A FRAMEWORK TO ASSESS SERVICES AS A DRIVER FOR ECONOMIC GROWTH AND STRUCTURAL TRANSFORMATION

HINH T. DINH

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Historically, manufacturing has served as the primary pathway to economic development, offering strong scale economies, learning-by-doing effects, and the capacity to generate the foreign exchange necessary to import capital goods and technology. However, advances in robotization and artificial intelligence (AI) are fundamentally undermining manufacturing's traditional role, making it increasingly skill- and capital-intensive while limiting its ability to absorb labor. This technological transformation forces developing countries to consider service-led development strategies, but most services exhibit low productivity, limited tradability, and minimal capacity to generate foreign exchange.

This paper is the first in a series to develop a methodology to identify and assess which specific services can serve as drivers for growth and structural transformation for the Global South. It proposes an analytical framework that classifies services into three categories: i) Knowledge Services (ICT and professional business services) which exhibit manufacturing-like characteristics such as tradability and foreign exchange generation capacity; ii) Enabling Services (transport, logistics, finance) which facilitate trade but generate limited independent value capture; and iii) Local Services (retail, hospitality, health, education, arts, and personal services) which absorb labor but cannot drive export-led growth. Critically, the paper addresses the education and health sectors separately, recognizing that, while they function as Local Services, they constitute essential foundational investments that enable the development of Knowledge Services. A companion paper applies this framework to assess the performance of the services sector of three North African countries: Egypt, Morocco, and Tunisia.

To establish a benchmark against which developing countries can be assessed, we apply this framework empirically to EU15 economies over the period 2010–2022 using OECD Trade in Value Added (TiVA), Trade in Employment (TiM), and inter-country input-output tables, measuring performance across sectoral GDP and employment shares, productivity levels, external integration indicators, employment embodied in external demand, Hirschman-Rasmussen backward and forward linkages, and Leontief employment multipliers. The EU15 evidence shows that successful service-led development is not simply about expanding services in aggregate, but about shifting the internal composition of services toward Knowledge Services while maintaining efficient Enabling Services—precisely the pattern absent in countries that participate in GVCs without capturing significant value.

HINH T. DINH

1. INTRODUCTION

Since the Industrial Revolution, manufacturing has been the primary pathway to growth and development for today's high-income countries (Kuznets, 1971). However, advances in AI and robotics have increasingly called this pathway into question (Rajan, 2025; Rodrik & Stiglitz, 2024). Rodrik and Stiglitz (2024) argue that traditional manufacturing-led growth is no longer viable because technological change has made manufacturing more skill- and capital-intensive, thereby restricting its capacity to absorb labor.

This technological transformation forces developing countries to consider adopting service-led development strategies; however, such strategies carry substantial risks (El Aynaoui and Dinh, 2024). Most services exhibit low productivity, limited tradability, and minimal potential for catching up with advanced economies. Developing countries cannot simply shift from manufacturing to services in general without addressing these risks.

This paper is the first in a series that develops a methodology to identify and assess which specific services can serve as drivers of growth and structural transformation for the Global South. We classify services into three distinct categories based on their tradability, knowledge intensity, and growth potential: Knowledge Services, Enabling Services, and Local Services. A companion paper uses this framework to assess the performance of the services sector in three North African countries—Egypt, Morocco, and Tunisia. To establish a benchmark against which developing countries can be assessed, we apply the framework to EU15 economies over the period 2010-2022 using OECD Trade in Value Added (TiVA) data and employment statistics.

We use a number of criteria to assess services performance across multiple dimensions: sectoral GDP and employment shares, productivity, domestic value retention (domestic value added in exports), forward integration (domestic value added in foreign final demand), employment embodied in external demand, Hirschman-Rasmussen backward and forward linkages, and Leontief employment multipliers. The empirical analysis reveals that successful adaptation to the declining role of manufacturing requires expanding Knowledge Services that exhibit strong performance across all indicators. Enabling Services play essential supporting roles with strong domestic value retention but weaker forward integration, while Local Services, despite employing the majority of workers, contribute minimally to export-led income growth or foreign exchange generation.

The framework demonstrates that only Knowledge Services can realistically replace manufacturing's developmental role by generating foreign exchange earnings, driving productivity convergence, and creating quality employment. However, global value chain integration alone does not guarantee these outcomes. Countries that expand only Enabling and Local Services risk becoming trapped in patterns of export growth without income convergence—participating in global value chains (GVCs) without capturing significant value or earning sufficient foreign exchange.

In general, only Knowledge Services can realistically replace manufacturing's developmental role by generating foreign exchange, driving productivity convergence, and creating quality

employment. Enabling Services provide important domestic value retention linkages but weaker forward integration, while Local Services—despite their large employment share—contribute little to export-led growth or income convergence, meaning countries that expand primarily these two categories risk participating in GVCs without capturing significant value or achieving sustained income growth. The policy framework that follows calls for disaggregating services in national strategies, adopting value-based trade performance metrics, investing in human capital and digital infrastructure, and pursuing selective industrial policy targeted at Knowledge Services. The paper concludes with a discussion of data limitations—particularly the restricted availability of inter-country input-output tables in developing countries—and directions for further research.

The paper is organized as follows. Section 2 defines and classifies the services sector, clarifying issues of terminology, scope, and tradability. Section 3 revisits the structural transformation question, examining why manufacturing historically played a special role and assessing the limits of a services-led replacement. Section 4 introduces a three-category analytical framework that distinguishes knowledge services, enabling services, and local services, and maps these categories onto development pathways. It also develops the theoretical foundation of this framework. Section 5 applies this framework empirically using EU15 evidence to analyze services integration into GVCs, sectoral shares, employment patterns, productivity, and external demand linkages. Section 6 explores the role of services in the context of the national economy—rather than the international environment in the previous section—through the Hirschman–Rasmussen (HR) backward and forward linkage indices and the employment multipliers. Section 7 discusses what the benchmarks reveal about successful service-led development. Section 8 concludes by outlining the limitations of the approach and suggesting directions for future research.

2. Defining and Classifying the Services Sector

2.1 Terminology and Scope

We use the "service sector" (singular) to refer to services as a unified entity as opposed to manufacturing or agriculture, and the "services sector" (plural) to emphasize the diversity of economic activities involving delivery of intangible goods—such as healthcare, education, retail, IT, finance, logistics, and professional services—that fall under this umbrella.

To link services to international trade and economic structure, we employ the Standard International Trade Classification (SITC Rev. 4), which contains 98 divisions. Services span divisions 45 through 98. Within this range:

- Divisions 45–82: Total Business Sector Services—activities that directly support business operations and trade.

- Divisions 84–98: Public administration, education, health, and personal services—activities that influence exports over the long term but have limited immediate impact on trade performance in the short to medium term.

Table 1 presents the detailed composition of services according to ISIC Rev. 4.

Table 1:

Detailed Decomposition of Services

Services of the business economy - sections G to N
    Wholesale & retail trade; repair of motor veh.; transport. & stor.; accom. & food act. (GTI)
        Wholesale and retail trade; repair of motor vehicles and motorcycles (G)
        Transportation and storage (H)
            Land transport and transport via pipelines (H49)
            Water transport (H50)
            Air transport (H51)
            Warehousing and support activities for transportation (H52)
            Postal and courier activities (H53)
        Accommodation and food service activities (I)
        Information and communication (J)
            Publishing, motion picture, video, television, sound recording & broadcasting (J58–60)
            Telecommunications (J61)
            Computer programming, consultancy, and information services (J62–J63)
        Financial and insurance activities (K)
        Real estate activities (L)
    Professional, scientific and technical; administrative and support services (M,N)
        Professional, scientific and technical activities (M)
        Administrative and support service activities (N)
Pub. Adm., ed & health; soc & pers. serv (OTT)
    Public administration, defence, education, human health and social work activities (OTQ)
        Public administration and defense; compulsory social security (O)
        Education (P)
        Human health and social work activities (Q)
    Arts, entertainment and recreation; other services; households as employers (RTT)
        Arts, entertainment and recreation (R)
        Other service activities (S)
        Households as employers (T)

Source: OECD Trade in Value Added https://www.oecd.org/en/topics/sub-issues/trade-in-value-added.html.

Note: Letters in parentheses denote ISIC Rev. 4 Divisions.

2.2 Analytical Approach: Input-Output Linkages

To capture the linkages between various services and other activities of the economy, we rely on input-output (I/O) tables. These I/O tables establish structural relationships between a sector's output and the inputs and final demand associated with it. Backward linkages capture the inputs required from the domestic economy to produce an additional unit of output. Forward linkages measure how an increase in one industry's output affects downstream sectors that use it as an input. This framework allows us to trace how services contribute to export production even when the services themselves are not directly exported.

3. Can Services Replace Manufacturing? The Structural Transformation Question

The classic development literature treated manufacturing as the central "escalator sector," not out of any inherent favoritism toward factories, but because of a set of well-documented empirical regularities. Manufacturing is characterized by strong economies of scale that reduce unit costs as production expands, learning-by-doing effects that steadily raise productivity, high exportability with demand and prices determined in global markets, and relatively broad scope for productivity catch-up by follower countries. Crucially, manufacturing has historically exhibited unconditional productivity convergence: once countries entered modern manufacturing, poorer economies tended to catch up more rapidly, a pattern far less evident in many other sectors.

Rodrik's work (2016) on "premature deindustrialization" documents that developing countries now reach peak manufacturing employment and output shares at much lower income levels than earlier industrializers, implying the traditional industrialization path is becoming harder to sustain. This diagnosis has motivated researchers to ask whether services can play the growth role that manufacturing played for East Asia.

3.1 The Services Heterogeneity Problem

Unlike other sectors such as agriculture, mining, manufacturing, or construction, "services" do not constitute a single sector. As Table 1 shows, services range from low-productivity, informal, and non-tradable activities—such as small retail and personal services—to high-productivity, scalable, and tradable activities, including ICT, business services, finance, logistics, engineering, design, specialized health and education segments, and tourism.

The optimistic case for service-led development rests on technological change, which has made a growing subset of services tradable and scalable. These modern services can generate export earnings, productivity growth, and spillovers in ways that resemble manufacturing. Evidence supporting this view includes the rapid expansion of services exports from countries such as India and the Philippines, as documented in global services trade data.

3.2 The Replacement Question and Its Limits

The harder question is whether services can *reliably substitute* for manufacturing as the primary ladder of convergence. The concern is twofold.

First, the employment absorption challenge arises when labor shifts out of agriculture disproportionately into low-productivity, non-tradable services, slowing structural transformation. As Baumol (1967) demonstrated, marginal workers entering services tend to reduce average sector productivity unless demand is sufficiently elastic. Timmer (2012) showed that the fastest structural transformation occurs when surplus labor moves into sectors where productivity can remain constant—such as export-oriented manufacturing—because global demand helps buffer diminishing returns.

Second, the skill-intensity barrier emerges because tradable services with manufacturing-like characteristics—such as ICT, business process outsourcing, and professional services—typically require skill levels that many lower-middle-income countries lack. This creates a bifurcation: countries with strong human capital can leverage modern services for growth, while others face a "missing middle"—unable to compete in manufacturing due to premature deindustrialization, yet unable to scale knowledge-intensive services due to skill constraints.

The policy implication is not that services cannot drive growth, but that the specific services a country can successfully develop depend critically on its human capital, infrastructure, and institutional capabilities. The methodology developed in this paper provides tools to assess these capabilities and identify strategic opportunities.

