Cross-Sectoral Inter-Country Linkages under the Belt and Road Initiative: Chinese ICT Services Value Added Inflows to Manufacturing Exports in the New Eurasian Land Bridge Economies

Ewa Cieślik

Department of International Economics, University of Economics and Business, 61-875 Poznan, Poland; ewa.cieslik@ue.poznan.pl

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Abstract: The article presents the New Eurasian Land Bridge (NELB) of the Belt and Road Initiative (BRI) and China, with a special focus on the role of these countries in global value chains (GVCs), to investigate the intensification of the Chinese ICT services’ value-added inflows to the NELB countries’ manufacturing, especially to transport equipment and computers, electronic and electrical equipment. The central question is how strong the linkages between the Chinese ICT services and the selected NELB countries’ manufacturing are. We hypothesized that: (1) As a result of the introduction of the BRI, the role of the Chinese ICT services’ value-added diverted to the NELB countries’ manufacturing gross exports increased; (2) The growth rate of the Chinese ICT services’ value-added directed to the NELB manufacturing gross exports exceeds the growth rate of the non-services’ value-added diverted to their manufacturing; (3) The NELB economies became more dependent on the Chinese ICT services’ value-added embodied in their manufacturing gross exports.

Keywords: foreign trade; global value chains; foreign value-added; manufacturing; ICT services; New Eurasian Land Bridge; Belt and Road Initiative; China

1. Introduction

The New Eurasian Land Bridge (NELB) is one of the routes of the Belt and Road Initiative (BRI), connecting Europe with the People’s Republic of China (PRC), as well as the Pacific with the Atlantic Ocean [1]. In fact, this corridor is perceived as a transcontinental rail route. Sometimes in the literature, it appears under other names, including the North Eurasian Corridor, the Second Eurasian Continental Bridge, or the New Eurasian Continental Bridge. The NELB covers the Visegrad Group countries (Czechia, Hungary, Poland, and Slovakia), Slovenia, Ukraine, and Kazakhstan.

Opened in the early 1990s, the NELB gained a new impetus thanks to the BRI. To date, several transcontinental rail routes have been launched, including the Chongqing-Xinjiang-Europe railway (to German Duisburg through Poland), the Chengdu-Xinjiang-Europe railway (to Poland), the Yiwu-Xinjiang-Europe railway (to Madrid), China-Europe Railway Express, New International Land-Sea Trade Corridor, and the Budapest-Belgrade railway connection, as well as a large port, power lines, and pipeline projects [1].

In December 2017, the China Daily agency defined the activity of the NELB: “In total, freight trains between China and Europe have made more than 6200 trips since this vital West-East trading corridor opened in 2011. The New Silk Road’s international cross-border rail network has connected 35 Chinese cities with 34 European destinations over the past six years. In 2017 alone, there took place over 3270 trips between cities on two continents, and the number of train trips is expected to reach 4000 in 2018” [2].
The creation of the NELB corridor occurred for several reasons. First, this route is a part of the PRC’s growing pressure on integration with the European markets, especially those from Western Europe [1].

Second, geopolitical conditions along the corridor (Russia and Central Asia) favored the creation of the route. In recent years, China has deepened strategic cooperation with the nations along this corridor, especially with Russia. In addition, Central Asian economies perceive the BRI as an opportunity to intensify trade and investment flows. Furthermore, economies covered by the NELB corridor are mostly positive about China and its impact on their economies [3].

Third, the integration of the region is supported by the functioning of several regional institutions, such as the Shanghai Cooperation Organization, the “16 + 1” (now “17 + 1”) format, or the Eurasian Economic Union, which together support the implementation of institutionalized dialogue and long-term planning. This is why this corridor stands out as an alternative to other land routes running through the Middle East and North Africa.

Fourth, the NELB is also a part of the Chinese energy strategy and an alternative to relations with Russia and the Central Asian economies. This corridor may also reduce dependence on raw material supplies from the Persian Gulf [4].

Despite many advantages of the corridor, the NELB covers a relatively small area and its role is relatively small among other BRI routes [5]. However, it can be considered as an important link between China and Europe.

