Etikonomi
Volume 25(1), 2026: 355 - 368
P-ISSN: 1412-8969; E-ISSN: 2461-0771
https://doi.org/10.15408/etk.v25i1.47258

Uncovering Indonesia's Sectoral Interdependencies in Global Value Chains: A Hypothetical Extraction Approach

Maura Bintang Potenza[1], M. Al Farisi[2], Alicia Ramadhani Putri Suwarno[3], Fitri Kartiasih[4*], Rita Yuliana[5]
[1,2,3,4,5]**Department of Statistics, Politeknik Statistika STIS, Jakarta, Indonesia**
E-mail: [1]212212723@stis.ac.id, [2]212212709@stis.ac.id, [3]212212477@stis.ac.id, [4]fkartiasih@stis.ac.id, [5]rita@stis.ac.id
[*)]**Corresponding Author**

JEL Classification:
F14
F15
C67

Received: 28 October 2025

Revised: 08 May 2026

Accepted: 09 May 2026

Available online: May 2026

Abstract

Research Originality: This study extends the multiregional input-output approach by longitudinally decomposing Indonesia's sectoral and intercountry linkages with major ASEAN FTA partners, providing a dynamic perspective on Indonesia's evolving role in global value chains over a 15-year period.

Research Objectives: This study aims to assess the economic interdependence between Indonesia and five ASEAN FTA partners, focusing on sectoral contributions and spatial trade dynamics.

Research Methods: This study applies the Hypothetical Extraction Method (HEM) to panel data from the World Input-Output Database (WIOD) spanning 2000 to 2014 to measure sectoral and spatial linkages.

Empirical Results: This study shows that the construction sector has the strongest backward linkages, while mining and manufacturing dominate forward linkages. Mining's forward linkages tripled between 2000 and 2014, indicating rising global dependence on Indonesian commodities. Intercountry backward linkages declined from 25.46% to 19.95%, suggesting increased domestic input substitution, whereas intercountry forward linkages rose, reinforcing Indonesia's role as a global supplier. Additionally, China has overtaken Japan and Australia as Indonesia's main trading partner.

Implications: The findings highlight the need to strengthen key sectors and pursue selective import substitution to boost Indonesia's competitiveness and resilience.

Keywords:

global value chains; hypothetical extraction method; intercountry linkages; trade interdependence; world input–output

How to Cite:

Potenza, M. B., Al Farisi, M., Suwarno, A. R. P., Kartiasih, F., & Yuliana, R.. (2026). Uncovering Indonesia's Sectoral Interdependencies in Global Value Chains: A Hypothetical Extraction Approach. *Etikonomi, 25*(1), 355 – 368. https://doi.org/10.15408/etk.v25i1.47258.

INTRODUCTION

The global economy is increasingly integrated through complex, interdependent cross-border production networks known as Global Value Chains (GVCs). According to the OECD (2020), approximately 70% of global trade involves the export of goods between countries participating in global value chains. This integration has driven economic growth in developing countries, including Indonesia, by enabling domestic firms to engage in economic upgrading, that is, shifting toward more complex and profitable activities (Humphrey & Schmitz, 2002). However, an academic debate has emerged regarding the effectiveness of GVCs in promoting sustainable industrialization: whether this integration truly leads to increased value addition or instead traps developing countries in repetitive, low-value-added activities (Kowalski et al., 2015; Zhang & Ding, 2024; Vrh, 2018; Sousa Filho et al., 2024). GVC dynamics also create new vulnerabilities due to high levels of cross-border interdependence. The COVID-19 pandemic, for example, caused widespread disruptions across global supply chains and a significant contraction of the world economy (Bonadio et al., 2021). Research by Zajidah et al. (2025) indicates that global economic dynamics, such as recessions and trade tensions, have a significant impact on Indonesia's manufacturing sector, which is highly integrated into international trade, particularly in the paper, chemical, and textile industries. This dependence underscores the importance of export diversification strategies and the strengthening of national economic resilience.

In this context, the World Input-Output Database (WIOD) has proven highly valuable for analyzing international trade (Muchdie et al., 2020). The tables in the WIOD are compiled from officially published input-output tables and integrated with national accounts data and international trade statistics. As emphasized by Tukker & Dietzenbacher (2013), frameworks such as WIOD are crucial because they enable analysis beyond gross export statistics and shift toward trade-in-value-added analysis. This approach can reveal a country's real economic position and contribution within GVCs (Humphrey & Schmitz, 2002).

In the ASEAN context, the implementation of Free Trade Agreements (FTAs), such as the ASEAN-Australia-New Zealand FTA and the ASEAN-China FTA, has accelerated regional integration in trade and investment. Park (2020) shows that intra-ASEAN economic integration increased the region's value-added contribution by 15% over a decade, while Obashi and Kimura (2017) confirm that ASEAN production networks have become increasingly deeper and more interconnected across industries and national borders. As one of the largest economies in ASEAN, Indonesia plays a strategic role in this regional production system. However, Indonesia's export structure remains dominated by raw commodities and intermediate goods. Esquivias et al. (2018) report that more than 59% of Indonesia's exports in 2012 consisted of intermediate products concentrated in primary sectors and early-stage manufacturing, indicating that Indonesia remains positioned at the upstream end of global value chains with relatively low domestic value added. This condition is consistent with the phenomenon of premature deindustrialization identified by Aswicahyono et al. (2010) and Sandi et al. (2025),

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258

in which the manufacturing sector's contribution to GDP peaked relatively early and subsequently declined.