4. A Three-Category Services Framework for Analysis

To operationalize the distinction among different types of services, we classify services into three categories based on their linkages, tradability, knowledge intensity, and potential for productivity growth.

- Knowledge Services encompass knowledge-intensive business services including ICT, professional services, R&D, design, engineering, and software development. These act as growth drivers: tradable, scalable, and capable of supporting productivity catch-up.
- Enabling Services include transport, logistics, finance, wholesale trade, and telecommunications infrastructure. These function as essential enablers of trade and participation in GVCs, but generate limited value capture on their own.
- Local Services comprise non-tradable, labor-absorbing services including retail, accommodation, personal care, and basic education and health. These stabilize employment but do not drive export-led growth or productivity convergence.

Table 2 maps the services categories presented in Table 1 into the three categories outlined above. The key insight of the three-category framework is that only Knowledge Services can reliably replace manufacturing as an engine of convergence, while Enabling Services facilitate participation and Local Services absorb labor. Successful development therefore requires the strategic expansion of Knowledge Services, not services in general.

Table 2.

The Three-category Services Framework

Knowledge Services

   Information and communication (J)

     Publishing, motion picture, video, television programme etc. (J58-60)

     Telecommunications (J61)

     Computer programming, consultancy, and information etc. (J62-63)

   Professional, scientific and technical activities (M)

   Administrative and support service activities (N)

Enabling Services

   Transportation and storage (H)

     Land transport and transport via pipelines (H49)

     Water transport (H50)

     Air transport (H51)

     Warehousing and support activities for transportation (H52)

     Postal and courier activities (H53)

   Financial and insurance activities (K)

Local Services

   Wholesale and retail trade; repair of motor vehicles and motorcycles (G)

   Accommodation and food service activities (I)

   Real estate activities (L)

   Public administration and defence; compulsory social security (O)

   Education (P)

   Human health and social work activities (Q)

   Arts, entertainment and recreation (R)

   Other service activities (S)

   Households as employers (T)

Source: Author's reclassification of Table 1

Note: Letters in parentheses denote ISIC Rev. 4 Divisions

4.1 Knowledge Services (The Growth Drivers)

Knowledge Services comprise information and communication services (ICT), professional, scientific, and technical services, and advanced business-support services such as management consulting, R&D, design, engineering, software development, and data analytics. These services are characterized by high skill intensity and human capital requirements, strong potential for tradability and scalability, the capacity to exhibit learning effects and productivity convergence potential, the ability to generate significant forward linkages by embedding knowledge in downstream products and services, and often increasing returns to scale at the firm or cluster level.

A caveat applies to the category "Administrative and Support Service Activities" (ISIC category N). In some developing countries such as India or the Philippines, the rapid expansion of Business Process Outsourcing (BPO) activities—such as customer service, accounting, and IT support—has been regarded as a major success in the development of

the services sector. These functions, outsourced by parent companies in developed economies, have generated employment and foreign exchange for the host countries. Accordingly, they are classified under Knowledge Services, alongside category M, "Professional, Scientific and Technical Activities."

When using a variety of indices to assess if a sector can serve as a genuine engine of growth, Knowledge Services turn out to be the most "manufacturing-like" sector. These indices include the Hirschman–Rasmussen (HR) linkage indices, the OECD's domestic value-added retention and domestic value-added in foreign demand (EXGR_DVA and FFD_DVA), as well as employment multipliers. Countries that successfully develop Knowledge Services capabilities—such as India in IT services, Ireland in software and business services, or Costa Rica in business process outsourcing—demonstrate that services can drive convergence. The key challenge is that these services require advanced infrastructure (digital connectivity, reliable power), strong tertiary education systems, and often benefit from urbanization economies and knowledge clusters. Many developing countries lack these prerequisites, limiting their ability to scale Knowledge Services.

4.2 Enabling Services (The Trade Facilitators)

Enabling Services comprise transport, storage, wholesale trade, basic finance and insurance, and telecommunications infrastructure. These services are essential for economic integration and participation in GVCs, functioning primarily as intermediate inputs rather than final services. They require moderate skill levels, are subject to network effects and infrastructure constraints, and often exhibit high fixed costs but lower knowledge intensity than Knowledge Services.

Enabling Services are critical enablers of trade and GVC participation. Their expansion allows firms to coordinate complex supply chains, source inputs globally, and reduce transaction costs. However, because these services are largely facilitating in nature, their expansion alone does not guarantee rising domestic value capture. They support both backward integration (importing inputs) and forward integration (delivering services to foreign markets), but the income effects depend on how they combine with other activities. The key distinction from Knowledge Services is that while Enabling Services enable trade, Knowledge Services create value that can be captured domestically. A country with strong logistics (Enabling Services) but weak design and engineering capabilities (Knowledge Services) may see rising export volumes without commensurate income gains—a pattern we analyze in detail below.

A measurement note concerns air transport: in developing-country applications, international air transport can directly earn foreign exchange through tourism and cross-border passenger flows. However, available data do not distinguish domestic from foreign passengers, so the sector is retained in the Enabling Services group for consistency rather than being reclassified.

4.3 Local Services (The Labor Absorbers)

Local Services include retail trade, accommodation and food services, personal care, real estate, public administration, and basic education and health services not integrated with international standards or oriented toward export markets. These services are location-bound and serve primarily domestic demand, require low to moderate skills (with important exceptions discussed below), have limited potential for productivity catch-up, are subject to

Baumol's cost disease (productivity grows slowly while wages rise with economy-wide trends), and claim a high employment share in developing economies.

Local Services are essential for domestic welfare and employment stabilization, but they do not drive export-led growth or productivity convergence. In fact, rapid expansion of Local Services relative to Knowledge Services and Enabling Services can signal stagnation—workers moving from agriculture to low-productivity urban services without genuine structural transformation. While Local Services should not be neglected (they provide livelihoods and social stability), policy makers should focus on expanding Knowledge Services and Enabling Services if the goal is convergence with high-income economies.

However, education and health sectors within this category require special attention and are treated in detail in Section 4.4 below.

4.4 The Special Role of Education and Health: Foundational Investments Versus Labor Absorption

The classification of education and health under Local Services requires explicit clarification, as these sectors fulfill a distinct strategic function compared to retail, hospitality, or personal care. Although education and health are grouped with these activities due to shared characteristics—being largely non-tradable, focused on domestic demand, and, in developing countries, not direct sources of foreign exchange—they nonetheless serve a critical foundational role in enabling the growth of Knowledge Services. This creates an apparent paradox: Local Services that appear peripheral to export-led growth are actually essential prerequisites for the very Knowledge Services that drive such growth.

This paradox can be resolved by focusing on the quality and strategic orientation of each sector. Foundational education and healthcare—universal primary schooling, community clinics, and basic hospital care—are indispensable for social stability and workforce productivity but do not directly generate foreign exchange. In contrast, advanced components such as world-class universities, specialized hospitals, and research centers act as enablers or even direct producers of Knowledge Services. The developmental payoff arises not just from sectoral expansion but from the strategic upgrading of certain subsegments within these sectors to meet international standards and link into global knowledge networks.

For education, this means distinguishing its foundational role from its Knowledge Services potential. Universal access to quality primary and secondary education remains essential for building basic human capital. However, tertiary education—especially in STEM and applied fields—requires strategic focus to supply the technical skills that power ICT, engineering, and professional services industries. Investments must therefore target curriculum redesign, partnerships with industry, faculty quality, and international accreditation, so that graduates meet global competitiveness benchmarks. Similarly, some parts of education are tradable: international student programs, online courses, and educational consulting directly generate export income while reinforcing domestic capability. Unfocused expansion of tertiary education may increase employment in the Local Services category without enhancing international competitiveness.

The same logic applies to health. Primary care fits the Local Services category by maintaining workforce health and productivity, yet advanced health activities—medical tourism,

pharmaceuticals, telemedicine, and international medical training—belong to the Knowledge Services sphere by earning foreign exchange and fostering technological innovation. Effective policy requires balancing universal access with the cultivation of globally competitive segments. True success for both education and health lies not in their employment shares but in their effectiveness as foundations for Knowledge Services competitiveness. Development strategies, therefore, must recognize that high-quality, strategically oriented investments in these sectors are prerequisites for export-led Knowledge Services growth and long-term structural transformation.

4.5 Mapping the Framework to Development Pathways

The three-category services framework clarifies why services performance varies so dramatically across countries. Successful service-led developers such as Ireland, Israel, Singapore, and parts of India built strong Knowledge Services capabilities, often through targeted investments in education, infrastructure, and institutional quality. Their Enabling Services are world-class enablers, and Local Services remain relatively contained.

Middle-income countries facing headwinds, including many Latin American and North African economies, have expanded Enabling Services and Local Services substantially but struggle to scale Knowledge Services. They participate actively in GVCs but capture limited value, leading to the phenomenon we explore in Annex 2: integration without income gains. Low-income countries face the starkest challenge: premature deindustrialization closes the manufacturing pathway before wages rise, while the skill requirements for Knowledge Services remain out of reach. The result is oversized Local Services sectors with stagnant productivity.

This framework suggests that services can replace manufacturing only when Knowledge Services can be successfully developed at scale. For many countries, this requires fundamentally different policies from those that supported manufacturing-led development. We will return to this issue in Section 7.

4.6 The Structural Mechanism: Why Knowledge Services Exhibit Manufacturing-Like Growth Properties

While the three-category classification is empirically motivated, its analytical force ultimately rests on the structural mechanisms that differentiate Knowledge Services from other service activities. This subsection clarifies the economic channels through which Knowledge Services can function as an engine of growth and structural transformation.

Consider a representative sector j producing output:

$$Y_j = A_j F(K_j, H_j, L_j)$$

where H_j denotes human capital and knowledge inputs. In Knowledge Services, the production technology typically exhibits two distinctive properties.

First, there is quasi-scalability. Once fixed investments in human capital and digital infrastructure are made, marginal cost declines or rises slowly with output. Formally, the sector tends toward:

$$\frac{\partial^2 Y_j}{\partial H_j^2} > 0 \ \text{or} \ MC_j' \approx 0$$

in relevant output ranges. By contrast, most Local Services exhibit approximately linear scaling with labor, implying limited scope for sustained productivity growth.

Second, Knowledge Services generate forward productivity spillovers. Let downstream sector k have production:

$$Y_k = A_k F(\alpha_{jk} S_j, X_k)$$

where S_j is knowledge-service input from sector j. When

$$\frac{\partial Y_k}{\partial S_j} > 0$$

and especially when the elasticity exceeds unity in some range, Knowledge Services act as economy-wide productivity multipliers. This mechanism underlies their consistently high Hirschman–Rasmussen forward indices observed in the data.

Third, these sectors are increasingly tradable at scale. Let foreign demand for sector j be

$$X_j^* = D(P_j, Y^*)$$

with high demand elasticity $|\varepsilon|$. When $|\varepsilon|$ is large and delivery costs are low (as in digitally deliverable services), sector expansion is not tightly constrained by domestic market size. This relaxes the Baumol demand constraint that binds many Local Services.

Fourth, Knowledge Services generate appropriable intangible rents. Let domestic income from the sector be

$$GNI_j = (1 - \theta_j) VA_j$$

where θ_j is the share of value-added accruing to foreign owners. High-skill, knowledge-intensive activities typically exhibit lower effective leakage when domestic capability is present, allowing expansion of the sector to translate more directly into national income gains.