The general goal of the article is to investigate the intensification of the Chinese ICT services’ value-added inflows to the NELB countries’ manufacturing, especially to transport equipment and computers, electronic and electrical equipment. The central question is how strong the linkages between the Chinese ICT services and the selected NELB countries’ manufacturing are. The article presents the transformation of these linkages since 2005. We ended our analysis in 2015 due to data availability.

We verified three hypotheses:

1. As a result of the introduction of the BRI, the role of the Chinese ICT services’ value-added diverted to the NELB countries’ manufacturing gross exports increased;
2. The growth rate of the Chinese ICT services’ value-added directed to the NELB manufacturing gross exports exceeds the growth rate of the non-services’ value-added diverted to their manufacturing;
3. The NELB economies became more dependent on the Chinese ICT services’ value-added embodied in their manufacturing gross exports.

In this article, we tried to link the traditional cross-sectoral connections (the so-called home market effect) with the global market effect. Therefore, we evaluated the foreign value added created by the Chinese ICT services embodied in the NELB countries’ manufacturing. To the best of our knowledge, this kind of study on the linkages between CEE countries and China in the global framework has never been conducted until now.

We classified the ICT services for OECD’s ISIC Revision 4. Originally, they consist of publishing, audio-visual and broadcasting activities, telecommunications and IT, and other information services. We focused on the main category and its subsectoral level. We analyzed the Visegrad Group members and Slovenia. Ukraine and Kazakhstan were not included.

Apart from the introduction and conclusions, the article is divided into three sections. Firstly, we explain the concept of linkages between services and manufacturing, followed by a brief description of the methodology applied in this article. The third section analyzes the Chinese value-added ICT services’ contribution to manufacturing in five European countries with respect to the foreign value added embodied in their gross exports. In the conclusions, we verify the research questions.
2. The Role of Services in Manufacturing: Literature Review

The manufacturing process does not only consist of activities connected to the respective manufacturing industries but also needs activities from non-manufacturing industries, for example, services that are produced domestically or imported from abroad. This approach is different from the “classical” perspective, which argues that manufacturing is involved only in the value-additions created through manufacturing activities, without any connections to the activities from other sectors. The alternative approach to the “classical” perspective focuses on value added in the manufacturing process created in all production stages. It implies that manufacturing comprises the sum of many activities, including services, along the production chain, which are used to create a final product [6,7]. Some authors call this process the “servicification” of manufacturing. Services are used throughout the manufacturing process in many ways. We apply them in the first stages of the value chain, for example, R&D activities. We can also use them at the end of the chain, for instance, maintenance or repair. Moreover, we utilize a lot of services at every stage of production, for example, IT services and telecommunications, which are also examined in this paper.

Due to the notable developments in ICT, the services sector has significantly contributed to productivity growth. Technological progress, digitalization, and significant reductions in transport costs have transformed a number of services into more tradable ones. Moreover, automation has changed the labor-intensive manufacturing sectors, and finally, at present, services account for a much higher share of value added than manufacturing; in 2015, services (including construction) accounted for almost 71% of global value added [8].

Connections between manufacturing and services fit in the debate on the deindustrialization of economies [9–13] and the above-mentioned “servicification” of economies [14,15]. Though we do not analyze the truth of these two approaches, we use the concept of inclusion of certain services’ value added into manufacturing.

We can indicate various types of interactions between manufacturing and services. According to [16], we may point out four broad forms of interaction between manufacturing and services (Table 1). These forms depend on whether the interaction happened domestically or internationally or which organizational form of production is chosen. By choosing vertical integration, a company may keep its production within its boundaries, but produce at home (standard vertical integration) or abroad (vertical integration FDI and intra-firm trade), depending on its preferences. There are also two other types of interaction among sectors: buying of components domestically (domestic outsourcing) or using a foreign supplier (foreign outsourcing). Vertical integration means that a company can keep production of an intermediate input within the company, and produce it at home or in a foreign country. When the company decides to produce at home, it engages in standard vertical integration. When it decides to produce it within the company but abroad, it engages in FDI and in intra-firm trade. Buying-in of components means that a company may choose to purchase components in the home (domestic outsourcing) or foreign country (foreign outsourcing).