One important academic debate in the GVC literature concerns whether participation in global production networks necessarily promotes industrial upgrading and long-term economic resilience in developing countries. On the one hand, participation in GVCs enables countries to access international markets, advanced technologies, and production specialization, which may improve productivity and export competitiveness (Humphrey & Schmitz, 2002; Urata & Baek, 2020). On the other hand, several studies argue that developing economies are often locked into low-value-added segments of production networks, limiting domestic technological capability and industrial deepening (Kowalski et al., 2015; Vrh, 2018). This debate has become increasingly relevant following the restructuring of global supply chains after the COVID-19 pandemic and the rise in geopolitical tensions. Basu & Ray (2022) describe the emergence of the "China-plus-one" strategy, where multinational firms diversify production locations to reduce excessive dependence on China. Such restructuring creates both opportunities and risks for emerging economies such as Indonesia, particularly regarding their ability to strengthen domestic industrial linkages and capture higher value-added activities within GVCs.

At the same time, another debate emerges regarding how global production interdependence should be measured. Conventional input-output linkage analyses based on the Leontief and Ghosh frameworks remain widely used in studies of international production networks (Miller & Blair, 2009; Muchdie & Imansyah, 2020). However, Johnson (2018) and Wang et al. (2017) argue that traditional trade and linkage indicators often fail to accurately capture value-added flows and cross-country production interdependencies within fragmented supply chains. Furthermore, conventional backward and forward linkage measures are prone to double-counting problems and may overestimate sectoral interdependencies (Temurshoev, 2010). Recent studies, therefore, emphasize the importance of adopting more comprehensive multiregional approaches capable of identifying both sectoral and spatial interdependence in global production systems (Dietzenbacher et al., 2019; Cho et al., 2026). Despite these developments, empirical evidence on the longitudinal evolution of Indonesia's sectoral and intercountry linkages within ASEAN-centered production networks remains very limited.

Several previous studies have explored interregional and international sectoral linkages using the input-output approach. However, most studies still rely on the framework developed by Leontief (1936) and further refined by Miller & Blair (2009), utilizing the Ghosh approach to measure backward and forward linkages separately. For instance, Muchdie & Imansyah (2020) applied this approach to analyze sectoral and cross-country linkages in Indonesia and several other economies longitudinally. This methodological choice has drawn critical scrutiny because the Ghosh model is considered to have serious theoretical flaws when applied as a quantity model. Furthermore, the traditional separation of linkages is highly susceptible to double-counting, in which the effects of forward linkages may be embedded in backward linkage measures, and vice versa (Temurshoev, 2010; Cho et al., 2026). To address this bias, this study employs

the approach developed by Dietzenbacher & Van Der Linden (1997), which introduces the Hypothetical Extraction Method (HEM) as an analytical tool to measure a sector or country's interdependence and impact within the global economic system. The application of HEM also offers a more comprehensive evaluation of a sector's "worth" compared to conventional multiplier analysis (Temurshoev, 2010). The global implementation of this method is supported by the availability of the World Input-Output Database (WIOD) framework, as outlined by Timmer et al. (2015). However, current literature remains limited and has not specifically addressed the longitudinal dynamics of Indonesia's sectoral linkages with its ASEAN partners.

Therefore, this study addresses two important gaps in the existing literature. First, previous studies on Indonesia's global production linkages largely rely on conventional backward and forward linkage measures and rarely examine the longitudinal evolution of both sectoral and spatial interdependencies within ASEAN-centered production networks. Second, empirical applications of the multiregional Hypothetical Extraction Method (HEM) remain limited in developing-country contexts, particularly for evaluating intercountry production dependence over time. To fill these gaps, this study applies the multiregional HEM to WIOD data from 2000–2014 to investigate Indonesia's sectoral and intercountry linkages with five major ASEAN FTA partners: Australia, China, India, Japan, and South Korea. Unlike previous studies, this research integrates Total Backward and Forward Linkages (TBL/TFL) with Intercountry Backward and Forward Linkages (ICBL/ICFL) indicators to capture the dynamic evolution of Indonesia's role within global value chains. By combining sectoral and spatial perspectives in a longitudinal framework, this study contributes to the growing literature on GVC participation, trade interdependence, and industrial transformation in developing economies.

METHODS

This study employs the World Input–Output Database (WIOD) developed by Timmer et al. (2015) to examine Indonesia's sectoral and spatial linkages within global production networks. The analysis uses WIOD tables for 2000, 2005, 2010, and 2014, covering 43 countries and the rest of the world (ROW). To focus the analysis, the database was restructured into seven regional groups: Indonesia, five major ASEAN FTA partners (Australia, China, India, Japan, and South Korea), and ROW. Sectoral aggregation was subsequently performed using the Indonesian interregional input–output classification (BPS, 2021), yielding 17 economic sectors (see Table 1).

This study applies the multiregional Hypothetical Extraction Method (HEM) developed by Dietzenbacher and Van der Linden (1997). Compared with conventional linkage measures, HEM provides a more comprehensive evaluation of sectoral and intercountry interdependence by estimating the reduction in total output when a sector is hypothetically removed from the production system (Temurshoev, 2010; Dietzenbacher et al., 2019). The analysis consists of two stages. First, sectoral linkages are measured using Total Backward Linkages (TBL) and Total Forward Linkages (TFL). TBL captures the decline in global output resulting from the hypothetical removal of a sector's input

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258

demand, while TFL measures the decline caused by the removal of a sector's output supply. The indicators are calculated as follows:

$$TBL, TFL = 100 \frac{\sum_i (x_i - x_i^{(-j)})}{x_j} \quad (1)$$

where x_i denotes actual output and $x_i^{(-j)}$ represents hypothetical output after extracting sector j.