Taken together, the interaction of (i) scalability, (ii) forward knowledge spillovers, (iii) tradability with elastic external demand, and (iv) rent capture gives Knowledge Services their "manufacturing-like" growth properties. The framework does not imply that all subsectors within this group will succeed uniformly, nor that Enabling or Local Services are unimportant. Rather, sustained convergence is most likely when economies expand service activities that combine these structural characteristics at scale.

5. Applying the Framework: Evidence from Developed Countries

Having established the three-category services framework and its theoretical foundation, we now demonstrate its practical application using comprehensive data from the EU15[1] economies. The EU15 serves as an ideal benchmark for several reasons: these economies have successfully undergone structural transformation from manufacturing-led to service-intensive growth, achieved high and rising productivity levels, and offer reliable Trade in Value Added (TiVA) and employment (TiM) data from the OECD that allow precise tracing of how different service categories contribute to exports, value capture, and employment generation.

This section walks through the empirical methodology step by step, tracking sectoral GDP and employment shares, productivity, external integration patterns, and employment embodied in foreign demand. Together, these indicators reveal whether services are genuinely driving growth or merely absorbing labor without productivity gains.

5.1 Sectoral Shares in GDP and Employment: The Structural Shift Toward Knowledge Services

The most recent OECD data indicate coverage through 2022 for value added and through 2020 for employment. As 2020 data are affected by the pandemic, they should be interpreted with caution.

Table 3 of Annex 1 decomposes EU15 GDP by services category for 2012–2022. The most distinctive feature is the steady rise of Knowledge Services—centered on Information and Communication (J), Professional, Scientific and Technical Activities (M), and Administrative and Support Services (N)—from approximately 15.6 percent of GDP in 2012 to 17.4 percent in 2022. Within this group, Sections M and N account for most of the expansion, while Section J grows more modestly from 4.9 to 5.3 percent—still meaningful growth in an already substantial sector.

This pattern reflects deepening digitalization, growing business complexity, and the rising value captured by firms providing design, engineering, software, and consulting inputs to both manufacturing and other service sectors. Crucially, this is not cyclical variation: it represents a structural shift toward services that support high-value production and exports.

Enabling Services (Transport and Storage plus Finance and Insurance) account for approximately 10.7 percent of GDP in 2012 and 10.3 percent in 2022, edging down slightly. Finance and insurance contracts from 5.8 to 5.2 percent while transport and storage remains roughly stable, dipping in 2020 before partially recovering. This stability is consistent with a

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[1] The EU15 refers to European Union members prior to the 2004 enlargement—generally more established, high-income economies that set benchmarks in economic maturity, labor standards, and wages.

mature economy where enabling services are already large, well-developed, and efficient—their quality and productivity can improve even as their GDP share remains constant, as automation and consolidation allow them to support a growing export base without proportional expansion.

Local Services remain the largest component at roughly 48 percent in 2012 and 46.5 percent in 2022, even as the total services share of GDP holds steady at around 74 percent. The EU15 benchmark is therefore not simply that "services are large," but that within services, the modern tradable and business-services segment is both large and rising. Economies that expand services without shifting composition toward Knowledge Services risk rising service employment shares without gains in productivity or income per capita.

OECD Trade in Employment (TiM) data reveal a parallel labor shift. Services rise from 76.0 percent of EU15 total employment in 2010 to 77.9 percent in 2020, while manufacturing declines from 12.9 to 12.0 percent and agriculture from 3.1 to 2.6 percent. This represents structural reallocation rather than a purely post-crisis cyclical phenomenon.

Table 5 of Annex 1 decomposes services employment into the three categories. Knowledge Services increase from 15.6 to 17.7 percent of total EU15 employment, with gains in ICT (2.9 to 3.3 percent) and professional and technical activities (12.8 to 14.4 percent), consistent with firms requiring more IT specialists, data analysts, logistics coordinators, and compliance managers as they deepen GVC participation.

Enabling Services remain essentially flat at 7.7 to 7.5 percent. Transport edges up slightly, reflecting e-commerce and supply chain reorganization, while financial and insurance employment declines from 2.9 to 2.6 percent as technology adoption and consolidation reduce labor intensity.

Local Services remain the large employment reservoir at approximately 52.6 percent in both 2010 and 2020, though with internal reallocation: health and social work expands from 11.1 to 12.1 percent due to demographic pressures, while retail and wholesale trade declines from 15.0 to 14.3 percent due to automation and e-commerce. Accommodation and food services rises gradually to 5.9 percent of total employment in 2019 before falling sharply to 5.3 percent in 2020 under pandemic restrictions.

Successful service-led development does not require abandoning labor-absorbing services, but it does require high-productivity tradable segments growing faster than low-productivity ones.

5.2 Productivity by Service Category: The Value-Added Dimension

Table 6 reports value added per worker in thousands of US dollars. Finance and insurance leads all service categories (except real estate, see below) at approximately $166–183

thousand over the decade—peaking around $183 thousand in 2014 before dipping to $156 thousand in 2016 and recovering to $168 thousand by 2020. This reflects digitalization and consolidation raising measured productivity while reducing headcount: automation of routine banking, branch network consolidation, and fintech adoption all contribute.

Knowledge Services sustain comparatively elevated productivity. Critically, productivity remains elevated even as employment expands, confirming that these are genuinely scalable activities rather than sectors simply absorbing surplus labor. The information and communication sector operates at high productivity levels, while professional activities show moderate value added per worker; administrative services have the lowest productivity within this group.

Enabling Services show a contrast between finance (high, as noted) and transport. Transport and storage exhibits moderate productivity early in the decade, peaking in 2014 before declining to about $68 thousand in 2020, reflecting margin compression, capacity adjustments, and pandemic disruption to mobility and logistics.

Local Services cluster at the low end. Wholesale and retail trade holds near $57–65 thousand with a modest mid-decade decline and recovery. Accommodation and food services is consistently the lowest-productivity activity in the sector, falling sharply from approximately $43–46 thousand to around $26 thousand in 2020—a dramatic decline highlighting extreme pandemic exposure. Public services and health sit in the $50–86 thousand range, constrained by the labor-intensive nature of teaching and healthcare. Real estate appears as an outlier at $790–910 thousand, but this reflects capital income and imputed rents divided by a small workforce rather than conventional labor productivity.

Overall, Table 6 confirms that the EU15 service transformation involves a widening separation between modern, scalable business services with high productivity and labor-absorbing, contact-intensive activities with persistently low or declining productivity.

5.3 External Integration

Two TiVA indicators measure external orientation. Domestic Value Added in Exports (EXGR_DVA) is a domestic value retention indicator measuring how much domestic value added is embodied in a country's exports. It is defined as the complement of EXGR_FVA, the conventional indicator for import intensity (EXGR_DVA = 1 − EXGR_FVA). Although the direction of the two indicators is opposite, both EXGR_DVA and EXGR_FVA are backward measures (domestic and foreign input shares, respectively). Both ask the same backward-looking question—"what went into making these exports?"—but attribute the answer to different origins. A higher EXGR_DVA signals greater reliance on domestic inputs in export production. Annex 2 explains these indicators in detail.

On the other hand, FFD_DVA (Domestic Value Added in Foreign Final Demand) is a forward-linkage indicator measuring how much domestic value added is ultimately absorbed by foreign final demand, regardless of whether exports are direct or indirect. Because the two indicators are normalized against different denominators—exports for EXGR_DVA and value added for FFD_DVA—they should not be compared in levels but rather interpreted within their respective conceptual domains.

Table 7 shows that Knowledge Services exhibit the strongest and most steadily rising EXGR_DVA, reflecting their deepening role as upstream inputs in export-oriented production. ICT and professional and technical services become increasingly embedded in manufacturing and advanced service exports throughout 2012–2022, indicating that EU15 export growth is becoming progressively more knowledge-intensive.

Enabling Services also display high domestic value added embodied in exports, particularly in transport, logistics, and finance. Their contribution remains robust and relatively stable, reflecting their structural role as trade infrastructure—every export relies on transport, storage, and financial intermediation. Their EXGR_DVA does not rise as sharply as Knowledge Services, likely reflecting sectoral maturity rather than declining importance.

Local Services remain peripheral in the domestic value retention dimension, with low and largely unchanged EXGR_DVA, as retail, real estate, and most personal and public services do not enter export production chains in significant ways.

Table 8 on FFD_DVA tells a consistent story. Knowledge Services show a strong and gradually increasing presence in foreign final demand, through both direct exports of high-value services and their embedding in goods and services ultimately consumed abroad. Enabling Services contribute more modestly and evolve more slowly, consistent with their facilitating rather than directly income-capturing role. Local Services show minimal forward integration, with little change over time.

5.4 External Demand Linkages: Employment Embodied in Exports and Foreign Final Demand

Tables 9 and 10 translate the integration measures into employment terms. EXGR_DEM attributes domestic employment to gross exports (domestic value retention employment intensity, expressed as a percentage of sector employment). FFD_DEM attributes employment to foreign final demand (forward-integration employment intensity). These indicators reveal not just which services are productive, but which ones are actually driving export-led income growth through employment sustained by foreign demand. As noted earlier, 2020 is the most recent year for which OECD employment data are available.

For Knowledge Services, domestic value retention employment intensity rises steadily from 2010 through roughly 2017–2018. Information and communication increases from about 12.8

percent to 18.8 percent in 2017 before easing to 17.2 percent in 2020; computer programming rises from 12.3 to 18.1 percent by 2017 and remains elevated at 16.7 percent in 2020; professional, scientific and technical activities increase from 11.6 percent to the mid-14s by 2015–2019, holding near 14.5 percent in 2020. The group shows a clear increase in how much of its employment base is "export-activated," consistent with deepening servicification of exports, followed by a mild retrenchment in 2020.

For Enabling Services, the pattern is similar in direction but shaped by extreme outliers in international transport. Financial and insurance activities increase strongly from 18.1 to 23.2 percent of employment over the decade, implying a growing fraction of finance employment is tied to export activity and cross-border production networks. Water and air transport report values well above 100 percent, which should be interpreted as indicating overwhelmingly export-oriented exposure in these small subsectors rather than literal headcounts.

Within Local Services, wholesale and retail trade shows a meaningful export connection—domestic value retention employment share rises from 17.0 to 19.7 percent, reflecting tight coupling between distribution networks and export-oriented supply chains. Administrative and support services rise from 6.9 to 10.0 percent. Accommodation and food services, by contrast, drops sharply in 2020 from around 10 percent pre-pandemic to about 5.2 percent, a clear pandemic signature as international demand and cross-border mobility collapsed.

Table 10 on forward-integration employment (FFD_DEM) tells a reinforcing story. In Knowledge Services, the increase is broad-based and persistent: computer programming moves from 17.1 percent in 2010 to around 22 percent by 2017–2019 and remains at 21.7 percent in 2020; professional, scientific and technical activities climb from 19.3 to 22.6 percent by 2020, ending clearly above their starting point. Administrative and support services rise from 18.3 to 23.2 percent.

In Enabling Services, transportation and storage rises from 22.6 to around 25.5 percent, warehousing reaches 27.2 percent, and financial and insurance activities rise from 18.0 to 22.9 percent. Water and air transport show forward-exposed shares roughly in the 45–60 percent range, underscoring their structural orientation toward international markets.

In Local Services, wholesale and retail trade is notably high at 22.2 percent by 2020—a reminder that distribution is a key interface between domestic production and foreign demand. Real estate, public administration, education, and health remain low throughout, confirming that EU15 forward-integration employment is not concentrated in these sectors.

