THE INTERSECTORAL STRUCTURE OF THE ROMANIAN ECONOMY AND ITS ECONOMIC IMPLICATIONS

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ABSTRACT: *This paper analyses the intersectoral structure of the Romanian economy and its implications for productivity, competitiveness and structural transformation. The study combines descriptive structural indicators with an input-output analytical framework based on Eurostat national accounts and FIGARO inter-country supply-use and input-output tables. Particular attention is given to sectoral composition, technical coefficients, the Leontief inverse, output multipliers and backward and forward linkages, while the empirical discussion places Romania within the broader EU convergence process. Recent statistics reveal a mixed structural profile. Romania reached approximately 78% of the EU average GDP per capita in 2024, compared with 44% at the time of EU accession, but important structural gaps remain. Agriculture still generated 2.5% of GDP in 2024, compared with 1.2% in the EU, while R&D intensity was only 0.5% of GDP versus about 2.2% in the EU. The share of Romanian SMEs with at least a basic level of digital intensity was 27% in 2023, compared with 57.7% in the EU. These indicators suggest that convergence in income has advanced faster than convergence in innovation and productive capabilities. The paper argues that Romania's next stage of development depends on strengthening domestic linkages between manufacturing, knowledge-intensive services, ICT, energy, transport, agriculture and SMEs. Industrial, digital and green policies should therefore be assessed not only by direct sectoral effects but also by their capacity to generate domestic value added, technological spillovers and resilient production networks.*

Keywords: *Romanian Economy; Intersectoral Structure; Input-Output Analysis; Structural Change; Sectoral Linkages; Productivity; Digitalization*

JEL classification: *C67; O11; O14; O33; L60*

1. INTRODUCTION

Romania has experienced one of the most pronounced income-convergence processes in the European Union. According to the European Commission (2026), GDP per capita increased from 44% of the EU average in 2007 to approximately 78% in 2024. This progress reflects capital accumulation, foreign direct investment, integration into the Single Market, labour reallocation and the expansion of export-oriented manufacturing and services.

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Nevertheless, rapid convergence in aggregate income does not automatically imply an equally rapid transformation of the productive structure. Persistent gaps in innovation, digital adoption, research intensity and labour productivity indicate that the quality of sectoral interactions remains a central issue for the sustainability of growth (European Commission, 2026; OECD, 2024).

The relevance of intersectoral analysis derives from the fact that modern economies operate as networks rather than as collections of isolated industries. Manufacturing purchases energy, metals, chemicals, transport, finance, software and professional services. Agriculture depends on machinery, fertilisers, energy, food processing, logistics and trade. ICT services increasingly enter the production process of almost every industry through software, data management, automation and digital platforms. As a result, the contribution of a sector cannot be evaluated only through its direct share in GDP or employment. Its wider importance also depends on the demand it creates for upstream suppliers and on the inputs it provides to downstream users (Leontief, 1986; Miller & Blair, 2009).

This perspective is particularly important for Romania. The economy combines internationally integrated manufacturing clusters with a rapidly expanding service sector and a still significant agricultural base. Eurostat (2026a) shows that agriculture generated 2.5% of Romanian GDP in 2024, more than twice the EU ratio of 1.2%. At the same time, the agricultural share of employment declined sharply during the previous decade, with Romania recording the largest reduction among EU Member States between 2013 and 2023 (-8.9 percentage points) (Eurostat, 2026b). These changes indicate substantial labour reallocation, but they do not by themselves reveal whether workers and resources have moved towards sectors with stronger productivity and linkage effects.

A second structural issue concerns the relationship between internationally competitive activities and the domestic economy. Participation in global and European value chains can stimulate exports, investment and technology transfer, but the domestic benefits depend on the local content of production and on the capacity of domestic suppliers to connect to multinational networks. When export-oriented industries rely heavily on imported intermediate inputs, part of the demand multiplier leaks abroad. Conversely, stronger domestic sourcing, engineering, logistics, ICT and business-service capabilities can increase the domestic value-added content of production (Eurostat & JRC, 2019; OECD, 2024).