Second, spatial interdependence is evaluated using Intercountry Backward Linkages (ICBL) and Intercountry Forward Linkages (ICFL), which decompose sectoral linkages into domestic and foreign components. These indicators measure the degree of Indonesia's production dependence on partner countries within global value chains. The intercountry linkage indicator is defined as:

$$ICBL, ICFL\ (by\ country) = \frac{100}{17} \frac{\sum_{j=1}^{17} \sum_{i=1}^{17} (x_{Ii} - x_{Ii}^{(-Jj)})}{x_{Jj}} \quad (2)$$

The results are used to identify the evolution of Indonesia's sectoral and spatial interdependencies with its major ASEAN FTA partners during 2000–2014.

Table 1. Classification of 17 Sectors

Sector		WIOD
		Code Aggregation
Agriculture, Forestry, and Fishing	A	A01, A02, A03
Mining and Quarrying	B	B
Manufacturing	C	C10-C12, C13-C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31_C32, C33
Electricity and Gas Supply	D	D35
Water Supply, Waste Management, and Recycling	E	E36, E37-E39
Construction	F	F
Wholesale and Retail Trade	G	G45, G46, G47
Transportation and Storage	H	H49, H50, H51, H52, H53
Accommodation and Food Services	I	I
Information and Communication	J	J58, J59_J60, J61, J62_J63
Financial and Insurance Services	K	K64, K65, K66
Real Estate	L	L68
Business Services	MN	M69_M70, M71, M72, M73, M74_M75, N
Public Administration and Defence	O	O84
Education	P	P85
Human Health and Social Work Activities	Q	Q
Other Services	RSTU	R_S, T, U

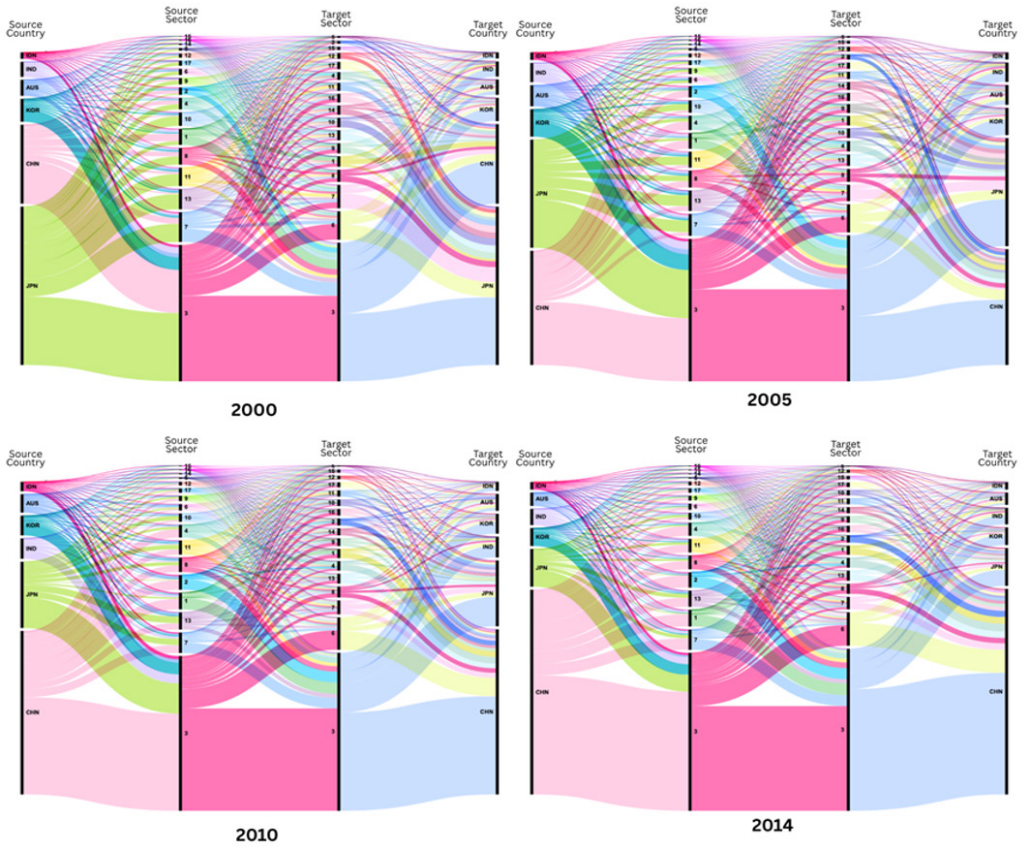
Source: BPS (2021)

RESULT AND DISCUSSION

This study reveals several key findings regarding Indonesia's sectoral and spatial linkages within the global production network. First, from a sectoral perspective, the Construction sector consistently exhibits the highest Total Backward Linkages (TBL), indicating a strong dependence on inputs from other sectors. In contrast, the Mining and Manufacturing sectors dominate Total Forward Linkages (TFL), highlighting their crucial role as global input suppliers. Second, from a spatial perspective, China emerges as Indonesia's most significant trading partner, with increasing intercountry forward linkages (ICFL), while intercountry backward linkages (ICBL) tend to decline over time. This pattern suggests a structural transformation in Indonesia's role, from an input-dependent economy toward a more prominent supplier within global value chains. These findings provide an analytical basis for the following discussion.

To trace cross-country and cross-sector economic flows during 2000–2014, this study presents an overview of the dynamics of input–output relationships between Indonesia and its five ASEAN FTA partner countries, using alluvial diagrams based on adjusted WIOD data. These visualizations capture the evolution of inter-industry linkages and the intensity of economic exchanges across countries over time. They also reveal structural shifts in regional production networks and Indonesia's changing position within global value chains.