6. The Role of Services in the Domestic Economy: Hirschman–Rasmussen Indices and Employment Multipliers

The preceding analysis examined the role of services from the perspective of international integration using inter-country input–output tables. This section approaches the same issue through the traditional national input–output framework. Specifically, the Hirschman–Rasmussen (HR) backward and forward linkage indices and the employment multipliers are calculated and presented in Tables 11 and 12 of Annex 1. The HR indices—rooted in the structural economics of Albert O. Hirschman and formalized within national input–output analysis—measure the extent to which a sector is interconnected with the rest of the national economy, either as a demander of inputs from other sectors (backward linkages) or as a supplier of inputs to other sectors (forward linkages). The relationship between these indicators and those discussed in the previous section is explained in detail in Annex 3.

The Hirschman–Rasmussen indices and employment multipliers require a Leontief inverse matrix unavailable for the EU15 aggregate. Therefore, we use the United States as a benchmark. In addition to avoiding the arbitrary decision to select one out of the 15 economies, the U.S. choice offers a useful corrective against a subtler distortion: since EU15 economies are geographically close to the North African countries under study, using them alone as a benchmark risks conflating developmental distance with physical proximity. The United States, as a high-income economy at a remove from the region, provides an independent reference point that helps isolate structural performance from the accidents of geography.

To calculate these indices, one has to take a vector of value added to output ratio and multiply it by the Leontief inverse matrix and then normalize this result by the average of all sectors. An HR index above 1 indicates that the sector has higher-than-average backward or forward linkages within the economy. Similarly, the employment multiplier is obtained by multiplying a vector of employment-to-output ratios by the Leontief inverse matrix and again normalizing by the average for all sectors. Employment multipliers are shown in Table 13 of Annex 1.

Across the period 2012–2021, the U.S. Hirschman–Rasmussen (HR) backward indices and Leontief employment multipliers display a clear and persistent hierarchy across the three service groupings, consistent with the structural roles typically attributed to each category. Knowledge Services remain tightly clustered around unity in the backward index, with only minor year-to-year fluctuations. This stability indicates that these sectors are deeply embedded in the production network but do not rely heavily on domestic intermediate inputs relative to the economy-wide average. The pattern suggests maturity and strong internal efficiency rather than expanding domestic linkage intensity. Over time, there is no structural break—only mild cyclical movement—reinforcing the view that U.S. Knowledge Services operate as highly optimized, globally integrated activities.

Enabling Services exhibit moderately higher and somewhat more variable backward linkages and employment multipliers than Knowledge Services. Their indices typically sit above unity and show modest upward drift in several years, reflecting their role as connective infrastructure within the economy (transport, finance, logistics). The employment multipliers for this group tend to be stronger than for Knowledge Services, indicating broader indirect job creation through supply chains. However, the trend is evolutionary rather than transformative: changes are incremental, suggesting that the U.S. system of enabling services is already highly developed and operates near its structural frontier.

Local Services stand out with the highest backward linkage values and the largest employment multipliers, but also with the greatest volatility. Their stronger multipliers reflect labor intensity and extensive domestic input use, which mechanically generates larger indirect employment effects. Yet this strength should be interpreted cautiously: the high linkage values do not translate into export dynamism or productivity leadership. Over time, the Local Services group shows some cyclical sensitivity—particularly around the late-decade and pandemic years—indicating greater exposure to domestic demand conditions compared with the more globally anchored Knowledge Services.

Taken together, the U.S. evidence reveals a structurally balanced but differentiated service economy. Knowledge Services provide stable, high-productivity nodes with limited but efficient domestic pull; Enabling Services function as the connective tissue with moderate multiplier strength; and Local Services generate the largest employment ripple effects but with weaker strategic positioning. The time trends are notably smooth across all three groups, underscoring the maturity of the U.S. service ecosystem and the absence of major structural reallocation during the 2012–2021 period.

7. Synthesis: What the Benchmarks Reveal About Successful Service-Led Development

The EU15 evidence establishes a coherent pattern that validates the three-category framework. Knowledge Services exhibit strong and rising performance across all key dimensions: high and increasing domestic value retention (EXGR_DVA), even stronger forward integration with growing capture of foreign final demand (FFD_DVA), expanding GDP and employment shares, sustained high productivity, and rapidly rising export-embodied employment. This convergence of positive indicators demonstrates that Knowledge Services are genuinely driving productivity growth, income gains, and structural transformation.

Enabling Services fulfil a critical but different function. They exhibit strong domestic value retention as essential inputs to export production but weaker forward integration, stable or declining GDP and employment shares, and highly variable productivity (very high for finance, moderate to declining for transport). These services are necessary for competitiveness but

not sufficient for convergence on their own. Local Services remain large in GDP and employment yet contribute minimally to export-led growth: integration indicators are weak, productivity is low or declining, and employment linked to foreign demand is either stagnant or falling.

The EU15 benchmark is therefore not simply "high service share" but rather a "shift in composition within services toward Knowledge Services." The total services share of GDP and employment rises, but within services, Knowledge Services expand faster than Local Services, preventing the productivity stagnation that would occur if service expansion were concentrated in low-productivity activities. For developing economies, this implies deliberate policies to expand Knowledge Services capabilities—investing in education aligned with ICT and professional services needs, building digital infrastructure, creating urban business-service clusters, and ensuring trade and investment policies support rather than hinder this expansion.

Internationally, Knowledge Services stand out for their high and rising domestic value added embodied in exports (EXGR_DVA): EU15 ICT, professional services, and computer programming increasingly supply domestically produced inputs into export-oriented manufacturing and advanced service chains—they are, in effect, the economy's upstream knowledge content.

The U.S. evidence strongly reinforces—and in several respects sharpens—the structural pattern identified for the EU15. As in Europe, Knowledge Services in the United States clearly occupy the system's strategic upstream position. Their HR forward indices are the highest of the three groups and remain remarkably stable through 2012–2021, confirming that these sectors function as key productivity-enhancing inputs for the rest of the economy. At the same time, their backward indices remain below or near unity, reflecting their relatively self-contained production structure. This is fully consistent with the EU15 interpretation: Knowledge Services do not need dense domestic input use to play a transformative role; their importance lies in the strength of their forward spillovers and their embedding in high-value export chains.

Enabling Services in the U.S. again mirror the European pattern but with even clearer "infrastructure" characteristics. Their backward linkages are moderately strong and their employment multipliers exceed those of Knowledge Services, indicating broader domestic supply-chain effects. Yet their forward indices, while above average, remain below the Knowledge Services frontier. This confirms the same functional distinction seen in the EU15: these sectors are essential connective tissue for competitiveness and trade facilitation, but they are not themselves the primary engines of productivity convergence. The time series shows only gradual movement, underscoring that in a mature economy these capabilities are already deeply institutionalized.

The most instructive parallel concerns Local Services. In the United States, as in the EU15, they generate the highest employment multipliers and display relatively strong backward linkages, reflecting their labor intensity and deep domestic embedding. However, their forward linkages remain weak and largely flat over time. This reproduces the central tension highlighted in the EU15 analysis: sectors that maximize domestic employment effects are not the ones that drive export dynamism or productivity upgrading. The U.S. data therefore provide an important robustness check—showing that even in the world's most advanced service economy, high job multipliers are concentrated in activities that are structurally insulated from the global productivity frontier.

Taken together, the U.S. case validates the EU15 benchmark in a particularly clear way. The key developmental signal is not the overall size of services but the internal reweighting toward Knowledge Services with strong forward spillovers. Both economies exhibit the same three-tier architecture: Knowledge Services as the strategic growth core, Enabling Services as necessary infrastructure, and Local Services as employment absorbers with limited convergence potential. For developing countries, the implication is reinforced rather than weakened by the U.S. evidence: pursuing services-led development without deliberately expanding Knowledge Services capabilities risks locking economies into high-employment but low-convergence service structures.

7.1 Interpreting the Benchmark Evidence: Causality, Co-Determination, and Structural Maturity

The EU15 and U.S. patterns documented above should be interpreted with appropriate caution regarding causality. The observed association between rising Knowledge Services shares and high-income levels does not, by itself, establish that expansion of these services caused advanced-economy status. Reverse causality and co-determination are both plausible: richer economies possess the human capital, institutional quality, and digital infrastructure that facilitate the growth of Knowledge Services.

Three considerations, however, support the interpretation that service composition plays an independent and policy-relevant role.

First, the EU15 and U.S. evidence reveals not merely high levels of Knowledge Services but a systematic within-services compositional shift over time, even among already high-income economies. The increase in the Knowledge Services share alongside relatively stable Enabling Services and gradually declining Local Services suggests an ongoing structural reallocation rather than a static income-level artifact. If Knowledge Services were purely a by-product of income, one would expect more stability in their internal composition at advanced stages of development.

Second, cross-country experience outside the EU15—most notably in economies such as India, Ireland, Israel, and Costa Rica—shows episodes in which rapid expansion of tradable

business services preceded or accompanied broader productivity gains. While not constituting definitive causal proof, these cases are consistent with the mechanism that knowledge-intensive services can function as growth accelerators when supporting conditions are present.

Third, the analytical contribution of the framework is primarily diagnostic rather than monocausal. The claim is not that expanding Knowledge Services mechanically guarantees convergence, but that countries whose service expansion is concentrated in Local and purely facilitating activities face structural headwinds in generating sustained productivity growth and foreign-exchange earnings. In this sense, service composition is best viewed as a necessary—though not sufficient—condition for successful service-led development.

Accordingly, the EU15 and U.S. benchmarks should be interpreted as identifying a structural pattern associated with successful high-income service economies, rather than as a reduced-form causal estimate. Future work using panel methods or natural experiments could further disentangle directionality, but the compositional evidence already provides actionable guidance for development strategy.

7.2 Empirical Patterns and Summary

Applied to developing countries, the framework identifies whether GVC participation is building toward Pattern A (advanced economy convergence) or becoming locked into Pattern B (assembly without value capture). The diagnosis proceeds through four steps: analyzing the sectoral decomposition of domestic value retention to determine whether declining EXGR_DVA is concentrated in industries where the country has weak Knowledge Services; tracking whether domestic value retention is rising, flat, or falling over time; evaluating FFD_DVA performance to assess whether domestic services are being embedded in global production or merely facilitating others' value creation; and examining employment and productivity trends to determine whether services jobs are concentrating in low productivity Local Services (signaling structural failure) or expanding in Knowledge Services.

The key diagnostic insight is that domestic value retention can rise without income gains precisely when Enabling Services expand without parallel Knowledge Services development. Expansion of Enabling Services facilitates imports and coordination but does not raise domestic value retention on its own. The expansion of Knowledge Services is the critical variable: it embeds domestic knowledge in exports, raises EXGR_DVA, and generates the forward linkages (FFD_DVA) that translate trade integration into sustained income gains. Local Services dominance signals a failure of structural transformation—workers shifting from agriculture to low-productivity urban services without the economy developing tradable, knowledge-intensive capabilities.

8. Limitations and Directions for Future Research

The proposed methodology is demanding in both data and institutional capacity, which limits its immediate applicability in many developing countries. Its full implementation relies heavily on detailed inter-country input-output tables—particularly for computing domestic value retention and forward integration (EXGR_DVA and FFD_DVA)—yet such infrastructure is available mainly for OECD members and a subset of emerging economies. Countries outside these databases would need significant investments in enterprise surveys, trade data reconciliation, and statistical harmonization to replicate comparable systems. Moreover, input-output tables are often updated infrequently, meaning structural coefficients may lag behind recent technological or value-chain changes. While this is generally acceptable for diagnosing medium-term structural patterns, it reduces precision when evaluating short-term shocks or recent policy interventions.