The research gap addressed by this paper lies in the need to connect Romania's sectoral transformation with an explicit intersectoral interpretation. Earlier research has demonstrated the usefulness of input-output tables for understanding the relationship between goods and services in Romania (Goschin et al., 2015) and has examined the country's position in global value chains (Zaman & Vasile, 2015). However, recent structural developments associated with digitalisation, green investment, post-pandemic supply-chain adjustment and the latest phase of EU convergence require an updated analytical perspective. The availability of Eurostat FIGARO tables also provides a harmonised framework for connecting national production with international value chains (Eurostat, 2025a).

The objective of the study is therefore to assess the economic significance of Romania's intersectoral structure and to identify the channels through which stronger domestic linkages could support productivity, competitiveness and resilience. Four research questions are addressed: (RQ1) How has Romania's structural position evolved relative to the EU? (RQ2) Which sectors are expected to generate the strongest upstream and downstream effects in an input-output framework? (RQ3) What do recent indicators of agriculture, employment, innovation and digitalisation reveal about the quality of structural convergence? (RQ4) What policy measures could strengthen domestic value chains in the context of digital and green transformation?

The paper contributes to the literature by combining recent structural statistics with the logic of input-output analysis and by interpreting Romania's convergence through the quality of sectoral connections rather than sector size alone. The central proposition is that future convergence will depend increasingly on the capacity to transform internationally integrated sectors into anchors for domestic supplier development, innovation diffusion and higher-value services.

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Structural transformation has traditionally been associated with the reallocation of labour and capital from low-productivity primary activities towards manufacturing and, subsequently, modern services. However, contemporary structural-change research emphasises that sectoral reallocation is only one dimension of development. Productivity also depends on technological specialisation, innovation intensity and the capacity of sectors to interact through intermediate demand (Fagerberg, 2000). The expansion of services does not necessarily reduce growth potential when services are used as productive intermediate inputs; knowledge-intensive business services can support innovation and value-added growth in client industries (Evangelista et al., 2013).

Input-output analysis provides a systematic framework for examining these interdependencies. Leontief (1986) conceptualised production as a system in which each industry simultaneously acts as a purchaser of inputs and a supplier of outputs. The technical coefficient matrix records the direct input requirements of production, while the Leontief inverse captures cumulative direct and indirect requirements. This makes it possible to calculate output multipliers and to evaluate the propagation of demand shocks across industries (Miller & Blair, 2009).

The linkage approach developed by Rasmussen (1956) and Hirschman (1958) extends this framework to the identification of key sectors. Backward linkages measure the intensity with which a sector stimulates its suppliers, whereas forward linkages reflect the extent to which its output supports downstream activities. A sector with strong backward and forward linkages can be economically important even if its direct GDP share is moderate because changes in its output propagate widely across the production network.

In open economies, domestic input-output relationships must be interpreted together with international production fragmentation. FIGARO provides harmonised EU inter-country supply-use and input-output tables that connect national accounts, trade, employment and production for EU Member States and major partners. The 2025 edition covers 2010-2023 at up to 64-industry detail, enabling analysis of domestic and foreign value added, global value-chain participation and employment embodied in exports (Eurostat, 2025a, 2025b).

Romania's integration into European value chains has been particularly important in manufacturing. Zaman and Vasile (2015) showed that global value-chain participation is relevant for understanding the origin and destination of income embodied in Romanian trade. At the same time, research on the Romanian service economy has highlighted the increasing interdependence between goods and services and the importance of input-output tables for structural analysis (Goschin et al., 2015). These findings remain relevant because modern manufacturing increasingly incorporates software, engineering, finance, logistics and data-intensive services.

The innovation dimension is critical. In 2024, Romania's R&D intensity was only 0.5% of GDP, compared with about 2.2% for the EU (Eurostat, 2025c). This gap limits the capacity of domestic firms to develop proprietary technologies, absorb external knowledge and enter more sophisticated supplier relationships. Similarly, digitalisation remains uneven. The European Commission (2024) reported that only 27% of Romanian SMEs reached at least a

basic level of digital intensity in 2023, compared with 57.7% in the EU. The 2025 Digital Decade assessment continued to identify weak SME digitalisation and low uptake of emerging technologies as constraints on competitiveness (European Commission, 2025).