Figure 1. Input-Output Between Origin and Destination Countries by 17 Sectors



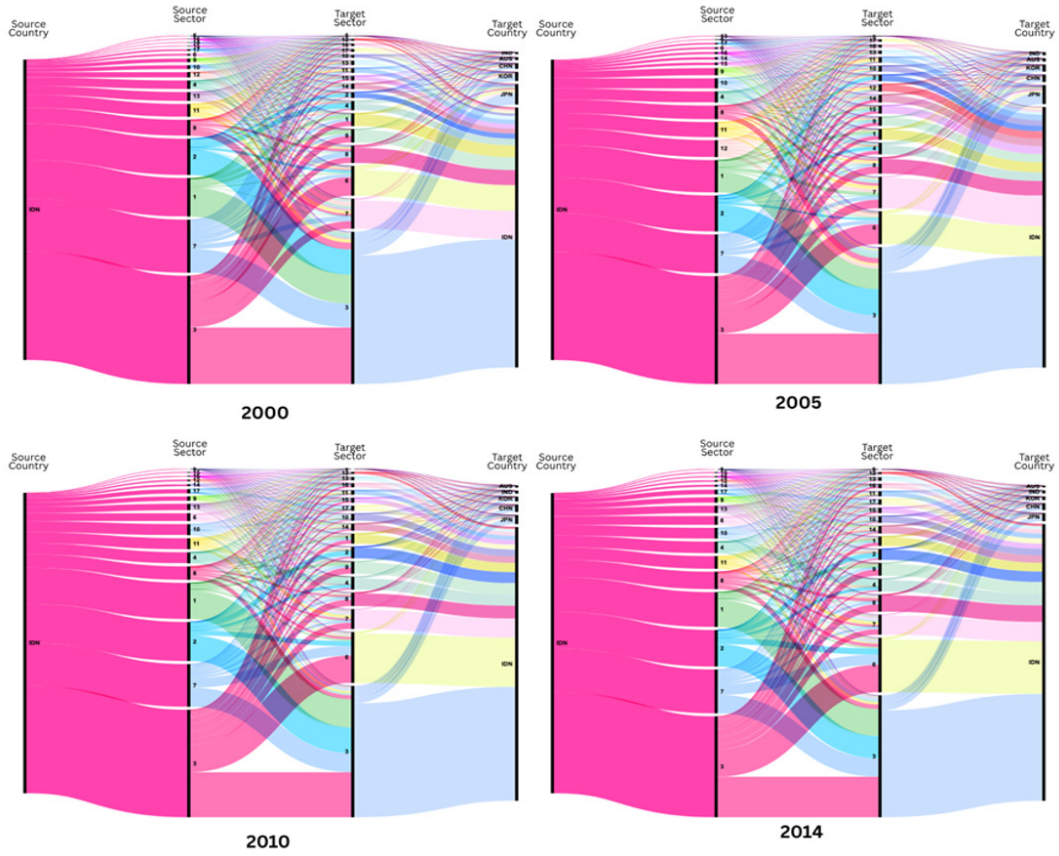
Source: WIOD, processed

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258

Figure 1 illustrates the dynamics of input–output relationships among the six main countries analyzed over four time periods. Among these countries, a clear shift in the production structure of Indonesia's main trading partners is evident. Initially dominated by Japan, this structure was gradually replaced by China starting in 2005. The increasing intensity of flows both to and from China reflects the country's strengthening position as a regional production hub, in line with international studies that identify China as a key center in global value chains (Basu & Ray, 2022).

Figure 2 further highlights Indonesia's role within these production networks. The results show that Indonesia allocates the majority of its production output to domestic use, particularly in 2010 and 2014, indicating the increasing importance of domestic demand in driving economic growth. Among all sectors, Manufacturing (sector C) consistently makes the largest contribution to Indonesia's production. This sector not only serves as an input provider for itself but also distributes outputs to other sectors, particularly Construction (sector F), indicating strong intersectoral connectivity.

Figure 2. Input-Output Between Indonesia and Five ASEAN FTA Partner Countries



Sources: WIOD, processed

Although domestic activities dominate, Indonesia also maintains significant cross-country linkages. The flow of outputs is primarily directed toward Japan, China, and South Korea, reflecting Indonesia's integration into regional supply chains. These flows

include both final goods and intermediate inputs used in production processes abroad. This pattern suggests a dual economic structure in which domestic demand remains dominant while international linkages continue to expand. From a policy perspective, this indicates that Indonesia is simultaneously strengthening its domestic economic base while maintaining its participation in global value chains. Table 2 presents the evolution of Indonesia's Total Backward Linkages (TBL) and Total Forward Linkages (TFL) during 2000–2014, revealing substantial structural transformation in Indonesia's role within global value chains (GVCs). Overall, Indonesia increasingly served as an upstream supplier in regional and global production systems, particularly through mining and manufacturing, while several domestic sectors strengthened their intersectoral dependence. This finding is consistent with recent studies on ASEAN economies, which show that developing countries tend to deepen GVC participation through intermediate-input specialization rather than through technological upgrading (Tian et al., 2021; Sousa Filho et al., 2024).