Beyond data availability, the approach requires substantial analytical expertise in input-output techniques and value-added trade accounting that many national statistical offices currently lack. Initial implementation will therefore often depend on international technical assistance—from organizations such as the OECD, World Bank, IMF, regional development banks, and PCNS—to provide training, methodological support, and knowledge sharing. Over time, building regional centers of excellence could help internalize these capabilities and reduce reliance on external support.

Future research should focus on six priorities: improving service-sector statistical disaggregation (ideally to two-digit ISIC levels); developing simplified methods that approximate TiVA indicators with limited data; constructing long-run panel datasets to study service-led structural transformation; examining the education and health foundations of Knowledge Services growth; analyzing the political economy conditions that enable successful service upgrading; and extending the framework to better capture complementarities between Knowledge Services and remaining manufacturing capabilities. Together, these efforts would broaden the framework's empirical reach and strengthen its policy relevance for developing economies.

References

- Baumol, W. J. (1967). Macroeconomics of unbalanced growth: The anatomy of urban crisis. *American Economic Review, 57*(3), 415–426.
- El Aynaoui, K., & Dinh, H. T., (2024, December 18). *Développer le nouveau Sud après le consensus de Washington*. Le Grand Continent. https://legrandcontinent.eu/fr/2024/12/18/developper-le-nouveau-sud-apres-le-consensus-de-washington/
- Kuznets, S. (1971). *Economic growth of nations: Total output and production structure*. Harvard University Press.
- Rajan, R. G. (2025, January 3). Economic development in a protectionist world. *Project Syndicate*. https://www.project-syndicate.org/commentary/protectionist-world-means-developing-countries-need-services-exports-by-raghuram-g-rajan-2025-01
- Rodrik, D. (2016). Premature deindustrialization. *Journal of Economic Growth, 21*, 1–33. https://doi.org/10.1007/s10887-015-9122-3
- Rodrik, D., & Stiglitz, J. E. (2024). A new growth strategy for developing nations. In L. Y. Ing & D. Rodrik (Eds.), *The new global economic order*. Routledge. https://drodrik.scholars.harvard.edu/sites/g/files/omnuum7106/files/2025-10/A%20New%20Growth%20Strategy%20for%20Developing%20Nations%20(Rodrik%20and%20Stiglitz).pdf
- Timmer, P. (2012). The mathematics of structural transformation. In *Patterns of growth and structural transformation in Africa: Trends and lessons for future development strategies*. IFPRI West & Central Africa Office, Thematic Research Note 02.

Annex 1

Table 3:

Service Category Shares in GDP, EU15, 2012-2022 (in percent)

SHARES BY SERVICE GROUPS	Services Shares in GDP										
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Knowledge Services	15.6%	15.8%	16.0%	16.3%	16.5%	16.6%	17.0%	17.1%	17.3%	17.6%	17.4%
Information and communication	4.9%	4.8%	4.8%	4.9%	4.9%	4.9%	5.1%	5.2%	5.5%	5.5%	5.3%
Publishing, motion picture, video, televi	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.2%	1.3%	1.2%
Telecommunications	1.5%	1.4%	1.3%	1.3%	1.3%	1.2%	1.2%	1.2%	1.2%	1.1%	1.0%
Computer programming, consultancy, a	0.4%	0.4%	0.4%	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Other information and communication	1.8%	1.9%	1.9%	2.0%	2.0%	2.0%	2.2%	2.3%	2.6%	2.7%	2.6%
Professional, scientific and technical activities	6.5%	6.7%	6.7%	6.8%	6.8%	6.9%	7.0%	7.0%	7.3%	7.4%	7.3%
Administrative and support service activities	4.2%	4.3%	4.5%	4.6%	4.7%	4.8%	4.9%	4.9%	4.6%	4.7%	4.8%
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Enabling Services	10.7%	10.7%	10.8%	10.6%	10.4%	10.2%	10.0%	9.9%	9.7%	10.0%	10.3%
Transportation and storage	4.9%	4.9%	4.9%	4.9%	4.8%	4.8%	4.7%	4.8%	4.3%	4.6%	5.1%
Land transport and transport via pipelin	2.2%	2.2%	2.2%	2.1%	2.1%	2.1%	2.0%	2.1%	1.9%	1.9%	2.1%
Water transport	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.4%	0.6%
Air transport	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.1%	0.2%	0.2%
Warehousing and support activities for	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.6%	1.7%	1.8%
Postal and courier activities	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.5%	0.4%	0.4%
Financial and insurance activities	5.8%	5.7%	5.8%	5.7%	5.6%	5.4%	5.3%	5.1%	5.4%	5.4%	5.2%
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Local Services	48.0%	48.0%	48.0%	47.7%	47.8%	47.6%	47.4%	47.5%	47.7%	47.0%	46.5%
Wholesale and retail trade; repair of motor vehicle	10.9%	10.9%	10.9%	10.9%	11.0%	11.0%	11.0%	11.0%	11.2%	11.3%	11.3%
Accommodation and food service activities	2.7%	2.7%	2.7%	2.7%	2.8%	2.9%	2.9%	3.0%	1.8%	2.0%	2.6%
Real estate activities	11.5%	11.6%	11.7%	11.7%	11.7%	11.5%	11.5%	11.4%	11.9%	11.3%	10.9%
Public administration and defence; compulsory so	6.5%	6.5%	6.4%	6.2%	6.2%	6.1%	6.1%	6.1%	6.5%	6.2%	6.0%
Education	5.2%	5.2%	5.2%	5.1%	5.1%	5.0%	5.0%	5.0%	5.3%	5.1%	5.0%
Human health and social work activities	7.6%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	8.2%	8.1%	7.8%
Arts, entertainment and recreation; Other service	3.4%	3.5%	3.4%	3.4%	3.4%	3.4%	3.4%	3.3%	3.0%	2.9%	3.0%
TOTAL SERVICES (Group 1,2,and 3)	74.3%	74.5%	74.8%	74.7%	74.7%	74.4%	74.4%	74.5%	74.8%	74.6%	74.3%

Source: Author's calculations from OECD (2025), "Trade in Value Added (TiVA)", https://stats.oecd.org (accessed on January 31, 2026).

Table 4:

Employment Shares by Broad Sector, EU15, 2010-2020 (level and percent of total employment)

EU15 Employment by Sector 2010-2020	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total - all sectors (in thousands)	180,366.8	180,797.9	180,555.5	180,226.4	182,054.1	183,979.0	186,588.3	189,335.1	192,247.2	194,697.4	191,942.3
Agriculture, forestry and fishing	5,523.5	5,443.9	5,388.4	5,283.7	5,336.0	5,243.7	5,240.9	5,245.9	5,220.1	5,111.5	4,999.6
Mining and quarrying	285.2	278.8	287.8	275.2	267.0	264.5	243.7	234.2	235.1	232.2	226.0
Manufacturing	23,265.5	23,219.7	23,022.4	22,703.3	22,649.1	22,642.1	22,775.7	22,992.6	23,345.0	23,565.4	23,053.9
Utilities and others	14,290.5	13,989.6	13,569.9	13,240.5	13,206.4	13,296.0	13,448.5	13,693.9	13,978.5	14,298.0	14,209.4
Services	137,002.1	137,865.9	138,287.0	138,723.7	140,595.6	142,532.7	144,879.5	147,168.5	149,468.5	151,490.3	149,453.4
Total - all sectors (% of total)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agriculture, forestry and fishing	3.1%	3.0%	3.0%	2.9%	2.9%	2.9%	2.8%	2.8%	2.7%	2.6%	2.6%
Mining and quarrying	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Manufacturing	12.9%	12.8%	12.8%	12.6%	12.4%	12.3%	12.2%	12.1%	12.1%	12.1%	12.0%
Utilities and others	7.9%	7.7%	7.5%	7.3%	7.3%	7.2%	7.2%	7.2%	7.3%	7.3%	7.4%
Services	76.0%	76.3%	76.6%	77.0%	77.2%	77.5%	77.6%	77.7%	77.7%	77.8%	77.9%

Source: Author's calculations from OECD (2025), "Trade in Employment (TiM)", https://stats.oecd.org (accessed on January 31, 2026).

Table 5:

Services Employment by Category, EU15, 2010-2020 (percent of total employment)

% of Total Employment of the Economy	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EU15: Knowledge Services	15.6%	16.0%	16.2%	16.4%	16.7%	17.0%	17.2%	17.5%	17.6%	17.7%	17.7%
Information and communication	2.9%	2.9%	2.9%	3.0%	3.0%	3.0%	3.0%	3.1%	3.1%	3.2%	3.3%
Publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities											
Telecommunications											
Computer programming, consultancy, and information service activities											
Professional, scientific and technical activi	6.3%	6.3%	6.5%	6.6%	6.7%	6.8%	6.8%	6.8%	6.9%	7.0%	7.2%
Administrative and support service activitie	6.5%	6.7%	6.8%	6.8%	7.0%	7.1%	7.3%	7.5%	7.6%	7.5%	7.2%
EU15: Enabling Services	7.7%	7.7%	7.7%	7.6%	7.6%	7.5%	7.5%	7.5%	7.4%	7.5%	7.5%
Transportation and storage	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.9%	4.9%	5.0%
Land transport and transport via pipelines											
Water transport											
Air transport											
Warehousing and support activities for transportation											
Postal and courier activities											
Financial and insurance activities	2.9%	2.9%	2.9%	2.8%	2.8%	2.7%	2.7%	2.6%	2.6%	2.5%	2.6%
EU15: Local Services	52.6%	52.6%	52.7%	52.9%	53.0%	53.0%	52.9%	52.8%	52.7%	52.7%	52.6%
Wholesale and retail trade; repair of moto	15.0%	15.0%	15.0%	14.8%	14.7%	14.7%	14.6%	14.5%	14.4%	14.3%	14.3%
Accommodation and food service activitie	5.0%	5.1%	5.1%	5.2%	5.3%	5.4%	5.6%	5.7%	5.8%	5.9%	5.3%
Real estate activities	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.2%	1.2%
Public administration and defence; compu	6.9%	6.7%	6.6%	6.6%	6.5%	6.4%	6.3%	6.2%	6.2%	6.2%	6.3%
Education	6.9%	6.8%	6.8%	6.9%	6.9%	6.9%	6.9%	6.9%	6.8%	6.8%	6.9%
Human health and social work activities	11.1%	11.3%	11.4%	11.6%	11.6%	11.7%	11.7%	11.8%	11.8%	11.8%	12.1%
Arts, entertainment and recreation; Other	6.6%	6.6%	6.7%	6.7%	6.8%	6.7%	6.7%	6.7%	6.6%	6.6%	6.5%
Total All Three Groups	76.0%	76.3%	76.6%	77.0%	77.2%	77.5%	77.6%	77.7%	77.7%	77.8%	77.9%

Source: Author's calculations from OECD (2025), "Trade in Employment (TiM)", https://stats.oecd.org (accessed on January 31, 2026).