| Organizational Form | Country |
|---------------------|---------|
| Standard vertical integration (a firm produces at home) | Buying from a domestic supplier (e.g., via outsourcing), use of domestic intermediate inputs |
| Vertical integration FDI and intra-firm trade (a firm produces abroad) | Buying from a foreign supplier (e.g., foreign outsourcing), inter- or intra-industry trade |

Source: Own work on the basis of [16].
There are a lot of studies that have been conducted to analyze sectoral linkages in the context of a national economy, for example, the Lewis [17] dual economy model, Hirschman’s [18] theory of unbalanced growth or their followers such as Leontief [19,20], Gurgul and Lach [21], and Zheng et al. [22].

Meckstroth [23] went one step further and transformed Hirschman’s theory of unbalanced growth in a useful way. He used the example of a manufacturing plant and examined how it stimulates domestic services in the upstream supply chain (R&D services, outsourced professional services, transport of inputs, utilities) and the downstream sales chain (transport, wholesale and warehousing operations, retail operations, maintenance and repair services). In turn, Berger [24] argued that some industries, for example, R&D and manufacturing, are closely linked to each other. Innovation is part of the whole process of manufacturing. Similarly, Pisano and Shih [25] stated that we should not separate manufacturing from services. The authors proposed a new term, “industrial commons”, which was defined as: “The R&D and manufacturing infrastructure, know-how, process-development skills, and engineering capabilities embedded in firms, universities, and other organizations that provide the foundation for growth and innovation in a wide range of industries”.

The importance of cross-sectoral linkages has been demonstrated in many empirical studies, but most of these studies were not international evidence. For instance, Kox [26] argued that Dutch business services played an important role in the national innovation system and created knowledge spillover to other sectors, including manufacturing. Similarly, Foster et al. [27] showed the prevalence of technology spillovers between services and industry. They proved that services are responsible for “non-negligible productivity effects through R&D for manufacturing”. Pilat and Wölfl [28] demonstrated that Danish and Swedish companies attribute a rising share of revenue in manufacturing firms to services. Similar conclusions were drawn by Breinlich and Criscuolo [29] for companies from the UK. Lodefalk [30] argued that manufacturing in industrialized countries is dependent on services more intensively than before. This thesis was confirmed by Nordås [31], who proved that the ratio of bought-in services to value-added has grown in importance across all manufacturing industries. Rueda-Cantuche et al. [32] found that the financial sector has been characterized by significant forward linkages to the other sectors of the EU economy. Šidlauskaitė and Miškinis [33] found in their study strong forward linkages between services and manufacturing in the Baltic states. Similar to Šidlauskaitė and Miškinis, Kowalski et al. [34] and Beverelli et al. [35] also showed strong linkages between domestic services and manufacturing that resulted in a higher level of GVCs integration. They explained that this phenomenon could be due to higher labor productivity and higher “value effects” in countries’ greater participation in GVCs.

Presently, joining the global economy also means cross-sectoral connections in international dimensions. Unfortunately, the influence of services on manufacturing exports has been scarcely examined so far. Nevertheless, we found a few studies focused on this problem.

Francois and Wörz [36] and Wolfmayr [37] examined the OECD countries. They demonstrated a significant and obviously positive effect of services on manufacturing competitiveness, which is limited to foreign and business services and the most skill- and technology-intensive manufacturing. Miroudot and Cadestin [38] estimated that the share of services value-added to manufacturing firms across OECD economies was nearly 40%. According to Baldwin et al. [39], the majority of manufacturing value-added stems from services in Asia. Neely et al. [40] showed that by 2011, roughly 46% of companies in Malaysia, 25% in Thailand, and 22% in Indonesia had undergone the “servicification” process. In turn, Landesmann and Leitner [41] focused on the EU members and they also found a positive impact on manufacturing competitiveness for both domestic and foreign intermediate business services. Amiti and Wei [42] argue that the productivity of US manufacturing companies has risen in response to the offshoring of services. Díaz-Mora et al. [43] examined the impact of foreign services’ value-added embodied in manufacturing exports on the export durations for 63 countries in 1995–2014. Similar to previous studies, their findings proved the positive effect that is more pronounced for developing economies. Liu et al. [44] find a positive influence of the development of financial
and business services on the competitiveness of manufacturing exports, especially for manufacturing sectors that utilize the services intensively. One of the latest large examinations on the role of services in manufacturing was prepared by Blázquez et al. [45]. They explored the phenomenon of the international “servicification” of manufacturing between 1995 and 2011. They revealed that service inputs are a key determining factor for manufacturing competitiveness.