Table 2. TBL and TFL for Indonesia in World Input Output

Sector	TBL IDN				TFL IDN			
	2000	2005	2010	2014	2000	2005	2010	2014
A	38.96 (16)	41.23 (17)	31.25 (17)	31.80 (17)	225.76 (6)	237.04 (5)	266.43 (4)	272.29 (4)
B	(14)	41.23	43.89 (14)	44.31 (14)	550.59 (1)	633.14 (1)	775.45 (1)	907.01 (1)
C	(16)	31.25	94.56 (6)	98.99 (6)	256.51 (4)	281.52 (3)	297.15 (3)	334.48 (3)
D	(17)	31.80	101.72 (4)	102.48 (4)	240.42 (5)	213.70 (8)	138.76 (11)	139.92 (9)
E	(17)	225.76	33.89 (16)	35.05 (16)	113.42 (12)	131.38 (11)	196.83 (8)	86.87 (11)
F	(6)	237.04	129.60 (1)	131.50 (1)	11.07 (16)	9.70 (17)	36.13 (16)	34.91 (16)
G	(5)	266.43	60.22 (11)	60.87 (11)	178.03 (9)	145.39 (10)	202.76 (7)	204.88 (6)
H	(4)	272.29	105.91 (2)	106.99 (2)	207.49 (7)	264.83 (4)	204.30 (6)	175.19 (8)
I	(4)	84.97 (7)	101.22 (5)	101.94 (5)	111.04 (13)	154.30 (9)	140.93 (10)	125.02 (10)
J	61.13 (12)	58.99 (13)	59.90 (12)	60.74 (12)	148.54 (11)	230.32 (6)	183.86 (9)	176.19 (7)
K	37.92 (15)	43.57 (15)	45.71 (13)	45.30 (13)	277.98 (3)	226.71 (7)	222.61 (5)	220.97 (5)
L	32.10 (16)	78.22 (10)	35.41 (15)	35.79 (15)	160.56 (10)	302.95 (2)	48.50 (13)	47.67 (13)
MN	85.37 (7)	82.46 (9)	76.33 (7)	76.89 (7)	285.45 (2)	55.63 (15)	412.19 (2)	368.04 (2)
O	69.79 (9)	82.74 (8)	75.63 (8)	76.52 (8)	8.84 (17)	43.76 (16)	45.57 (15)	41.31 (14)
P	78.20 (9)	99.66 (4)	67.50 (10)	68.04 (9)	15.80 (15)	60.13 (14)	11.54 (17)	11.26 (17)
Q	101.15 (8)	77.73 (11)	102.27 (3)	103.01 (3)	35.20 (14)	96.91 (12)	46.80 (14)	38.30 (15)
RSTU	61.49 (5)	56.81 (14)	67.55 (9)	67.14 (10)	185.58 (8)	66.28 (13)	62.52 (12)	62.49 (12)
Averages	75.01	79.80	72.50	73.37	177.19	18.51	193.67	190.90

*The terms in parentheses indicate the ranking of the sector within its column.
Source: Author's calculation

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258

From the **backward linkage** perspective, the Construction sector (F) consistently has the highest TBL, meaning it depends heavily on inputs from manufacturing, mining, transportation, electricity, and business services. This supports the idea that sectors with strong backward linkages create wide economic multiplier effects (Miller and Blair, 2009) and confirms construction as one of Indonesia's most interconnected sectors (Muchdie and Imansyah, 2020). Its strong role from 2000–2014 reflects infrastructure growth and post-crisis urbanization (Aswicahyono et al., 2010). Transportation and Storage (H) and Information and Communication (J) also show high TBL values, indicating the growing importance of logistics and connectivity in ASEAN production networks. This is consistent with Obashi and Kimura (2017) and later studies highlighting logistics as key to GVC participation (Taguchi & Thet, 2021; Chatterjee, 2023).

From the **forward linkage** perspective, Mining and Quarrying (B) dominates, with TFL rising from 550.59 in 2000 to 907.01 in 2014. This shows that Indonesia's mining outputs are widely used as inputs by industries abroad, confirming its role in upstream, resource-based stages of GVCs. This finding supports Kowalski et al. (2015) and Wang et al. (2017), who argue that developing countries often act as suppliers of raw materials and intermediate goods. The growing importance of mining is also linked to increased demand from China during the commodity boom and its central role in regional production networks (Basu and Ray, 2022). However, reliance on resource-based exports limits ASEAN countries in capturing higher value-added activities (Zhong & Su, 2021).

However, the dominance of mining-based forward linkages also reveals structural vulnerabilities. Heavy dependence on commodity exports exposes Indonesia to external shocks, price volatility, and disruptions in global supply chains. Bonadio et al. (2021) demonstrated that economies deeply integrated into global production networks are highly vulnerable to international crises, while Zhang and Ding (2024) highlighted that recent GVC restructuring and geopolitical tensions have intensified uncertainty in international production systems. In contrast, the Manufacturing sector (C) demonstrates relatively balanced backward and forward linkages, indicating its dual role as both a user and supplier of intermediate inputs. This finding supports Hayuningtyas et al. (2025), who identified manufacturing as one of Indonesia's strategic sectors with strong multiplier effects. Nevertheless, Indonesia's manufacturing activities remain concentrated in medium- and low-technology industries, supporting the premature deindustrialization argument proposed by Aswicahyono et al. (2010).

Overall, the combination of declining TBL and increasing TFL suggests that Indonesia's economy transitioned toward a deeper export orientation and stronger integration into regional supply chains. While domestic production integration has strengthened, Indonesia's role in GVCs remains concentrated in upstream, resource-intensive activities rather than in technologically advanced production stages. This finding confirms the argument of Humphrey and Schmitz (2002) and Vrh (2018) that deeper GVC participation does not automatically guarantee industrial upgrading or higher domestic value added. Recent international evidence further suggests that successful upgrading in GVCs requires stronger

innovation networks, industrial capability, and governance quality rather than merely increasing trade participation (Tian et al., 2021).