Table 6:

Value Added Per Worker by Service Category, EU15, 2010-2020 (thousand USD)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ANALYSIS BY GROUPS	Value Added per Worker ($000)										
EU15: Knowledge Services											
Information and communication	135.7	144.7	135.7	139.0	141.2	123.1	122.5	123.9	133.0	130.3	132.6
Publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities											
Telecommunications											
Computer programming, consultancy, and information service activities											
Professional, scientific and technical activi	83.4	89.0	82.7	86.2	86.9	76.4	75.5	78.9	84.3	80.0	80.2
Administrative and support service activitie	51.1	53.9	50.8	54.5	56.6	49.3	48.8	49.5	53.2	52.4	50.3
EU15: Enabling Services											
Transportation and storage	83.1	88.2	83.5	88.5	90.9	77.9	74.8	77.5	80.4	77.7	68.0
Land transport and transport via pipelines											
Water transport											
Air transport											
Warehousing and support activities for transportation											
Postal and courier activities											
Financial and insurance activities	166.1	174.6	165.9	172.6	183.2	158.9	156.3	160.7	170.3	162.4	167.8
EU15: Local Services											
Wholesale and retail trade; repair of moto	59.5	64.2	60.0	62.7	65.1	56.8	56.7	59.3	63.2	61.6	62.1
Accommodation and food service activities	43.1	46.2	43.3	44.2	44.5	38.5	38.3	39.5	41.8	40.5	26.5
Real estate activities	828.6	907.5	856.2	891.2	917.4	796.0	787.8	793.4	830.0	791.6	799.6
Public administration and defence; compul	78.8	85.4	81.8	85.1	86.4	74.1	74.2	76.6	81.2	78.7	81.0
Education	61.9	65.9	62.4	64.6	65.7	56.4	55.2	56.9	60.4	58.9	60.3
Human health and social work activities	54.5	57.8	54.7	56.7	57.9	50.0	49.7	51.0	53.8	52.4	53.6
Arts, entertainment and recreation; Other	124.9	134.2	124.7	129.2	130.7	112.9	110.9	114.7	121.4	117.4	104.5

Source: Author's calculations from OECD (2025), "Trade in Value-Added (TiVA)" and "Trade in Employment (TiM)", https://stats.oecd.org (accessed on January 31, 2026).

Table 7:

Domestic Value Retention (EXGR_DVA) by Service Category, EU15, 2012-2022

SHARES BY SERVICE GROUPS	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Knowledge Services											
Information and communication	87.8	87.5	86.7	85.8	86.3	85.4	84.4	83.7	82.6	83.1	82.5
Publishing, motion picture, video, television programme production; sour	90.7	90.7	90.5	89.0	88.7	87.6	88.5	87.7	86.8	85.8	85.6
Telecommunications	91.7	91.6	91.9	91.7	91.9	91.4	91.6	91.4	91.4	90.3	88.7
Computer programming, consultancy, and information service activities	84.6	84.2	83.3	82.4	83.5	82.6	80.8	79.9	78.6	80.2	79.7
Professional, scientific and technical activities	93.5	93.6	93.5	93.1	93.0	92.8	92.4	91.7	91.8	91.4	89.6
Administrative and support service activities	92.1	92.5	93.0	93.3	93.4	92.7	92.4	92.0	92.8	92.0	90.4
EU15: Enabling Services											
Transportation and storage	77.5	78.9	79.6	81.4	82.1	80.7	78.4	78.5	80.7	80.0	79.0
Land transport and transport via pipelines	86.7	87.4	88.2	89.1	89.7	89.2	88.3	88.4	89.6	87.7	85.4
Water transport	73.1	74.3	75.2	75.7	75.3	72.8	69.5	69.6	73.3	74.1	75.2
Air transport	70.0	71.5	72.0	76.7	78.4	77.9	75.6	75.3	78.5	76.9	75.3
Warehousing and support activities for transportation	89.5	89.7	90.1	90.2	90.5	90.0	89.1	89.2	89.0	88.3	85.9
Postal and courier activities	90.7	90.9	91.1	91.3	91.5	90.1	82.2	84.6	83.8	85.3	83.5
Financial and insurance activities	90.6	90.4	89.8	88.9	88.6	87.7	87.6	86.3	85.9	86.5	85.4
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Local Services											
Wholesale and retail trade; repair of motor vehicles and motorcycles	92.7	92.9	93.1	93.1	93.3	93.0	92.7	92.5	92.9	92.2	90.8
Accommodation and food service activities	92.6	92.7	93.0	93.0	93.2	93.0	92.8	92.8	92.7	92.0	90.2
Real estate activities	96.9	97.1	97.1	96.8	96.8	96.6	96.9	96.8	95.8	96.2	96.3
Public administration and defence; compulsory social security	95.1	95.2	95.4	95.3	95.5	95.4	95.1	95.0	95.1	94.7	93.9
Education	96.4	96.6	96.7	96.8	96.8	96.7	96.7	96.6	96.5	96.3	95.6
Human health and social work activities	95.2	95.3	95.3	94.8	94.9	94.8	94.6	94.7	94.9	94.3	93.3
Arts, entertainment and recreation; Other service activities; Activities of households	93.8	94.0	94.2	94.1	94.2	93.9	93.7	93.7	93.6	92.9	91.6

TOTAL SERVICES (Group 1,2,and 3)

Source: Author's calculations from OECD (2025), "Trade in Value Added (TiVA)", https://stats.oecd.org (accessed on January 31, 2026).

Table 8:

Forward Integration (FFD_DVA) by Service Category, EU15, 2012-2022

SHARES BY SERVICE GROUPS	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Knowledge Services											
Information and communication	18.1	18.5	19.1	20.6	20.7	21.7	22.3	23.1	23.2	24.2	25.6
Publishing, motion picture, video, television p	17.8	18.3	18.8	20.5	20.4	22.4	23.2	25.2	28.1	29.4	31.0
Telecommunications	14.8	15.4	15.4	17.1	17.4	17.8	17.9	18.1	16.0	16.9	18.3
Computer programming, consultancy, and inf	20.4	20.6	21.3	22.6	22.6	23.3	23.8	24.3	24.3	24.8	25.8
Professional, scientific and technical activities	23.0	23.4	23.6	24.8	24.4	24.8	25.3	25.2	24.9	26.1	27.1
Administrative and support service activities	22.4	22.8	23.2	23.9	24.6	25.3	25.4	25.5	25.5	26.7	27.3
EU15: Enabling Services											
Transportation and storage	29.3	29.7	29.4	30.3	29.6	30.6	30.2	30.2	28.6	31.3	33.5
Land transport and transport via pipelines	24.1	24.6	24.5	25.0	24.6	25.4	25.2	25.0	24.0	25.3	26.8
Water transport	63.5	63.3	61.8	61.3	60.5	62.8	62.6	62.5	70.4	67.6	65.3
Air transport	50.3	48.5	49.6	51.7	52.4	53.5	52.9	50.6	57.8	61.2	55.6
Warehousing and support activities for transp	29.0	29.2	28.7	29.4	28.9	29.2	28.8	29.7	28.0	28.3	29.2
Postal and courier activities	21.5	21.8	21.5	22.5	22.7	23.4	23.8	24.3	22.9	23.6	23.7
Financial and insurance activities	22.0	22.1	21.9	22.2	22.9	23.9	24.6	24.9	23.7	27.4	29.0
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU15: Local Services											
Wholesale and retail trade; repair of motor vehicles and	23.2	23.3	22.8	23.1	22.8	23.6	23.5	23.8	22.7	23.5	24.6
Accommodation and food service activities	13.2	13.7	13.8	14.7	14.7	15.3	15.9	15.9	10.7	11.0	15.5
Real estate activities	5.3	5.3	5.2	5.3	5.3	5.5	5.5	5.3	4.5	5.2	6.0
Public administration and defence; compulsory social se	1.7	1.8	1.8	2.0	2.0	2.1	2.1	2.1	2.0	2.1	2.4
Education	3.3	3.5	3.6	4.0	4.0	3.9	3.6	3.6	2.9	3.1	3.8
Human health and social work activities	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.7	0.5	0.5	0.7
Arts, entertainment and recreation; Other service activi	5.7	5.8	5.8	6.1	6.2	6.4	6.4	6.4	5.3	5.3	6.5

TOTAL SERVICES (Group 1,2,and 3)

Source: Author's calculations from OECD (2025), "Trade in Value Added (TiVA)", https://stats.oecd.org (accessed on January 31, 2026).

Table 9:

Employment Embodied in Gross Exports (EXGR_DEM), EU15, 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ANALYSIS BY GROUPS		EXGR_DEM (Backward Integration-Employment Generation) as percentage of sector employment									
EU15: Knowledge Services											
Information and communication	12.8	14.4	14.5	14.9	15.9	16.7	17.4	18.8	18.5	17.7	17.2
Publishing, motion picture, video	13.5	13.9	15.1	15.3	16.0	17.4	18.8	20.3	20.3	19.2	19.5
Telecommunications	13.3	14.2	16.2	17.4	17.2	18.2	18.6	19.7	19.3	18.2	16.1
Computer programming, consult	12.3	14.7	13.7	14.1	15.5	16.0	16.6	18.1	17.7	17.1	16.7
Professional, scientific and technical activit	11.6	12.1	13.0	13.0	13.8	14.6	14.6	14.4	15.1	14.7	14.5
Administrative and support service activitie	6.9	7.4	8.3	8.4	8.7	9.1	9.6	9.8	9.7	9.2	10.0
EU15: Enabling Services											
Transportation and storage	20.0	21.2	22.7	22.7	23.3	23.9	23.4	23.6	22.9	23.0	21.7
Land transport and transport via	12.7	13.5	14.5	15.3	15.6	16.2	15.8	16.6	16.2	16.5	15.9
Water transport	174.3	192.5	206.1	195.6	201.1	202.4	192.8	181.1	178.9	177.9	196.2
Air transport	122.7	123.7	132.7	128.5	137.8	137.2	140.9	143.5	139.0	134.4	114.1
Warehousing and support activit	12.5	12.9	13.4	14.0	14.1	15.0	14.5	14.7	14.1	14.7	14.3
Postal and courier activities	3.6	4.5	5.2	4.9	4.8	5.0	5.4	5.5	5.2	5.3	4.4
Financial and insurance activities	18.1	21.2	21.7	22.1	21.4	20.3	22.2	21.9	23.2	22.3	23.2
EU15: Local Services											
Wholesale and retail trade; repair of motor	17.0	18.0	19.2	19.4	19.4	20.0	19.6	20.3	20.1	20.4	19.7
Accommodation and food service activities	8.3	8.8	9.1	9.5	9.2	9.9	9.5	10.2	10.1	10.1	5.2
Real estate activities	2.7	1.7	1.7	1.7	1.7	1.7	1.6	1.8	1.8	1.8	1.0
Public administration and defence; compul	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Education	1.5	1.6	1.9	2.0	2.2	2.4	2.5	2.5	2.6	2.7	1.3
Human health and social work activities	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
Arts, entertainment and recreation; Other s	6.2	6.4	7.0	7.2	6.9	7.6	8.5	8.5	8.4	8.1	5.5

Source: Author's calculations from OECD (2025), "Trade in Value-Added (TiVA)" and "Trade in Employment (TiM)", https://stats.oecd.org (accessed on January 31, 2026).

