clear heterogeneity. The largest increases in employment shares occurred in human health and social work activities (Q), professional, scientific and technical activities (M), and administrative and support service activities (N). These sectors are closely associated with service provision and knowledge-intensive activities, highlighting the growing importance of service-oriented employment within the EU labor market. Conversely, the most significant declines were recorded in manufacturing (C) and agriculture, forestry, and fishing (A) reflecting the long-term reduction of employment in traditional production sectors. These patterns indicate a gradual reallocation of labor toward service-based activities, consistent with the broader structural transformation observed in advanced economies.

3.5 Digital Intensity and Sectoral Dynamics

Figure 5 presents the relationship between sectoral digital intensity and changes in sectoral shares of gross value added between 2005 and 2023. The distribution of observations revealed a heterogeneous pattern across sectors, suggesting that digital intensity alone does not systematically explain changes in sectoral contributions to value creation.

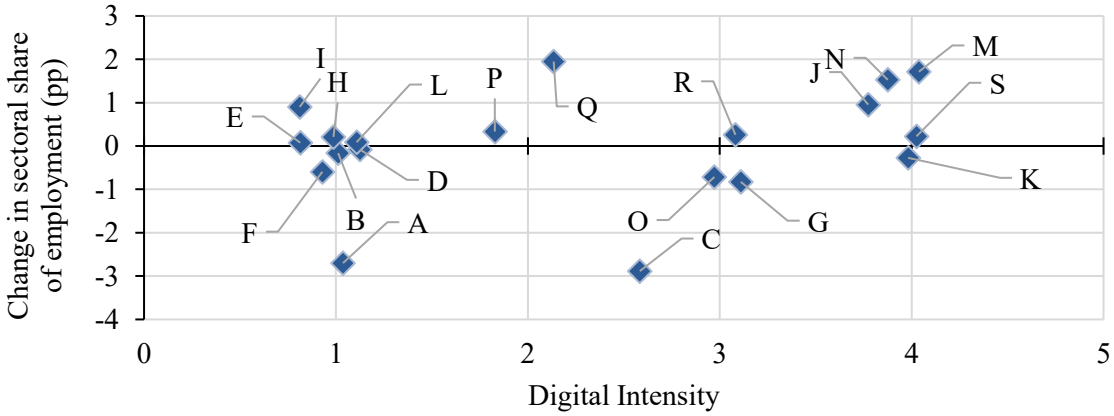


Source: Own using (OECD, 2025a)

Fig. 5: *Digital intensity and changes in sectoral shares of gross value added in the EU economy (2005–2023)*

Several digitally intensive sectors recorded positive changes in their shares of gross value added. In particular, administrative and support service activities (N), professional, scientific and technical activities (M), and information and communication activities (J) experienced noticeable increases. These trends reflect the growing role of certain knowledge-intensive services within the EU. However, this pattern is not uniform across all digitally intensive activities. Financial and insurance activities (K) and other service activities (S), despite their high digital intensity, recorded declines in their sectoral shares of gross value added. This indicates that the relationship between digital intensity and sectoral value creation is not linear and depends on additional sector-specific factors. Among sectors with lower digital intensity, the most substantial decline was observed in manufacturing (C) which recorded the largest negative change in gross value added share. The empirical evidence, therefore, points to heterogeneous sectoral dynamics as the primary driver of changes in value creation, while digital intensity appears to play only a limited explanatory role.

The same analytical framework can be applied to examine the relationship between digital intensity and changes in sectoral employment shares. The results are presented in Figure 6. The analysis revealed a clearer structural pattern than in the case of gross value added.



Source: Own using (OECD, 2025b)

Fig. 6: *Digital intensity and changes in sectoral shares of employment in the EU economy (2005–2023)*

Sectors with higher levels of digital intensity are generally associated with positive changes in employment shares. This pattern is particularly visible in professional, scientific, and technical activities (M), administrative and support service activities (N), and information and communication activities (J), which recorded some of the strongest employment growth over the observed period. Positive dynamics were also observed in arts, entertainment, and recreation (R) and human health and social work activities (Q). By contrast, sectors characterized by lower levels of digital intensity tend to exhibit declining employment shares. The most substantial reductions in employment shares occurred in agriculture, forestry, and fishing (A) and manufacturing (C), both traditional production sectors. These patterns suggest a gradual reallocation of labor toward service sectors with higher digital and knowledge intensity. The findings also indicate that digital intensity appears more closely associated with employment dynamics than with changes in the shares of gross value added.

4 Discussion

The findings of this research provide new evidence on the relationship between sectoral digital intensity and structural dynamics in the EU economy and answer the research questions (RQ) formulated in section 2.