Table 3. ICBL and ICFL for Indonesia, Per Sector

Sector	ICBL IDN				ICFL IDN			
	2000	2005	2010	2014	2000	2005	2010	2014
A	12.48 (32.02)	14.69 (35.62)	7.85 (25.11)	9.47 (29.76)	144.74 (64.11)	151.73 (64.01)	174.74 (65.59)	183.82 (67.51)
B	8.12 (36.14)	11.97 (41.29)	13.74 (31.30)	14.93 (33.70)	468.38 (85.07)	565.53 (89.32)	686.53 (88.53)	815.49 (89.91)
C	35.66 (36.95)	38.28 (39.69)	30.23 (31.97)	36.71 (37.08)	219.60 (85.61)	237.97 (84.53)	244.59 (82.31)	284.16 (84.96)
D	33.88 (30.73)	42.03 (35.05)	19.00 (18.68)	22.60 (22.06)	122.95 (51.14)	109.37 (51.18)	53.13 (38.29)	55.80 (39.88)
E	14.87 (25.43)	26.48 (28.18)	10.27 (30.31)	12.43 (35.46)	50.05 (44.13)	50.94 (38.77)	124.59 (63.30)	63.21 (72.76)
F	47.61 (36.25)	47.99 (37.07)	43.80 (33.80)	50.76 (38.60)	5.09 (45.98)	4.91 (50.63)	21.75 (60.21)	20.77 (59.49)
G	24.88 (36.43)	19.90 (27.72)	17.43 (28.94)	19.15 (31.46)	96.42 (54.16)	81.25 (55.88)	112.80 (55.63)	116.68 (56.95)
H	46.08 (41.41)	42.24 (39.14)	37.65 (35.55)	41.56 (38.84)	141.62 (68.26)	206.35 (77.92)	138.03 (67.56)	110.24 (62.93)
I	29.42 (26.65)	24.09 (28.35)	21.66 (21.40)	26.17 (25.67)	95.56 (86.06)	107.34 (69.57)	115.25 (81.78)	95.29 (76.23)
J	18.21 (29.79)	12.84 (21.76)	15.33 (25.59)	15.38 (25.32)	70.98 (47.79)	134.41 (58.36)	105.84 (57.56)	97.31 (55.23)
K	10.93 (28.83)	8.98 (20.61)	9.66 (21.12)	9.23 (20.38)	187.10 (67.31)	111.24 (49.07)	117.22 (52.66)	117.31 (53.09)
L	8.91 (27.76)	24.99 (31.95)	8.15 (23.02)	8.50 (23.76)	66.81 (41.61)	177.91 (58.73)	25.95 (53.50)	24.72 (51.85)
MN	29.08 (34.06)	25.85 (31.36)	22.89 (29.98)	23.61 (30.71)	143.81 (50.38)	45.54 (81.87)	298.64 (72.45)	246.54 (66.99)
O	27.58 (39.52)	26.68 (32.25)	22.80 (30.14)	21.60 (28.23)	4.22 (47.77)	27.23 (62.21)	31.00 (68.02)	26.71 (64.66)
P	29.60 (37.86)	35.23 (35.35)	19.73 (29.23)	22.30 (32.78)	10.09 (63.85)	39.08 (64.99)	5.24 (45.41)	4.28 (38.01)
Q	35.68 (35.28)	17.94 (23.09)	26.61 (26.02)	30.13 (29.24)	20.79 (59.07)	46.36 (47.84)	30.92 (66.07)	21.36 (55.77)
RSTU	19.86 (32.30)	20.08 (35.34)	12.40 (18.36)	13.00 (19.36)	156.31 (84.23)	36.94 (55.73)	19.60 (31.36)	18.45 (29.52)
Averages	25.46	25.90	19.95	22.21	117.91	125.53	135.64	135.42

*The terms in parentheses give the intercountry backward linkages as a percentage of the total backward linkages as reported in Table 2.

Source: Author's calculation

Table 3 presents Indonesia's Intercountry Backward Linkages (ICBL) and Intercountry Forward Linkages (ICFL) during 2000–2014, revealing significant structural transformation in Indonesia's spatial production interdependence within global value chains (GVCs). Overall, Indonesia experienced a decline in its dependence on foreign intermediate inputs while simultaneously strengthening its role as a supplier of outputs to foreign production systems. This divergence between backward and forward spatial linkages reflects Indonesia's transition toward a more export-oriented and upstream position in regional production

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258

networks. Similar patterns were identified by Dietzenbacher and Van der Linden (1997) and more recently by Sousa Filho et al. (2024), who found that developing economies increasingly participate in GVCs as intermediate-input suppliers rather than as producers of high-value-added final goods.

From the backward linkage perspective, the average proportion of ICBL to TBL declined from 25.46% in 2000 to 19.95% in 2014, indicating that Indonesian sectors increasingly relied on domestically produced intermediate inputs. The decline was particularly evident in Transportation and Storage (H), Information and Communication (J), and Financial Services (K), suggesting stronger domestic production integration and the gradual development of local supporting industries. This finding aligns with Obashi and Kimura (2017), who documented the strengthening of regional production complementarities in ASEAN economies. It also supports Bonadio et al. (2021), who argued that countries tend to strengthen domestic sourcing capacity to reduce vulnerability to disruptions in fragmented global supply chains.

Indonesia's average ICFL rose from 117.91 in 2000 to 135.42 in 2014, showing that its outputs became more important as inputs for foreign production. The largest increase came from Mining and Quarrying (B), rising from 468.38 to 815.49, followed by Manufacturing (C), which grew from 219.60 to 284.16. This confirms Indonesia's specialization in upstream, resource-based roles within GVCs. These results support Kowalski et al. (2015) and Wang et al. (2017), who argue that developing countries often act as suppliers of raw materials and intermediate goods. Similar findings by Zhong & Su (2021) show that ASEAN economies still rely heavily on commodity exports, which limits industrial upgrading.