Note: This table shows the percentages of each category employment; the denominator is total employment in the subsector (taken from the worksheet "Employment broad category"

Table 10:

Employment Embodied in Foreign Final Demand (FFD_DEM), EU15, 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
ANALYSIS BY GROUPS	FFD_DEM level (Forward Integration-Employment Generation) as percentage of sector employment										
EU15: Knowledge Services											
Information and communication	15.2	16.8	17.4	17.6	18.4	19.3	19.6	20.6	20.8	20.4	20.2
Publishing, motion picture, video	12.9	13.9	15.0	15.1	15.6	16.3	16.6	17.7	18.0	17.4	17.6
Telecommunications	12.9	14.0	14.9	15.4	15.5	16.7	17.3	17.8	17.9	17.4	16.5
Computer programming, consul	17.1	19.1	19.2	19.4	20.3	21.1	21.3	22.2	22.3	22.1	21.7
Professional, scientific and technical activi	19.3	20.6	22.1	22.3	22.8	23.5	23.5	23.4	23.8	23.3	22.6
Administrative and support service activitie	18.3	19.7	21.4	21.5	21.8	22.0	22.5	23.0	22.8	22.4	23.2
EU15: Enabling Services											
Transportation and storage	22.6	24.0	25.6	25.7	25.5	26.3	25.6	26.5	26.2	26.3	25.5
Land transport and transport via	19.5	20.6	22.1	22.4	22.2	23.0	22.1	23.1	22.7	22.7	22.0
Water transport	52.6	50.9	53.7	53.4	53.7	55.3	54.0	57.2	56.7	56.9	60.8
Air transport	44.1	44.6	46.7	44.8	46.2	48.1	48.5	49.9	48.6	47.9	53.1
Warehousing and support activi	25.5	27.2	28.8	28.9	28.4	29.1	28.3	28.6	28.1	28.6	27.2
Postal and courier activities	18.2	20.2	21.4	21.6	21.4	22.2	22.2	23.0	23.1	23.2	21.5
Financial and insurance activities	18.0	20.1	21.2	21.4	21.1	21.1	21.8	22.3	23.1	23.0	22.9
EU15: Local Services											
Wholesale and retail trade; repair of motor	20.0	21.5	23.1	23.1	22.8	23.3	22.7	23.4	23.3	23.3	22.2
Accommodation and food service activities	8.6	9.4	9.8	10.0	9.9	10.9	10.8	11.3	11.3	11.2	7.4
Real estate activities	4.8	4.7	4.8	4.7	4.6	4.8	4.7	4.8	4.8	4.8	4.2
Public administration and defence; compul	1.9	2.1	2.2	2.2	2.2	2.2	2.3	2.4	2.5	2.5	2.3
Education	2.4	2.6	3.0	3.1	3.3	3.7	3.9	3.9	4.1	4.1	2.8
Human health and social work activities	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.5
Arts, entertainment and recreation; Other	10.8	11.5	12.3	12.5	12.2	12.8	13.5	13.8	13.9	13.5	11.4

Source: Author's calculations from OECD (2025), "Trade in Value-Added (TiVA)" and "Trade in Employment (TiM)", https://stats.oecd.org (accessed on January 31, 2026).

Note: This table shows the percentages of each category employment; the denominator is total employment in the subsector (taken from the worksheet "Employment broad

U.S. Hirschman-Rasmussen Backward Indices 2012-2022

Table 11. U.S. Hirschman-Ramussen Backward Indices (Columns AF-AV)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Knowledge Services										
Information and communication (J)										
Publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities (J58-60)	1.008926	1.008889	1.008606	1.007646	1.007213	1.008422	1.007737	1.008571	1.006461	1.006812
Telecommunications (J61)	1.007686	1.007744	1.007022	1.006363	1.005905	1.006985	1.005973	1.005775	1.004526	1.004893
Computer programming, consultancy, and information service activities (J62-63)	1.00641	1.006937	1.007214	1.006683	1.006378	1.006543	1.006544	1.00785	1.005673	1.006291
Professional, scientific and technical activities; administrative and support service activities (M)	1.008407	1.007689	1.007805	1.006901	1.006403	1.007701	1.006859	1.007967	1.005422	1.006453
Administrative and support service activities (N)	1.006196	1.006069	1.005794	1.00489	1.004362	1.005799	1.004604	1.005937	1.003946	1.004767
Enabling Services										
Transportation and storage (H)										
Land transport and transport via pipelines (H49)	0.987767	0.98772	0.988243	0.989361	0.988632	0.990549	0.990923	0.99515	0.992691	0.994861
Water transport (H50)	1.001682	1.002729	1.002706	1.002409	1.001455	0.996575	1.001245	1.002945	1.002418	1.00554
Air transport (H51)	1.000157	1.000772	1.001667	1.002123	1.002835	1.002975	1.00256	1.003993	0.999727	1.000266
Warehousing and support activities for transportation (H52)	1.00557	0.998434	0.999132	0.999981	0.999958	0.997367	0.999567	1.002414	1.000206	1.00009
Postal and courier activities (H53)	0.995355	0.995108	0.995992	0.996339	0.995472	0.993941	0.99131	0.996103	0.995545	0.996693
Financial and insurance activities (K)	1.010055	1.007149	1.008237	1.007406	1.007169	1.009107	1.007276	1.009278	1.006618	1.008208
Local Services										
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	1.007033	1.00581	1.006239	1.005691	1.005197	1.006099	1.004977	1.006254	1.004486	1.00428
Accommodation and food service activities (I)	1.002348	1.001318	1.001656	1.002182	1.002925	1.002487	1.003022	1.00537	1.002728	1.002524
Real estate activities (L)	1.010361	1.009221	1.008947	1.007236	1.006332	1.008623	1.00699	1.008082	1.005797	1.006399
Public administration and defence; compulsory social security (O)	1.002524	0.995288	0.996977	0.997827	0.998089	1.002925	0.996574	0.999575	0.997908	0.997159
Education (P)	1.004447	1.005072	1.005455	1.004682	1.004306	1.004672	1.003761	1.005061	1.00485	1.004014
Human health and social work activities (Q)	1.006709	1.006365	1.006462	1.005485	1.005269	1.00697	1.006069	1.007526	1.005213	1.006281
Arts, entertainment and recreation (R)	1.008637	1.006435	1.007239	1.005986	1.005798	1.007941	1.005745	1.007142	1.004939	1.004727
Other service activities (S)	1.009454	1.006934	1.007682	1.006918	1.006183	1.007581	1.006172	1.006062	1.005186	1.006156
Households as employers (T)	1.014006	1.014195	1.013777	1.012503	1.011639	1.01249	1.012398	1.012919	1.011325	1.012056

Source: OECD (2025), "Trade in Value Added (TiVA)", https://stats.oecd.org (accessed on January 31, 2026).

Table 12:

U.S. Hirschman-Rasmussen Forward Indices 2012-2022

Table 12 U.S. Hirschman-Ramussen Forward Indices (Rows 32-51)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Knowledge Services										
Information and communication (J)										
Publishing, motion picture, video, television programme production; sound recording, programming and broadcasting activities (J58-60)	1.067347	1.070944	1.044909	1.056183	1.075759	1.10391	1.071019	1.056056	1.039172	1.017541
Telecommunications (J61)	0.841893	0.878443	0.81948	0.857998	0.863492	0.807715	0.836905	0.824257	0.800942	0.771327
Computer programming, consultancy, and information service activities (J62-63)	1.15798	1.20707	1.233598	1.269949	1.332563	1.423422	1.418228	1.436582	1.4981	1.503095
Professional, scientific and technical activities; administrative and support service activities (M)	3.051866	3.048022	3.07568	3.162772	3.205362	3.094507	3.189548	3.266554	3.337673	3.21233
Administrative and support service activities (N)	1.845439	1.859416	1.887652	1.922773	1.977217	2.091699	2.013207	2.041065	2.016029	2.053596
Enabling Services										
Transportation and storage (H)										
Land transport and transport via pipelines (H49)	1.055715	1.068448	1.090188	1.10194	1.072829	1.087692	1.099462	1.100815	1.123802	1.131571
Water transport (H50)	0.42155	0.480672	0.448385	0.461525	0.38147	0.387076	0.352132	0.354938	0.420606	0.64091
Air transport (H51)	0.52662	0.535303	0.561404	0.639587	0.682966	0.672069	0.639368	0.643895	0.597536	0.613276
Warehousing and support activities for transportation (H52)	0.8845	0.898293	0.89633	0.946797	0.968036	0.972728	0.99872	1.025075	1.068541	1.070254
Postal and courier activities (H53)	0.732282	0.726095	0.729366	0.784597	0.781461	0.766792	0.78289	0.801729	0.905134	0.896491
Financial and insurance activities (K)	2.341748	2.286164	2.386001	2.42951	2.48707	2.470221	2.486289	2.509219	2.628613	2.448095
Local Services										
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	2.999216	3.060615	3.027187	3.069414	2.997221	2.972199	3.042015	3.015555	2.894101	3.104368
Accommodation and food service activities (I)	0.779215	0.796777	0.800215	0.822137	0.760676	0.690451	0.672988	0.683408	0.641424	0.655782
Real estate activities (L)	1.647154	1.737462	1.757225	1.834408	1.849097	1.778517	1.812406	1.876613	1.859043	1.823641
Public administration and defence; compulsory social security (O)	1.107184	1.140972	1.124459	1.026817	1.116515	1.121223	1.117557	1.11137	1.086063	1.075096
Education (P)	0.841839	0.838513	0.847346	0.840918	0.913864	0.894244	0.860119	0.846242	0.903201	0.867278
Human health and social work activities (Q)	0.649867	0.658561	0.650888	0.664832	0.689204	0.681095	0.688975	0.693372	0.703236	0.688635
Arts, entertainment and recreation (R)	0.720937	0.721655	0.719561	0.725036	0.736972	0.720921	0.728476	0.71799	0.699917	0.680302
Other service activities (S)	0.647608	0.633185	0.640136	0.648097	0.657519	0.653766	0.640761	0.646156	0.648732	0.645916
Households as employers (T)	1.014006	1.014195	1.013777	1.012503	1.011639	1.01249	1.012398	1.012919	1.011325	1.012056

Source: OECD (2025), "Trade in Value Added (TiVA)", https://stats.oecd.org (accessed on January 31, 2026).

U.S. Leontief Employment Multipliers 2012-2022

Table 13 Employment M

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Knowledge Services										
Information and communication (J)										
Publishing, motion picture, video, television programme production; sound recordi	0.610577	0.598624	0.612822	0.6004	0.585691	0.573837	0.585286	0.57768	0.571293	0.586957
Telecommunications (J61)	0.584412	0.546756	0.584374	0.545164	0.534869	0.530989	0.513212	0.489138	0.51173	0.518364
Computer programming, consultancy, and information service activities (J62-63)	0.755342	0.732627	0.728823	0.705185	0.683466	0.678757	0.665204	0.646658	0.647435	0.660681
Professional, scientific and technical activities; administrative and support service activities (M	0.830687	0.832057	0.82867	0.802392	0.812965	0.809338	0.804397	0.793776	0.801673	0.791518
Administrative and support service activities (N)	1.372176	1.367181	1.351627	1.327725	1.314924	1.288577	1.261875	1.215787	1.235242	1.231775
Enabling Services										
Transportation and storage (H)										
Land transport and transport via pipelines (H49)	0.923844	0.929379	0.925052	0.940003	0.971276	0.949328	0.944554	0.966861	1.005552	1.005022
Water transport (H50)	0.72241	0.680487	0.714744	0.722202	0.797537	0.817572	0.780711	0.788657	0.796084	0.619232
Air transport (H51)	0.765382	0.761932	0.724804	0.701934	0.669637	0.68219	0.713384	0.716636	1.043288	1.028975
Warehousing and support activities for transportation (H52)	1.094338	1.109669	1.129949	1.145675	1.168234	1.234894	1.220505	1.263628	1.407902	1.414879
Postal and courier activities (H53)	1.284736	1.301068	1.317804	1.31476	1.364253	1.354545	1.367092	1.467182	1.569584	1.538676
Financial and insurance activities (K)	0.635742	0.674034	0.637984	0.610219	0.597667	0.585548	0.594115	0.574813	0.572565	0.554085
Local Services										
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	1.209663	1.196487	1.194242	1.16311	1.177466	1.160787	1.156609	1.133844	1.120929	1.160047
Accommodation and food service activities (I)	2.049365	2.060026	2.039765	1.963007	1.950116	1.948633	1.944161	1.902729	2.064926	2.0713
Real estate activities (L)	0.2824	0.286916	0.29329	0.305147	0.315511	0.309608	0.310548	0.31636	0.313376	0.330753
Public administration and defence; compulsory social security (O)	0.913618	0.899683	0.899327	0.896504	0.91222	0.914019	0.900077	0.898113	0.880967	0.89413
Education (P)	1.393222	1.386926	1.392829	1.37204	1.380466	1.374885	1.383698	1.37424	1.381059	1.400538
Human health and social work activities (Q)	1.338244	1.351577	1.358155	1.332708	1.335102	1.325771	1.345747	1.325924	1.333676	1.344396
Arts, entertainment and recreation; Other service activities; Activities of households as emplc	1.332172	1.351786	1.352546	1.332924	1.3353	1.309027	1.325563	1.319272	1.468937	1.515071
	1.770769	1.790052	1.754857	1.706811	1.688896	1.69389	1.725774	1.697797	1.671027	1.682381
	7.316413	7.149746	7.032399	6.760778	6.798244	6.947546	6.96399	7.051329	6.210098	6.170442