Regarding RQ1, the analysis revealed that changes in the sectoral distribution of gross value added were relatively limited, while employment shifts were more pronounced over the observed period.

Concerning RQ2, the SCI indicated that only a small proportion of economic activity was reallocated between sectors. This suggests that major structural shifts in the sectoral composition of value creation have not accompanied digital transformation. This result is consistent with research arguing that technological change often occurs within existing sectors rather than through rapid reallocation across industries. Zhang et al. (2024) and Matthess & Kunkel (2020) emphasize that structural change in advanced economies tends to be gradual. New technologies often improve productivity and production processes within sectors without fundamentally altering the overall sectoral structure. The results of this study support this interpretation. Digital technologies are integrated into a wide range of economic activities rather than driving the expansion of a small number of sectors.

In response to RQ3, the analysis revealed that the relationship between digital intensity and sectoral dynamics is not uniform. Some sectors with relatively higher digital intensity increased their shares of gross value added, while others did not. This suggests that digital intensity alone does not determine sectoral growth. Previous studies report similar findings. For instance, David et al. (2025) and Nucci et al. (2023) argue that the economic effects of technologies depend on complementary factors such as organizational capabilities, innovation systems, and institutional conditions. Sectoral performance, therefore, reflects a combination of technological and structural factors. On the other hand, a clearer pattern was observed in the case of employment. The results indicated a gradual shift of employment toward sectors with higher digital and knowledge intensity. This trend aligns with previous research on the labor-market effects of digitalization. Studies by Acemoglu and Restrepo (2020) and Charles et al. (2020) show that digital technologies tend to change the structure of labor demand rather than reduce overall employment (Sojková, 2019). Digitalization increases the importance of occupations that require analytical, technological, and knowledge-based skills. The observed growth of employment in professional, administrative, and information-related services is consistent with this pattern.

The results suggest that digital transformation in the EU should not be interpreted as a process of rapid sectoral restructuring. Instead, it appears to be associated with gradual adjustments

within existing sectors (Matthess & Kunkel, 2020). Digital technologies function primarily as enabling tools that enhance productivity and organizational practices across a wide range of industries. As a consequence, structural change occurs slowly and is reflected mainly in the expansion of knowledge-intensive and service-oriented activities rather than in the emergence of entirely new sectors. At the same time, the findings indicate that digital transformation may have stronger implications for labor reallocation than for the distribution of economic output. Employment growth is concentrated in sectors with higher levels of digital intensity, suggesting a gradual shift of labor toward activities requiring more advanced analytical and digital skills. This pattern is consistent with the broader literature on skill-biased technological change, which emphasizes that technologies tend to modify the composition of labor demand rather than fundamentally alter the structure of economic output in advanced economies (Acemoglu & Restrepo, 2020; Autor et al., 2003).

Several limitations of this study should be acknowledged. First, the analysis relied on aggregated EU-27 data. This approach allows a consistent macroeconomic perspective but does not capture heterogeneity across individual member states. The level of digitalization, industrial structure, and labor market dynamics differ considerably across EU member states, which may lead to different structural patterns at the national level. Second, the analysis is exploratory. The study examines changes in sectoral shares and measures structural dynamics using the SCI. While this approach provides useful insights into the magnitude and direction of structural developments, it does not allow causal inference regarding the relationship between digital intensity and sectoral performance. Third, the analysis is conducted at the one-digit NACE sectoral level. This level of aggregation provides a clear overview of the sectoral structure of the economy but may mask substantial heterogeneity within sectors. Firms and sub-industries within the same industry may differ significantly in their adoption of digital technologies, investment in ICT capital, and occupational structures. Consequently, sector-level indicators of digital intensity may not fully capture the microeconomic dynamics of digital transformation. Fourth, the analysis employed two macroeconomic indicators that capture the production and labor dimensions. However, these indicators do not fully reflect other aspects of digital transformation. Complementary measures, such as labor productivity, ICT investment, and digital technology adoption, could reveal additional patterns of sectoral dynamics and potentially lead to a more nuanced interpretation of the results.

Conclusion

This article examined the structural patterns of digitally intensive sectors in the EU and assessed how sectoral digital intensity relates to changes in value creation and employment. By analyzing sectoral shares of gross value added and employment, and by quantifying structural dynamics using the SCI, the study provides a macroeconomic perspective on the role of digital intensity in the evolving sectoral structure of the EU economy. The findings contribute to the debate on the economic implications of digital transformation. They suggest that digital transformation in the UE primarily unfolds through structural adjustments within existing sectors rather than through major sectoral reallocation. The analysis shows that digital transformation is closely linked to structural developments within existing sectors. In addition, the results indicate that the relationship between digital intensity and sectoral performance is heterogeneous and depends on broader structural factors. These observations support the view that technologies function as enabling tools embedded across a wide range of sectors.