Table 4. ICBL and ICFL for Indonesia, by Country

Country	ICBL IDN by other country				ICFL IDN by other country			
	2000	2005	2010	2014	2000	2005	2010	2014
Indonesia	49.54	53.8	52.55	51.17	59.28	59.98	58.03	55.57
Australia	1.36	1.23	0.68	0.65	1.14	5.97	1.09	0.85
China	1.37	2.63	3.08	4.28	3.51	5.97	9.98	10.62
India	0.34	0.59	0.41	0.41	0.78	1.37	1.68	1.62
Japan	3.53	2.54	1.80	1.53	7.35	6.93	4.52	3.90
South Korea	1.41	1.68	1.25	1.46	2.99	3.11	2.69	2.35

Source: Author's calculation

At the country level, there is a clear shift from Japan to China in Indonesia's production network. China's ICBL with Indonesia rose from 1.37 to 4.28, while its ICFL jumped from 3.51 to 10.62 between 2000 and 2014. This means China became both a key market for Indonesia's intermediate goods and a major supplier of inputs. This supports Johnson (2018) and Basu and Ray (2022), who highlight China's rise as the main hub in East Asian supply chains. In contrast, Japan's role declined. Indonesia's ICBL with Japan fell from 3.53 to 1.53, and ICFL dropped from 7.35 to 3.90. This

shift toward China-centered networks is also noted by Obashi and Kimura (2017). However, dependence on China creates risks, as geopolitical tensions and GVC changes increase uncertainty (Zhang & Ding, 2024).

Overall, the spatial linkage analysis indicates that Indonesia experienced substantial transformation within regional and global production networks during 2000–2014. Domestic production integration strengthened as dependence on imported inputs declined, while Indonesia simultaneously became more important as an upstream supplier within GVCs. Nevertheless, this integration remains concentrated in resource-based and intermediate-input activities rather than technologically advanced production stages. This finding confirms the arguments of Humphrey and Schmitz (2002) and Vrh (2018) that deeper GVC participation in developing economies does not automatically generate industrial upgrading or higher domestic value added, especially when production specialization remains concentrated in upstream sectors.

CONCLUSION

This study examines Indonesia's role in the global production system using the World Input-Output Database (WIOD) and the Hypothetical Extraction Method (HEM). The results show that the construction sector has the highest Total Backward Linkages (TBL), meaning it depends heavily on inputs from many other sectors. In contrast, mining, quarrying, and manufacturing have the strongest Total Forward Linkages (TFL), indicating their role as key suppliers in global production. From a spatial perspective, China is Indonesia's main partner, serving as both a major source of inputs and a key export destination. The rise in Intercountry Forward Linkages (ICFL) and the decline in Intercountry Backward Linkages (ICBL) suggest that Indonesia is increasingly acting as a supplier in global value chains, while becoming less dependent on foreign inputs.

Based on these findings, several policy steps are important. First, Indonesia should promote industrial upgrading, especially through downstreaming in mining and manufacturing, to increase domestic value added and reduce reliance on raw commodity exports. Second, sectors with strong backward linkages—such as construction, transportation, and information and communication—should be strengthened because they generate large multiplier effects in the economy. This requires better logistics, stronger digital infrastructure, and improved domestic supply networks. Finally, Indonesia needs to balance global integration with greater self-reliance by developing domestic intermediate industries, diversifying trade partners, and improving technology and innovation. This will help the country achieve more sustainable and higher-value participation in global value chains.

REFERENCES

Aswicahyono, H., Hill, H., & Narjoko, D. (2010). Industrialisation after a Deep Economic Crisis: Indonesia. *Journal of Development Studies*, *46*(6), 1084–1108. https://doi.org/10.1080/00220380903318087.

Basu, P., & Ray, P. (2022). China-Plus-One: Expanding Global Value Chains. *Journal of Business Strategy*, *43*(6), 350–356. https://doi.org/10.1108/JBS-04-2021-0066.

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258

Bonadio, B., Huo, Z., Levchenko, A. A., & Pandalai-Nayar, N. (2021). Global Supply Chains in the Pandemic. *Journal of International Economics*, *133*, 103534. https://doi.org/10.1016/j.jinteco.2021.103534.

Chatterjee, S. (2023). FDI Inflows and Global Value Chains in the ASEAN in Recent Years. *Journal of Economic Integration*, 38(4), 615–638. https://doi.org/10.12792/JMTI.10.2.59.

Cho, W.-H., Seung, C. K., Choi, J.-H., & Kim, D.-H. (2026). Evaluating the Economic Contribution of Seafood Industries in Busan using the Hypothetical Extraction Method. *Frontiers in Marine Science*, *13*. https://doi.org/10.3389/fmars.2026.1732248.

Dietzenbacher, E., van Burken, B., & Kondo, Y. (2019). Hypothetical Extractions from a Global Perspective. *Economic Systems Research*, *31*(4), 505–519. https://doi.org/10.1080/09535314.2018.1564135.

Dietzenbacher, E., & Van Der Linden, J. A. (1997). Sectoral and Spatial Linkages in the EC Production Structure. *Journal of Regional Science*, *37*(2), 235–257. https://doi.org/10.1111/0022-4146.00053.

Esquivias, M. A., Sari, D. W., & Handoyo, R. D. (2018). *Increasing Management Relevance and Competitiveness*. New York: CRC Press.

Hayuningtyas, A., Lubis, M. F., Anam, M., Kusumawardani, S. A., & Kartiasih, F. (2025). Potensi Ekonomi Industri Pengolahan Indonesia: Analisis Input-Output. *Margin Eco*, *8*(2), 152–173. https://doi.org/10.32764/margin.v8i2.5145.