The green transition also changes intersectoral relationships. Renewable energy, grid investment, building renovation, low-emission transport and circular production generate demand for construction, electrical equipment, machinery, engineering, ICT and professional services. The impact on domestic growth depends on whether these investments activate Romanian supply chains or primarily increase imports. For this reason, digital and green transformation should be treated as production-network processes rather than as isolated sectoral agendas.

Based on the literature, three analytical expectations are formulated. H1 expects manufacturing and infrastructure-related activities to display relatively strong backward linkages because they use a broad range of intermediate inputs. H2 expects energy, transport, ICT and selected business services to display important forward linkages because their outputs are used widely across the economy. H3 expects the economic gains from Romania's EU integration to increase when export-oriented activities develop stronger domestic connections with SMEs, knowledge-intensive services and innovation systems.

3. DATA AND METHODOLOGY

3.1. Data sources and analytical period

The study uses secondary data from Eurostat, the European Commission, OECD and the Romanian National Institute of Statistics. The core input-output source is Eurostat's FIGARO database. FIGARO contains EU inter-country supply, use and input-output tables, is updated annually and, in the 2025 edition, covers 2010-2023. It provides 64-industry and 64-product detail and is explicitly designed for the analysis of global production networks (Eurostat, 2025a, 2025b). National supply-use and input-output tables are generally available with a longer publication lag, which makes it necessary to distinguish the most recent macroeconomic benchmark year from the latest complete input-output reference year.

The empirical discussion therefore uses 2023-2024 indicators when reliable recent statistics are available, while the input-output methodology is specified for the latest FIGARO matrices. This avoids the methodological error of presenting 2024 as a complete harmonised input-output reference year. The analysis is primarily structural and descriptive: it establishes a reproducible framework for identifying key sectors while using recent statistics to interpret Romania's current convergence position.

Table 1. Statistical and input-output data architecture used in the study

Component	Indicator / content	Reference period	Primary source
Macroeconomic convergence	GDP per capita relative to EU average	2007, 2024	European Commission
Sectoral structure	Agricultural value added / GDP	2024	Eurostat
Labour reallocation	Agriculture share of employment	2013-2023 change	Eurostat
Innovation	R&D expenditure / GDP	2024	Eurostat
Digitalisation	SMEs with basic digital intensity	2023	European Commission / DESI

Component	Indicator / content	Reference period	Primary source
Labour market	Employment rate, age 20-64	2024	Eurostat
Input-output structure	Industry-by-industry transactions; value added in trade; GVC indicators	2010-2023	Eurostat FIGARO 2025

Source: Author's synthesis based on European Commission (2024, 2025, 2026) and Eurostat (2025a, 2025b, 2025c, 2026a, 2026b, 2025d).

Note**:** FIGARO 2025 covers 2010-2023. Recent 2024 indicators are used for structural benchmarking, not as a complete 2024 input-output matrix.

Table 1 clarifies the temporal structure of the empirical evidence. The most recent macroeconomic and structural indicators can be used to characterise Romania's position in 2024, but input-output calculations must rely on the latest available matrix. This distinction is important for reproducibility and prevents the mixing of annual national-account indicators with unavailable transaction matrices.

3.2. Input-output model

Let $Z = [z_{ij}]$ denote the matrix of intermediate transactions, where z_{ij} represents the monetary value of input supplied by industry i to industry j, and x_j represents total output of industry j. The direct technical coefficient is $a_{ij} = z_{ij}/x_j$. Matrix A therefore measures the amount of intermediate input from each supplying industry required per unit of output in the purchasing industry.

The standard Leontief quantity model is $x = Ax + y$, where x is the vector of gross output and y is final demand. Rearranging gives $x = (I - A)^{-1} y$. The Leontief inverse, $L=(I-A)^{-1}$, captures both the direct and indirect production requirements associated with a given vector of final demand, such that $x=Ly$. The column sum of L for a sector can be interpreted as an output multiplier: the larger the value, the greater the total production generated throughout the economy by an additional unit of final demand for that sector.

Backward linkages are derived from the column structure of the Leontief inverse and capture the capacity of a sector to stimulate upstream suppliers. A normalised backward linkage greater than one indicates an above-average upstream effect. Forward linkages capture the importance of a sector as an input supplier to downstream industries. In empirical applications, these can be derived from row-based measures or a Ghosh-type supply framework. Sectors with both normalised backward and forward indices above one may be classified as structurally key sectors (Rasmussen, 1956; Hirschman, 1958; Miller & Blair, 2009).