Given the limitations of the present study, several directions for future research can be identified. One avenue would be to examine structural developments at the level of individual EU member states in order to capture cross-country differences in digital transformation, industrial structure, and labor market dynamics. Further research could also employ

econometric or panel-data approaches to explore potential causal relationships between sectoral digital intensity and structural economic outcomes. In addition, analyses based on more disaggregated industry data or firm-level datasets could provide deeper insights into the heterogeneity of digital technology adoption across sectors and better capture the microeconomic dynamics of digital transformation.

From a practical perspective, the results imply that digital transformation policies should not focus solely on developing new digital industries. Since digital technologies increasingly shape production and organizational practices within existing sectors, effective policy strategies should support digital adoption across a broad range of economic activities. Moreover, the growing importance of digitally intensive sectors in employment suggests that investment in workforce skills and digital competencies will be essential for enabling workers to adapt to ongoing technological change.

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DIGITÁLNĚ INTENZIVNÍ ODVĚTVÍ V EKONOMICE EVROPSKÉ UNIE: STRUKTURÁLNÍ VZORCE TVORBY PŘIDANÉ HODNOTY A ZAMĚSTNANOSTI

Tento článek zkoumá strukturální vzorce digitálně intenzivních odvětví v Evropské unii (EU) v období 2005–2023. S využitím sekundárních dat Organizace pro hospodářskou spolupráci a rozvoj (OECD) studie analyzuje změny podílů hrubé přidané hodnoty a zaměstnanosti napříč odvětvími klasifikovanými podle taxonomie digitální intenzity. Strukturální dynamika je kvantifikována pomocí indexu strukturálních změn (SCI). Výsledky ukazují, že změny v odvětvovém rozdělení tvorby hodnoty byly relativně omezené, zatímco posuny v zaměstnanosti byly výraznější. Digitální transformace se proto zdá probíhat především prostřednictvím postupných změn uvnitř jednotlivých sektorů spíše než prostřednictvím zásadní restrukturalizace jejich odvětvové struktury.

DIGITALINTENSIVE BRANCHEN IN DER WIRTSCHAFT DER EUROPÄISCHEN UNION: STRUKTURELLE MUSTER DER WERTSCHÖPFUNG UND BESCHÄFTIGUNG

Dieser Artikel untersucht die strukturellen Muster digitalintensiver Branchen in der Europäischen Union (EU) im Zeitraum 2005–2023. Unter Verwendung von Sekundärdaten der Organisation für wirtschaftliche Zusammenarbeit und Entwicklung (OECD) analysiert die Studie Veränderungen der Anteile an der Bruttowertschöpfung und der Beschäftigung in verschiedenen Branchen, die nach der Taxonomie der Digitalintensität klassifiziert wurden. Die strukturelle Dynamik wird anhand des Strukturwandelindex (SCI) quantifiziert. Die Ergebnisse zeigen, dass die Veränderungen in der sektoralen Verteilung der Wertschöpfung relativ begrenzt waren, während die Verschiebungen bei der Beschäftigung deutlicher ausfielen. Die digitale Transformation scheint daher vor allem durch schrittweise Veränderungen innerhalb einzelner Sektoren statt durch eine grundlegende Umstrukturierung ihrer sektoralen Zusammensetzung zu verlaufen.

SEKTORY O WYSOKIEJ INTENSYWNOŚCI CYFROWEJ W GOSPODARCE UNII EUROPEJSKIEJ: STRUKTURALNE WZORCE TWORZENIA WARTOŚCI DODANEJ I ZATRUDNIENIA

Niniejszy artykuł bada strukturalne wzorce sektorów o wysokiej intensywności cyfrowej w Unii Europejskiej (UE) w latach 2005–2023. Wykorzystanie danych wtórnych Organizacji Współpracy Gospodarczej i Rozwoju (OECD) analizowano zmiany udziałów wartości dodanej brutto oraz zatrudnienia w sektorach sklasyfikowanych zgodnie z taksonomią intensywności cyfrowej. Dynamika strukturalna została oszacowana przy użyciu wskaźnika zmian strukturalnych (SCI). Wyniki wskazują, że zmiany w sektorowym rozkładzie tworzenia wartości były stosunkowo ograniczone, natomiast zmiany w zatrudnieniu były bardziej wyraźne. Transformacja cyfrowa wydaje się więc zachodzić głównie poprzez stopniowe zmiany w obrębie poszczególnych sektorów, a nie poprzez zasadniczą restrukturyzację ich struktury sektorowej.