More detailed surveys that focus on selected sectors of Central and Eastern Europe (CEE) economies can be found. Kaminski and Ng [46] investigated trade networks. They emphasized that the growth of specialization in manufacturing was an important driver of the economic growth of many transitional CEE countries. They argued that these production linkages underwent a significant transition: a shift from labor-intensive simple assembly operations to processing and local production of parts, and an expansion beyond the EU. Moreover, they presented the integration of CEE countries into the EU production networks in, inter alia, sectors experiencing the “information revolution”, especially Estonia and Hungary.

3. Data Description and Method

In order to analyze the participation and position of the NELB economies in GVCs as well as the flows of value added between Chinese services and these countries’ manufacturing, we applied the methodology described in detail in another paper [47]. A multi-regional input-output model was employed, which also included value-additions in industries/sectors. This approach was a combination of methods adopted by several authors [6,7,48,49]. These authors have applied models for calculating value added for the entire economy, not for individual sectors. In our approach, these models were expanded to sector/industry analyses, as far as statistical data allowed.

The key to calculating foreign-value added (FVA) embodied in gross exports is to define what is FVA and what distinguishes this category from standard calculations in foreign trade covered by the imperfection associated with the so-called “double counting”. In order to remove the effect of “double counting” from aggregate trade statistics, gross exports were decomposed and we distinguished three categories: domestic value added, domestic value added in indirect export that returns to the home country, and foreign value added.

Data referring to trade in value added statistics are collected by OECD’s Inter-Country Input-Output Database which provides information up to 2015. We collected the data and constructed an index of foreign value added embodied in a country’s gross exports that helped us to assess the extent to which a country is dependent on the global/certain state’s production chain.

We assume that there are S different sectors and N different economies. Each sector in one country produces a single differentiated product: SN goods.

We state that we have S sectors and N countries. Each sector in one country produces a single differentiated product: SN goods. Production (α) is used for both, to satisfy final demand (absorption) (δ) and for the production of intermediate input in the production process (at home country and abroad) (z): αi (s) = Σδij (s) + Σzij (s, t). Then we can define the coefficient matrix A as a matrix with an SN by SN dimension, where elements:

\[ a_{ij} (s, t) = \frac{z_{ij} (s,t)}{\alpha_j (t)} \]  

we can reformulate (1) as x=Ax + y.

Thus we may formulate a fundamental condition

\[ \alpha = (I - A)^{-1} \delta \] —where \((I - A)^{-1}\) is the Leontief Inverse Matrix, which means the total requirement matrix that gives the amount of gross output in country s required for an increase in final demand in the destination country by unit.
This can be presented as a matrix:

\[
\begin{bmatrix}
X_1 \\
\vdots \\
X_N
\end{bmatrix} = 
\begin{bmatrix}
I - A_{11} & \cdots & -A_{1N} \\
\vdots & \ddots & \vdots \\
-A_{N1} & \cdots & I - A_{NN}
\end{bmatrix}^{-1}
\begin{bmatrix}
\sum_{j}^{N} Y_{1j} \\
\vdots \\
\sum_{j}^{N} Y_{Nj}
\end{bmatrix} = 
\begin{bmatrix}
B_{11} & \cdots & B_{1N} \\
\vdots & \ddots & \vdots \\
B_{N1} & \cdots & B_{NN}
\end{bmatrix}^{-1}
\begin{bmatrix}
Y_1 \\
\vdots \\
Y_N
\end{bmatrix}
\]