3.3. Complementary structural indicators

Because linkage intensity alone does not reveal productivity, innovation or social value, the input-output framework is complemented by indicators of income convergence, agricultural weight, employment reallocation, R&D intensity, SME digitalisation and labour-market performance. The comparison with the EU is used as a structural benchmark rather than as a target of identical sectoral composition. The purpose is to identify areas in which Romania's convergence in income is accompanied - or not accompanied - by convergence in productive capabilities.

3.4. Methodological limitations

Input-output models assume fixed production coefficients within each reference year and do not explicitly model price changes, substitution or capacity constraints. Linkage measures are therefore structural indicators rather than causal estimates. In addition, strong multipliers may occur in sectors with high environmental costs or low productivity, while technologically advanced sectors can have smaller domestic multipliers if they depend heavily on imported inputs. The interpretation consequently combines network centrality with productivity, innovation and digitalisation evidence. A further limitation is the publication lag of detailed matrices. Future versions of the analysis should update sector-level multipliers as new FIGARO matrices become available and should distinguish domestic from imported technical coefficients.

4. RESULTS AND DISCUSSION

4.1. Romania's structural convergence: a statistical benchmark

Romania's structural convergence with the European Union can be assessed not only through income dynamics but also through changes in the productive, technological and labour-market characteristics of the economy. While GDP per capita provides a general measure of economic convergence, indicators related to sectoral structure, research and development, digitalisation and employment offer a broader perspective on the capacity of the economy to sustain productivity growth and structural upgrading. Comparing these dimensions with EU benchmarks makes it possible to identify whether improvements in living standards have been accompanied by corresponding advances in innovation, technological capabilities and labour-market performance. Table 2 summarises the main indicators used to assess these different dimensions of Romania's structural convergence.

Table 2. Selected structural indicators: Romania and EU benchmark

Indicator	Romania	EU benchmark	Year / period	Romania relative to EU*
GDP per capita (EU=100)	78	100	2024	78.0%
Agricultural value added (% GDP)	2.5	1.2	2024	208.3%
R&D intensity (% GDP)	0.5	2.2	2024	22.7%
SMEs with at least basic digital intensity (%)	27.0	57.7	2023	46.8%
Employment rate, age 20-64 (%)	69.5	75.8	2024	91.7%

Source: European Commission (2024, 2026); Eurostat (2025c, 2025d, 2026a).

Note: *Author's calculation: Romania / EU benchmark × 100. Agricultural value added above 100% indicates a higher structural weight, not superior performance.

Table 2 reveals a clear distinction between income convergence and capability convergence. Romania reached approximately 78% of the EU average GDP per capita in 2024, a major improvement from the 44% recorded at accession in 2007 (European Commission,

2026). However, the innovation and digital indicators remain substantially weaker. R&D intensity was only 0.5% of GDP, or roughly 23% of the EU level, while the share of SMEs with at least basic digital intensity was below half of the EU benchmark. This suggests that a significant part of convergence has occurred without equivalent convergence in knowledge creation and technology diffusion.

The agricultural indicator points to another structural asymmetry. Agriculture's value added represented 2.5% of Romanian GDP in 2024, compared with 1.2% in the EU. The ratio is not inherently negative: agriculture can support food processing, bioeconomy activities and exports. Nevertheless, when combined with lower productivity and a historically high employment share, it indicates that structural transformation remains incomplete. The key policy issue is therefore not the elimination of agriculture but its integration with higher-value processing, technology, logistics and services.

The employment rate provides a more moderate gap. At 69.5% in 2024, Romania was closer to the EU benchmark of 75.8% than in R&D or digitalisation. This reinforces the view that Romania's structural challenge increasingly concerns the productivity and technological content of employment rather than employment quantity alone.

4.2. Agriculture: declining labour weight but persistent structural importance

Agriculture represents an important dimension of Romania's structural transformation, given its historically significant contribution to employment and its still comparatively high weight in economic activity. Although the sector has experienced a substantial decline in its share of total employment, its contribution to GDP remains above the EU average, indicating that agricultural restructuring is still ongoing. At the same time, recent productivity developments highlight the sector's vulnerability to economic, climatic and production-related shocks. Examining value added, employment and labour productivity together therefore provides a more comprehensive assessment of agriculture's changing position within the Romanian economy and its potential connections with food processing, technology, energy, transport and logistics.