Annex 2

Backward Integration Indicators

By convention, TiVA measures backward integration by the foreign value added in gross exports (EXGR_FVA). Backward integration is about import dependence of exports and EXGR_FVA directly answers the question: *How deeply are exports embedded in foreign production networks?* This indicator maps one-to-one to the definition of backward integration. Higher $\text{EXGR\_FVA} \Rightarrow$ more backward integration; lower EXGR_FVA $\Rightarrow$ less backward integration.

The complement of this indicator, 1-EXGR_FVA = EXGR_DVA is the domestic value added in gross exports. In this paper, we are interested in EXGR_DVA indicator and not EXGR_FVA because it shows the extent of the domestic value retention of exports rather than backward integration per se. High EXGR_DVA $\Rightarrow$ exports rely more on domestic inputs, while low EXGR_DVA $\Rightarrow$ exports rely more on foreign inputs. So EXGR_DVA moves in the opposite direction of backward integration. It answers the question: *How much domestic value is retained per dollar of exports?*

EXGR_DVA is crucial for our framework because it measures:

- Value retention

- Domestic content of growth

- Import leakage per unit of exports

In fact, our core policy message hinges on EXGR_DVA, not on backward integration per se. This is because backward integration can rise without raising national income if domestic value retention (EXGR_DVA) does not rise in parallel. That distinction is analytically powerful and fully consistent with TiVA accounting.

How is it possible? This situation arises when a country deepens its participation in global value chains through imported inputs, but does not simultaneously expand the *domestic* activities that generate value added. Put differently, the export machine grows by assembling or coordinating foreign value, not by creating more domestic income. The precise circumstances under which this happens are listed below.

Let gross exports X decompose as

$$X = \text{DVA}_X + \text{FVA}_X,$$

with

$$\text{EXGR\_DVA} = \frac{\text{DVA}_X}{X}, 1 - \text{EXGR\_DVA} = \frac{\text{FVA}_X}{X}.$$

Backward integration rises whenever foreign value added embodied in exports grows faster than domestic value added. Crucially, this can occur even when exports themselves expand rapidly. From a national income perspective, what matters is not export growth per se, but

whether domestic value added embedded in those exports rises sufficiently—and whether it accrues to domestic residents.

When Backward Integration Rises Without Income Gains

Backward integration can increase without a corresponding rise in national income under several structural circumstances.

First, export growth may be driven by assembly-led or processing trade, in which firms import a large share of intermediate inputs and perform only limited domestic tasks, such as basic assembly, testing, or packaging. In such cases, gross exports increase and foreign value added embodied in exports rises sharply, but domestic value added per unit of exports remains low. Backward integration therefore deepens, yet domestic income gains are modest.

Second, economies may integrate more deeply into GVCs through coordination and facilitation activities—such as logistics, basic trade finance, or compliance with foreign standards—without developing domestic knowledge-intensive inputs. This often reflects an expansion of enabling services that allow firms to source more components internationally. While such services increase the scale and complexity of cross-border production, they do not necessarily generate scalable rents or high domestic value added. Backward integration rises mechanically, but domestic value retention does not.

Third, even when domestic value added embodied in exports increases, ownership matters. If export-oriented production is dominated by foreign-owned firms, a significant share of capital income may be repatriated. In this case, measured domestic value added (and GDP) can rise, but national income (GNI) rises much less. Backward integration may deepen alongside widening income leakages, a mechanism that is central to the GDP–GNI wedge highlighted in the literature.

Fourth, intensified GVC participation can be accompanied by price competition and thin margins. Firms may expand exports by cutting costs, sourcing more intermediates abroad, and competing on price rather than on embedded knowledge. Export volumes rise, foreign content increases, and backward integration deepens, but domestic wages and profits stagnate. Here again, backward integration does not translate into sustained income gains.

Finally, expansion of import-facilitating services—such as wholesale trade, transport, and basic finance—can lower trade costs and increase the foreign content of exports without raising domestic value capture. These services are essential for participation in GVCs, but on their own they do not generate the kinds of rents that support long-run productivity growth.

The Role of Services and the Three-Group Framework

These mechanisms can be understood clearly through the three-group services framework.

Enabling Services—transport, storage, and finance—play a critical enabling role. Their expansion often raises backward integration by allowing firms to coordinate complex international supply chains and source inputs globally. However, because these services are largely intermediate and facilitating in nature, their expansion alone does not guarantee rising domestic value retention.

Knowledge Services—information and communication, professional, scientific, technical, and business-support services—are the key to breaking this pattern. These services embed domestic knowledge, design, software, engineering, and organizational capabilities into exports. When Group 1 services expand and internationalize, they raise EXGR_DVA by increasing the domestic value added embodied in exports, and they often generate forward linkages that capture foreign final demand.

Local Services—largely non-tradable and labor-absorbing activities—play little role in either backward or forward integration. Their expansion may stabilize employment or domestic demand, but it does not materially affect value capture in GVCs.

Backward integration can therefore rise without income gains precisely when Group 2 expands without a parallel expansion of Group 1, or when Group 1 exists only as a narrow niche that fails to scale across the economy.

Implications for Growth and Policy

The central implication is that backward integration is not inherently beneficial or harmful. It is a descriptive measure of how exports are produced, not a sufficient indicator of development success. What determines income outcomes is whether deeper integration is accompanied by rising domestic value retention and by domestic ownership of value-creating activities.

Advanced economies illustrate this distinction clearly. They often exhibit high backward integration, but also high and rising EXGR_DVA, because exports embed substantial domestic knowledge-intensive services and intangible assets. In contrast, many middle-income economies experience rising backward integration without comparable gains in EXGR_DVA, leading to export growth with limited income convergence.

From a policy perspective, the lesson is not to resist backward integration, but to complement it with deliberate strategies that expand domestic value creation, particularly in modern, tradable services. Without such strategies, deeper participation in GVCs may amplify import dependence and income leakages rather than delivering sustained gains in national income.

Conclusion

Backward integration, measured by a rising foreign value-added share of exports, can increase without raising national income when export growth is driven primarily by imported inputs, foreign-owned production, or low-margin activities. Only when domestic value retention rises in parallel—through the expansion of knowledge-intensive, scalable, and tradable services—does deeper GVC integration translate into durable income gains. This distinction is central to understanding why some economies converge through globalization while others remain trapped in low-value segments of global production networks.

Annex 3

How Does the Domestic Value Retention Indicator for External Demand (EXGR_DVA in TiVA) Differ from the Hirschman-Rasmussen Backward Normalized Index for an Economy?

These two indicators measure fundamentally different things, and conflating them is a common source of confusion in applied GVC research.

Conceptual Object Being Measured

The **Hirschman-Rasmussen (HR) backward linkage index** is a measure of *domestic production interdependence*. For sector *j*, it captures how much an additional unit of final demand for *j*'s output will stimulate upstream domestic industries through input purchases. Formally, it is the column sum of the Leontief inverse normalized by the economy-wide average:

$$B_j = \frac{\frac{1}{n}\sum_i (I-A)^{-1}_{ij}}{\frac{1}{n^2}\sum_i \sum_j (I-A)^{-1}_{ij}}$$

It answers: *given that demand for my output exists, how much do I pull domestic suppliers?* The entire mechanism is interior to the domestic input-output structure. Foreign linkages enter only insofar as imports are treated as non-competitive (subtracted from the A-matrix), in which case HR actually *understates* true backward pull by excluding import leakage.

EXGR_DVA (domestic value added embodied in gross exports) is a measure of *GVC integration from the demand side*. It tells you how much of a country's domestic value added—across all sectors—is ultimately absorbed by foreign final demand through the export channel. It is derived from a global multi-country Leontief inversion:

$$EXGR\_DVA_i = \hat{v}_i (I-A)^{-1} e_i$$

where $\hat{v}_i$ is the diagonal matrix of value-added coefficients, $(I-A)^{-1}$ is the global inverse, and e_i is the export vector of country *i*. The TiVA presentation then decomposes this by whether DVA is absorbed by the direct importer or re-exported onward.

Key Structural Differences

Unit of analysis. HR is a *sector-level* index normalized across sectors within one economy. EXGR_DVA is typically an *economy-level* or *sector-economy* aggregate measuring participation in world demand.

Direction of causality. HR runs from *final demand → upstream domestic stimulus* (a supply-chain pull concept). EXGR_DVA runs from *domestic factor input → foreign absorption* — it is about where your value added ends up, not about who you pull domestically.

Treatment of import leakage. The HR index computed on a domestic I-O table implicitly treats imports as exogenous leakages; it cannot see the cross-border portion of the value chain. EXGR_DVA, being built on the inter-country input-output (ICIO) framework, explicitly

follows value added across borders. A country can have a *high* HR backward index (strong domestic inter-industry linkages) yet a *low* EXGR_DVA share (because its exports are thin or its production is domestically oriented), and vice versa—Vietnam in the electronics sector is a telling example: weak HR backward linkages domestically precisely because assembly relies on imported components, but high EXGR_DVA in absolute terms because gross export volumes are enormous.

Normalization. HR is a relative, dimensionless index—it indicates which sectors are above or below the economy average. EXGR_DVA is an absolute dollar value (or a ratio to gross exports or GDP), carrying distributional information about the magnitude of an economy's dependence on external demand.

ABOUT
THE AUTHOR

HINH T. DINH

Hinh T. Dinh is a Senior Fellow at the Policy Center for the New South, Morocco and President of Economic Growth and Transformation, LLC., VA, USA. Previously, he spent over 35 years working at the World Bank Group where his last position was Lead Economist in the Office of the Senior Vice President and Chief Economist. He has authored and co-authored books published by the World Bank, Oxford University, and the Policy Center for the New South, and has written articles in professional journals covering public finance, international finance, and industrialization. His latest books include Tales from the Development Frontier (2013), Light Manufacturing in Vietnam (2013), Jobs, Industrialization, and Globalization (2017), Morocco (2020), and COVID-19 and Developing Countries (2022).

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