Then, we can rearrange the above equation into:

\[
\begin{bmatrix}
\alpha_{11} & \cdots & \alpha_{1N} \\
\vdots & \ddots & \vdots \\
\alpha_{N1} & \cdots & \alpha_{NN}
\end{bmatrix} \begin{bmatrix}
\beta_{11} & \cdots & \beta_{1N} \\
\vdots & \ddots & \vdots \\
\beta_{N1} & \cdots & \beta_{NN}
\end{bmatrix} + \begin{bmatrix}
\delta_{11} & \cdots & \delta_{1N} \\
\vdots & \ddots & \vdots \\
\delta_{N1} & \cdots & \delta_{NN}
\end{bmatrix}
\]

where:

- \( \beta \)—the total amount of gross output in producing economy i needed to satisfy consumption (absorption) in economy j
- \( a \)—gross output produced in economy i and absorbed in economy j
- \( \delta \)—gross output produced in economy i and absorbed in economy j

Then we create the value-added production matrix \( \hat{V} \beta \delta \):

\[
\begin{bmatrix}
\hat{V}_1 & \cdots & 0 \\
\vdots & \ddots & \vdots \\
0 & \cdots & \hat{V}_N
\end{bmatrix} \begin{bmatrix}
\alpha_{11} & \cdots & \alpha_{1N} \\
\vdots & \ddots & \vdots \\
\alpha_{N1} & \cdots & \alpha_{NN}
\end{bmatrix} + \begin{bmatrix}
\hat{V}_1 \sum_{j}^{N} \beta_{1j} \delta_{j1} & \cdots & \hat{V}_1 \sum_{j}^{N} \beta_{1j} \delta_{jN} \\
\vdots & \ddots & \vdots \\
\hat{V}_N \sum_{j}^{N} \beta_{Nj} \delta_{j1} & \cdots & \hat{V}_N \sum_{j}^{N} \beta_{Nj} \delta_{jN}
\end{bmatrix}
\]

\( \hat{V} \) is a diagonal matrix with the dimension N by N, with direct value-added coefficients along the diagonal. Elements in the diagonal matrix mean value-added absorbed at home. All elements of the diagonal matrix mean value-added embodied in a partner’s gross exports.

The whole process of decomposition of gross exports was presented by Koopman et al. [49] who identified which parts of value-added are double–counted (Figure 1). As we focused on the foreign value-added embodied in gross exports, we omitted some equitation that concerned domestic value-added and domestic intermediate exports that return home.

![Figure 1. Gross exports decomposition scheme. Source: Based on [49].](image-url)
Foreign content embodied in a country’s gross exports can be formulated as follows:

\[
VS = \sum_{j=1}^{N} V_i \beta_{ij} E_{i^*} = \sum_{i=1}^{N} \sum_{j=1}^{N} V_i \beta_{ij} \delta_{ij} + \sum_{i=1}^{N} \sum_{j=1}^{N} V_i \beta_{ij} A_{ij} (I - A_{ij})^{-1} \delta_{jj} + \\
\sum_{i=1}^{N} V_i \beta_{ii} (I - A_{ii})^{-1} E_{i^*}
\]

(6)

where: \( \sum_{i=1}^{N} \sum_{j=1}^{N} V_i \beta_{ij} \delta_{ij} \) — foreign value-added embodied in final goods exports;
\( \sum_{i=1}^{N} \sum_{j=1}^{N} V_i \beta_{ij} A_{ij} (I - A_{ij})^{-1} \delta_{jj} \) — foreign value-added embodied in gross exports of intermediate products;
\( \sum_{i=1}^{N} V_i \beta_{ii} (I - A_{ii})^{-1} E_{i^*} \) — double-counted intermediate goods’ value-added manufactured abroad.

Eventually, the decomposition of gross exports may be formulated:

\[
DCP = \left[ V_i \sum_{j=1}^{N} \beta_{ij} \delta_{ij} + V_i \sum_{j=1}^{N} \beta_{ij} \delta_{jj} + V_i \sum_{j=1}^{N} \sum_{i=1}^{N} \beta_{ij} \delta_{jj} \right] + \left[ \sum_{i=1}^{N} \sum_{j=1}^{N} V_i \beta_{ii} \delta_{ij} + \sum_{i=1}^{N} \sum_{j=1}^{N} V_i \beta_{ii} A_{ij} (I - A_{ij})^{-1} \delta_{jj} + V_i \sum_{j=1}^{N} \sum_{i=1}^{N} \beta_{ij} \delta_{jj} \right] + \left[ V_i \sum_{j=1}^{N} \sum_{i=1}^{N} \beta_{ij} A_{ij} (I - A_{ii})^{-1} \delta_{ii} + V_i \sum_{j=1}^{N} \sum_{i=1}^{N} \beta_{ij} A_{ij} (I - A_{ii})^{-1} E_{i^*} \right]
\]