Humphrey, J., & Schmitz, H. (2002). How Does Insertion in Global Value Chains Affect Upgrading in Industrial Clusters? *Regional Studies*, *36*(9), 1017–1027. https://doi.org/10.1080/0034340022000022198

Johnson, R. C. (2018). Measuring Global Value Chains. *Annual Review of Economics*, *10*(1), 207–236. https://doi.org/10.1146/annurev-economics-080217-053600

Kowalski, P., Gonzalez, J. L., Ragoussis, A., & Ugarte, C. (2015). Participation of Developing Countries in Global Value Chains. *OECD Trade Policy Papers*, *179*. OECD Publishing.

Leontief, W. W. (1936). Quantitative Input and Output Relations in the Economic Systems of the United States. *The Review of Economics and Statistics*, *18*(3), 105. https://doi.org/10.2307/1927837.

Miller, R. E., & Blair, P. D. (2009). *Input-Output Analysis*. Cambridge: Cambridge University Press.

Muchdie, M., & Imansyah, M. H. (2020). Inter-Sector and Inter-Country Linkages in the Indonesian Economy: World Input-Output Analysis. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan*, *20*(2), 232–245. https://doi.org/10.23917/jep.v20i2.9057.

Muchdie, M., Imansyah, M. H., & Prihawantoro, S. (2020). Keterkaitan Spasial di Enam Negara Asia: Analisis Input-Output Dunia. *Jurnal Ekonomi dan Pembangunan Indonesia*, *20*(1), 20–32. https://doi.org/10.21002/jepi.2020.02.

Obashi, A., & Kimura, F. (2017). Deepening and Widening of Production Networks in ASEAN. *Asian Economic Papers*, *16*(1), 1–27. https://doi.org/10.1162/ASEP_a_00479.

Park, I. (2020). Regional Trade Agreements in East Asia: Past and Future. *Development Policy Review*, *38*(2), 206–225. https://doi.org/10.1111/dpr.12418.

Sandi, I. M., Abioga, N. R., Aditya, R. D., & Kartiasih, F. (2025). Analysis of Carbon Emissions in ASEAN Manufacturing: Input-Output and Panel Data Approach. *Efficient: Indonesian Journal of Development Economics*, *8*(1), 323–339. https://doi.org/10.15294/jsnnrt5.

Sousa Filho, J. F. de, Santos, G. F. dos, Ribeiro, L. C. de S., de Cerqueira, R. B., & Lima, L. L. (2024). Global Value Chains and Intra-BRICs Trade in Value-Added. *Journal of Government and Economics*, *16*, 100127. https://doi.org/10.1016/j.jge.2024.100127.

Taguchi, H., & Thet, M. S. (2021). Quantitative Linkage between Global Value Chains' Backward Participation and Logistics Performance in the Host Country: A Structural Gravity Model Analysis of Emerging ASEAN Economies. *Asia-Pacific Journal of Regional Science*, *5*(2), 453–475. https://doi.org/10.1007/s41685-020-00187-z.

Temurshoev, U. (2010). Identifying Optimal Sector Groupings with the Hypothetical Extraction Method. *Journal of Regional Science*, *50*(4), 872–890. https://doi.org/10.1111/j.1467-9787.2010.00678.x.

Tian, K., Dietzenbacher, E., & Jong- A- Pin, R. (2021). Global Value Chain Participation and Its Impact on Industrial Upgrading. *The World Economy*, *1*, 1–24.

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & de Vries, G. J. (2015). An Illustrated User Guide to the World Input–Output Database: The Case of Global Automotive Production. *Review of International Economics*, *23*(3), 575–605. https://doi.org/10.1111/roie.12178.

Tukker, A., & Dietzenbacher, E. (2013). Global Multiregional Input–Output Frameworks: An Introduction and Outlook. *Economic Systems Research*, *25*(1), 1–19. https://doi.org/10.1080/09535314.2012.761179.

Urata, S., & Baek, Y. (2020). Does Participation in Global Value Chains Increase Productivity? An Analysis of Trade in Value Added Data. *Thailand and the World Economy*, *38*, 1–28.

Vrh, N. (2018). What Drives the Differences in Domestic Value Added in Exports Between Old and New E.U. Member States? *Economic Research-Ekonomska Istraživanja*, *31*(1), 645–663. https://doi.org/10.1080/1331677X.2018.1438910.

Wang, Z., Wei, S.-J., Yu, X., & Zhu, K. (2017). Measures of Participation in Global Value Chains And Global Business Cycles. *NBER Working Paper No. w23222.*

Zajidah, A. M., Widyastuti, D., Samosir, I. N. F., Simamora, P. N., & Kartiasih, F. (2025). Global Economic Dynamics and Its Impact on Indonesian Trade: Multi-Regional Input-Output Analysis Approach. *Cendekia Niaga: Journal of Trade Development and Studies*, *9*(1), 69-82.

Zhang, H., & Ding, Y. (2024). The Impact of Global Value Chain Restructuring on the Product Structure of China-EU Exports. *Journal of Asian Economics*, *91*, 101708. https://doi.org/10.1016/j.asieco.2024.101708.

Zhong, S., & Su, B. (2021). Investigating ASEAN' s Participation in Global Value Chains: Production Fragmentation and Regional Integration. *Asian Development Review*, *38*(2), 159–188. https://doi.org/10.1142/S0116110521500025.

https://journal.uinjkt.ac.id/index.php/etikonomi
DOI: https://doi.org/10.15408/etk.v25i1.47258