Table 3. Agriculture-related structural indicators

Indicator	Romania	EU	Period	Interpretation
Agricultural value added / GDP	2.5%	1.2%	2024	Romania retains a larger agricultural economic weight
Change in agriculture share of total employment	-8.9 pp	EU share: 5.2% to 3.9%	2013-2023	Romania recorded the largest decline among EU countries
Agricultural labour productivity, annual change	-16.8%	+1.6%	2024 estimate	Strong adverse short-term productivity shock in Romania

Source: Eurostat (2024, 2026a, 2026b). Datasets cited by Eurostat include aact_eaa01, nama_10_gdp and nama_10_a64_e.

Note: The productivity figure is an annual change estimate for 2024 and should not be interpreted as a long-run productivity level.

Table 3 shows that Romania has undergone substantial labour reallocation away from agriculture. Between 2013 and 2023, agriculture's share of total employment fell by 8.9 percentage points, the largest decline reported among EU Member States (Eurostat, 2026b). This is consistent with structural transformation, as labour moves away from primary activities. Yet agriculture still generated 2.5% of GDP in 2024, more than twice the EU ratio, indicating that the sector continues to have macroeconomic relevance.

The 2024 fall in agricultural labour productivity (-16.8%, compared with an EU increase of 1.6%) illustrates the sector's exposure to climatic, price and production volatility (Eurostat, 2024). From an intersectoral perspective, this volatility can be partly mitigated by deeper integration with food processing, irrigation and energy infrastructure, machinery, storage, insurance, digital agriculture and logistics. The objective of structural policy should therefore be to raise value added along the agri-food chain rather than to assess primary agriculture in isolation.

4.3. Innovation and digitalisation as determinants of linkage quality

The innovation gap is one of the clearest constraints on intersectoral upgrading. Eurostat (2025c) reports that Romania devoted only 0.5% of GDP to R&D in 2024, compared with approximately 2.2% for the EU. Such a gap affects more than the research sector itself. Low R&D intensity can weaken the ability of manufacturing firms to develop advanced products, of SMEs to meet demanding supplier standards, and of service firms to provide specialised engineering, software and research inputs.

Digitalisation shows a similar pattern. In 2023, only 27% of Romanian SMEs had at least a basic level of digital intensity, compared with 57.7% in the EU (European Commission, 2024). The 2025 Digital Decade Country Report continues to describe enterprise digitalisation, especially among SMEs, as lagging behind the EU average, despite Romania's strong fixed-connectivity infrastructure and ICT talent base (European Commission, 2025). The policy significance is intersectoral: Romania already possesses a relatively visible ICT sector, but the economy-wide productivity effect depends on whether digital capabilities diffuse into manufacturing, agriculture, logistics, construction and business services.

Table 4. Innovation and digitalisation indicators relevant to intersectoral upgrading

Indicator	Romania	EU	Reference year	Gap (pp)
R&D expenditure / GDP	0.5%	2.2%	2024	-1.7
SMEs with at least basic digital intensity	27.0%	57.7%	2023	-30.7
Digital roadmap measures	98 measures	n/a	2025	n/a
Budget of Romania's Digital Decade roadmap	EUR 3.6 bn (1.01% GDP)	n/a	2025	n/a

Source: Eurostat (2025c); European Commission (2024, 2025).
Note: Digital roadmap values describe planned measures and budget, not realised outcomes.

The Romanian Digital Decade roadmap contains 98 measures with a budget of EUR 3.6 billion, equivalent to 1.01% of GDP (European Commission, 2025). The scale of planned intervention is relevant, but the structural criterion for success should be diffusion. Public support creates larger economic effects when digital investments strengthen supplier-client relationships and raise productivity in sectors beyond ICT itself.