(7)

In our study, we classified ICT services according to OECD’s ISIC Revision 4. Originally ICT services consisted of publishing, audio-visual and broadcasting activities, telecommunications and IT, and other information services. ICT services and their subgroups are part of business sector services. We focused on the main category and its two last subgroups. Under ISIC Revision 4 the category “manufacturing” comprises also activities that are services, such as “repair and installation of machinery and equipment”. We did not deduct these questionable activities from manufacturing in general calculations. Nevertheless, for a more detailed examination, we focused only on transport equipment and computers, and electronic and electrical equipment as the two very integrated into the GVCs subsectors of manufacturing in the NELB economies.

4. Discussion

The Chinese export sector is characterized by its persistently high growth rates; between 2005 and 2015, it grew at a compounded annual growth rate of over 12%. When we compare the proportions of Chinese manufacturing and services gross exports, we observe the predominance of the former; in 2015, manufacturing accounted for almost 90% of gross exports, while services exports accounted for less than 10%. Disaggregation at the subsectoral level revealed that traditional services (e.g., wholesale, retail trade, transportation), not advanced ones (e.g., IT and other information services, telecommunications), dominated Chinese exports. However, conventional statistics inclined to underestimate the actual contribution of services at different production stages. When we compare Chinese services’ value-added, it is easy to see the important role of the contribution of services in gross exports. In 2015, services’ value-added accounted for almost 35% of Chinese gross exports and almost 30% of manufacturing gross exports. The PRC’s manufacturing gross exports use advanced services to a small degree, being dominated by traditional services. However, the contribution of these services has grown in importance significantly [8].

In 2015, ICT services also played an important role in China’s exports of services, accounting for 40% of the PRC’s total exports of services, which exceeded Japan or the US. This phenomenon is reflected in the intensification of the inflow of value-added of services related to advanced technologies. In recent years, especially after the creation of the “16 + 1” format, technological cooperation between China and the NELB countries has intensified. Almost all countries have established joint activities with China in technological science and technology cooperation [50]. When examining the pattern of trade between the PRC and the NELB countries in the past decades, it underwent structural changes that are characterized by a sharp rise in exports of high-tech products and supported ICT services, increasing the high technology intensity of trade. The high technology intensity of trade is mainly
due to the large flows of transport equipment, electronics and telecommunications products, and ICT service facilities, based on the activity of multinational companies in global production networks, not in local companies.

In this section, we tried to examine the connections between Chinese ICT services and the NELB countries’ manufacturing in terms of value-added embodied in gross exports. The figures reveal that in each of the analyzed countries, Chinese FVA grew in importance in 2005–2015. Taking into account the statistics, we can surmise that the largest changes in FVA occurred in Slovakia (3.4%), Poland (3.2%), and Czechia (3.1%). These high FVA were reflected in China’s position among FVA suppliers. In 2015, Czechia ranked the highest place (fifth), but Poland and Slovakia also kept high ranks (seventh for both countries). In Hungary, there was the lowest change between 2005 and 2015. After a sudden rise in Chinese FVA in Hungarian manufacturing exports in 2005–2010, it plunged back to its original level. In 2015, Czechia’s and Slovakia’s manufacturing exports relied on Chinese FVA (5% both) the most. We noticed the lowest dependency on Chinese FVA in Slovenia (3.1%). In 2015, Slovenia and Hungary were characterized by the lowest of China’s positions among FVA suppliers (eighth). Chinese ICT services’ FVA was directed mainly to manufacturing exports. For example, in 2015, 91% of the ICT services’ FVA was utilized in Slovakian manufacturing exports (the highest level among all analyzed countries), while in Poland it was 82% (the lowest level among all analyzed nations). In Poland, business sector services accounted for a large portion of Chinese ICT services’ FVA as well. In all analyzed economies, the EU-28 countries, primarily UE-15, and especially Germany and the UK, remained the largest suppliers of ICT services’ FVA to manufacturing. Furthermore, the US played an important role as a supplier of value added to manufacturing gross exports. It is important to emphasize that China’s position among FVA suppliers went up in the period 2005–2015 in almost all analyzed economies, except for Hungary, where the Chinese role was fluctuating (Tables 2 and 3).