4.4. Manufacturing and the logic of backward linkages

Manufacturing remains central to the Romanian production network because it combines export orientation with intensive intermediate-input use. Automotive, electrical equipment, machinery, chemicals, pharmaceuticals and other manufacturing activities require inputs from metals, plastics, energy, transport, warehousing, finance, software and professional services. In a Leontief framework, such input intensity normally produces substantial backward linkages. The magnitude of the domestic multiplier, however, depends on the origin of these inputs.

If a large share of intermediate goods is imported, the gross production response may be strong while the domestic value-added effect remains more limited. This is particularly relevant for economies integrated into cross-border manufacturing chains. FIGARO explicitly allows the researcher to distinguish domestic and foreign value added in exports and to measure global value-chain participation (Eurostat, 2025a). For Romania, this distinction should be central to future sector-level calculations: a strategically important sector is not simply one that exports heavily, but one that combines export capacity with domestic supplier development and knowledge spillovers.

The policy implication is that industrial upgrading should not be reduced to attracting final assemblers. Supplier-development programmes, certification support, technology transfer and collaboration with universities can increase the share of domestic firms able to provide components, engineering and specialised services. This would strengthen backward linkages and retain a larger proportion of final-demand effects within Romania.

4.5. Energy, transport and ICT as forward-linkage sectors

Energy, transport and ICT are structurally important because their outputs enter a broad range of downstream activities. Electricity affects virtually all production costs; transport and logistics connect suppliers, factories and markets; and ICT increasingly functions as a general-purpose input. These sectors are therefore expected to display significant forward-linkage characteristics, consistent with H2.

Energy is particularly relevant in the context of decarbonisation. Investment in renewable generation, electricity grids and energy efficiency can stimulate construction, machinery, electrical equipment, engineering and digital monitoring. At the same time, energy-price shocks can propagate rapidly into manufacturing and services. The intersectoral perspective therefore helps explain why energy policy is simultaneously an industrial and competitiveness policy.

Transport infrastructure has a similar horizontal function. Better road and rail connectivity can deepen domestic markets, reduce logistics costs and connect less-developed regions to industrial networks. The benefits extend to agriculture, manufacturing, tourism and services. Conversely, infrastructure bottlenecks reduce the effective multiplier of productive investment by increasing transaction costs.

ICT presents perhaps the clearest example of the difference between sectoral success and economy-wide transformation. Romania can have a competitive ICT industry while still recording weak enterprise digitalisation. The 27% SME digital-intensity figure demonstrates

this disconnect. Stronger forward linkages from ICT require widespread adoption of cloud computing, data analytics, artificial intelligence, cybersecurity and integrated enterprise systems across traditional sectors.

4.6. Interpreting Romania's intersectoral profile

The previous analysis highlights the heterogeneous contribution of Romania's major economic sectors to structural transformation, suggesting that their importance extends beyond their direct shares in output or employment. From an input-output perspective, the economic relevance of a sector also depends on the intensity of its relationships with upstream suppliers and downstream users. Manufacturing, energy, transport, ICT, construction, agriculture and services occupy different positions within the production network and therefore differ in their capacity to transmit demand, supply and productivity effects across the economy. Based on the theoretical framework of intersectoral linkages and the structural evidence discussed above, Table 5 synthesises the expected backward and forward linkage profiles of the main sector groups and identifies the principal channels through which they may influence Romania's broader production system.

Table 5. Expected structural role of major sector groups in the Romanian input-output network

Sector group	Expected backward linkage	Expected forward linkage	Main structural channel
Manufacturing	High	Medium-High	Demand for components, energy, logistics and business services
Energy & utilities	Medium	High	Input into almost all production activities
Transport & logistics	Medium-High	High	Connects domestic production and external markets
ICT & knowledge services	Medium	High and rising	Digital and knowledge inputs across sectors
Construction	High	Low-Medium	Strong demand for materials and local services
Agriculture	Medium	Medium	Potential through food processing, chemicals, machinery and logistics
Trade & consumer services	Medium	Low-Medium	Large final-demand role; heterogeneous productivity

Source: Author's conceptual synthesis based on Leontief (1986), Rasmussen (1956), Hirschman (1958), Miller and Blair (2009), Eurostat (2025a) and the Romanian structural evidence discussed above.

Note: These are analytical expectations, not estimated linkage coefficients. Empirical classification requires calculation from a specified FIGARO or national input-output matrix.

Table 5 summarises the structural expectations generated by the analytical framework. It deliberately distinguishes expected network roles from estimated coefficients. Manufacturing and construction are expected to have strong backward effects because they purchase diverse intermediate inputs. Energy, transport and ICT are expected to have stronger forward effects because they supply widely used inputs. Agriculture's network role depends heavily on its connection to processing and logistics. This classification provides a transparent basis for the next empirical stage, in which normalised linkage indices can be calculated directly from FIGARO.

4.7. Assessment of the analytical expectations

H1 is conceptually supported by the input structure of manufacturing and construction, but definitive confirmation requires calculated Leontief multipliers for the selected FIGARO year. The expectation is economically plausible because these sectors use broad bundles of intermediate goods and services. The domestic strength of the effect will depend on import penetration.

H2 is also consistent with the functional role of energy, transport and ICT. These sectors provide inputs used throughout the economy, making them likely candidates for above-average forward linkages. The digitalisation evidence reinforces the importance of ICT but also shows that Romania has not yet fully converted ICT capabilities into broad SME adoption.

H3 receives the strongest support from the combined structural indicators. Romania's income convergence is much more advanced than its R&D and SME digitalisation convergence. This suggests that the next stage of development requires qualitative upgrading of domestic production networks: stronger innovation, higher digital adoption and deeper connections between export-oriented firms and domestic suppliers.

5. POLICY IMPLICATIONS

The first policy priority is to move from sector-specific support towards intersectoral capability building. Industrial policy should strengthen networks linking manufacturing with Romanian SMEs, engineering, ICT, logistics, energy and research organisations. Supplier-development schemes should focus on standards, certification, automation, quality management and access to finance so that domestic firms can enter higher-value production chains.

Innovation policy must address the exceptionally low R&D intensity. At 0.5% of GDP in 2024, Romania remains far from the EU benchmark. Public policy should encourage business R&D, university-industry collaboration, applied research, demonstration projects and innovation procurement. The objective is not only to increase R&D expenditure statistically but to create commercially relevant knowledge flows between sectors.

Digital policy should prioritise diffusion rather than connectivity alone. Romania's digital infrastructure is a comparative strength, but only 27% of SMEs met basic digital-intensity criteria in 2023. Support for cloud services, AI, data analytics, cybersecurity and enterprise-resource planning should therefore target manufacturing, agriculture, logistics, construction and traditional services, where productivity spillovers can be substantial.

Green investment should be designed as an industrial-development opportunity. Renewable energy, grid modernisation, building renovation and sustainable transport can create domestic demand for electrical equipment, construction materials, machinery, engineering and software. Policy evaluation should monitor domestic value-added content and import dependence so that green spending also contributes to productive upgrading.

Agricultural policy should increasingly focus on value-chain integration. The decline in agricultural employment demonstrates ongoing structural change, but the sector's 2.5% GDP share remains significant. Investment in food processing, storage, irrigation, precision agriculture, renewable energy, logistics and branding can raise value retention without attempting to preserve low-productivity employment.

Finally, public investment appraisal should incorporate input-output and value-chain indicators. Direct jobs or sectoral output are incomplete measures of impact. Output multipliers, domestic value added, import leakage, employment embodied in final demand and normalised backward/forward linkages can provide a stronger basis for prioritising projects.

6. CONCLUSIONS

The analysis shows that Romania's economic convergence has been substantial but structurally uneven. GDP per capita reached approximately 78% of the EU average in 2024, yet the country remained far below EU levels in R&D intensity and SME digitalisation. Agriculture retained more than twice the EU economic weight, despite a pronounced decline in its employment share. These patterns indicate that the next stage of convergence will depend less on broad sectoral reallocation and more on productivity, innovation and the quality of intersectoral linkages.

The input-output framework provides a suitable analytical foundation for this assessment because it distinguishes direct sector size from economy-wide influence. Manufacturing can generate strong backward effects when it sources inputs domestically; energy, transport and ICT can generate broad forward effects because they supply essential inputs to multiple sectors. The economic value of Romania's participation in European value chains therefore depends on the density of domestic supplier networks and on the technological content of the relationships connecting firms.

The statistical evidence also reveals a gap between infrastructure or sectoral potential and economy-wide diffusion. Romania's ICT capabilities coexist with weak SME digital intensity, while rapid income convergence coexists with very low R&D intensity. Closing these gaps requires coordinated industrial, innovation, digital, education, infrastructure and green policies rather than isolated sector programmes.

The principal limitation of the current study is that the recent structural indicators and the latest complete input-output matrix do not refer to exactly the same year. For this reason, the paper avoids presenting invented 2024 multiplier values. Future research should calculate sector-level output multipliers and normalised backward and forward linkages from the latest FIGARO matrix, compare them with 2015 and 2019, and benchmark Romania against Central and Eastern European economies such as Czechia, Hungary and Poland. Additional extensions should distinguish domestic from imported inputs and combine the input-output structure with employment, emissions, innovation and ownership data.

Overall, Romania's development challenge is not simply to increase the size of manufacturing, services or agriculture. It is to create a more connected production system in which competitive sectors generate stronger domestic demand, knowledge-intensive services diffuse across traditional industries, green investment activates local capabilities and SMEs capture a larger share of value added. Such a transformation would strengthen productivity, resilience and the sustainability of long-term convergence.

REFERENCES

1. European Commission. (2024). Romania 2024 Digital Decade Country Report. Brussels: European Commission.

2. European Commission. (2025). Romania 2025 Digital Decade Country Report. Brussels: European Commission.
3. European Commission. (2026). 2026 Country Report - Romania. Brussels: Directorate-General for Economic and Financial Affairs.
4. Eurostat. (2024). EU agricultural labour productivity up by 1.6% in 2024. Eurostat News, 16 December 2024.
5. Eurostat. (2025a). FIGARO tables: EU inter-country supply, use and input-output tables, 2025 edition. Luxembourg: Eurostat.
6. Eurostat. (2025b). EU inter-country supply, use and input-output tables (FIGARO) - current prices (naio_10_fcp): Metadata. Luxembourg: Eurostat.
7. Eurostat. (2025c). EU spending on R&D exceeded EUR 403 billion in 2024. Eurostat News, 4 December 2025. Dataset: rd_e_gerdtot.
8. Eurostat. (2025d). EU's employment rate reached almost 76% in 2024. Eurostat News, 15 April 2025. Dataset: lfsi_emp_a.
9. Eurostat. (2026a). Key figures on food chain - agriculture's value added. Eurostat News, 23 February 2026. Datasets: aact_eaa01; nama_10_gdp.
10. Eurostat. (2026b). Key figures on food chain - employment in agriculture. Eurostat News, 16 January 2026. Dataset: nama_10_a64_e.
11. Eurostat, & Joint Research Centre. (2019). European Union inter-country supply, use and input-output tables: Full international and global accounts for research in input-output analysis (FIGARO). Luxembourg: Publications Office of the European Union.
12. Evangelista, R., Lucchese, M., & Meliciani, V. (2013). Business services, innovation and sectoral growth. Structural Change and Economic Dynamics, 25, 119-132.
13. Fagerberg, J. (2000). Technological progress, structural change and productivity growth: A comparative study. Structural Change and Economic Dynamics, 11(4), 393-411.
14. Goschin, Z., Constantin, D. L., Roman, M., & Ileanu, B. (2015). Services and structural patterns of a post-transition Romanian economy. Economic Research-Ekonomska Istraživanja.
15. Hirschman, A. O. (1958). The Strategy of Economic Development. New Haven, CT: Yale University Press.
16. Leontief, W. (1986). Input-Output Economics (2nd ed.). New York: Oxford University Press.
17. Miller, R. E., & Blair, P. D. (2009). Input-Output Analysis: Foundations and Extensions (2nd ed.). Cambridge: Cambridge University Press.
18. OECD. (2024). OECD Economic Surveys: Romania 2024. Paris: OECD Publishing. https://doi.org/10.1787/106b32c4-en
19. Rasmussen, P. N. (1956). Studies in Inter-Sectoral Relations. Copenhagen: Einar Harcks Forlag.
20. Romanian National Institute of Statistics. (2025). National Accounts and Supply-Use Tables. Bucharest: INSSE.
21. Zaman, G., & Vasile, V. (2015). Romania and its position on the global value chain: An introductive analysis. Procedia Economics and Finance, 27, 136-143.