When we analyzed China’s role in the interactions between telecommunications value added and the NELB countries’ manufacturing gross exports, the figures revealed a huge dependence—much higher than in terms of total ICT services’ FVA. Moreover, the results of the study demonstrated the substantial surge of Chinese FVA in all countries in 2005–2015. In 2015, Polish manufacturing was the most dependent on Chinese telecommunications services’ FVA (14.3%), followed by Slovakia (13.4%), and Czechia (13.3%). The PRC remained a leader among telecommunications FVA suppliers for these economies. Hungarian and Slovenian manufacturing gross exports were not so dependent on Chinese FVA, but China remained one of their leading FVA suppliers. In 2015 in Czechia, the lion’s share of telecommunications services’ FVA was absorbed by two branches: computer, electronic and optical products (32.6% of the total telecommunications services’ FVA). As a subsector of computers, electronic and electrical equipment; and motor vehicles, trailers, and semi-trailers (25.2%) as a subgroup of transport equipment. Generally, three-quarters of the total Chinese telecommunications services’ FVA directed to manufacturing exports were absorbed into computers, electronic and electrical equipment, and transport equipment together. The rest of this share was divided among many other industries’ gross exports in small portions. Hungary was similar to Czechia with respect to the export absorption of Chinese telecommunications services’ FVA—computer, electronic and optical products accounted for 37.2% of the total telecommunications FVA and motor vehicles, trailers and semi-trailers FVA absorbed 24.4%. In 2015, 78% of the total Chinese telecommunications services’ FVA directed to manufacturing was absorbed into two main groups: computers, electronic and electrical equipment, and transport equipment. In Poland, three industries: computer, electronic and optical products (18.5% of the total telecommunications services’ value-added); electrical equipment (13.1%); and motor vehicles, trailers and semi-trailers (11.6%) absorbed the largest part of Chinese telecommunications services’ FVA. Furthermore, chemicals and non-metallic mineral products were important recipients of this FVA. Generally, 55.2% of total Chinese telecommunications services’ FVA diverted to manufacturing exports went to two main production groups. In Slovakia, we observed a similar situation to Czechia and Hungary: computer, electronic and optical products (32.8% of the total telecommunications services’ value-added); and motor vehicles, trailers and semi-trailers (25.3%) dominated among other product
groups’ absorption of Chinese telecommunications services’ FVA. Generally, 73.6% of the total Chinese telecommunications services’ FVA diverted to Slovakia’s manufacturing gross exports were directed to two main product groups. In Slovenia, the numbers of total Chinese telecommunications services’ FVA remained much smaller in comparison to the previous economies. The largest demand for this value added was reported in electrical equipment exports (16%) and motor vehicle, trailer, and semi-trailer exports (13.6%). Also, chemicals and non-metallic mineral products and basic metals and fabricated metal products utilized the Chinese telecommunications services’ FVA. A total of 44.1% of Chinese telecommunications services’ FVA directed to manufacturing exports was absorbed by computers, electronic and electrical equipment, and transport equipment gross exports (Tables 2 and 3) [8].

Chinese IT and other information services’ FVA in the NELB countries’ manufacturing gross exports was less significant. In 2015, the most dependent on this FVA were Czechia and Slovakia (1.7% each). The figures did not reveal a substantial change between 2005 and 2015. In Hungary, we even saw a decrease in this share. Moreover, the data suggest that China was less important than the EU as an IT and other information services’ FVA provider to manufacturing gross exports. The PRC ranked at the highest places among these FVA suppliers in Czechia and Slovakia, but these locations were far from the leaders. Generally, China’s positions fluctuated in the analyzed period (Tables 2 and 3).

China’s ICT services’ FVA seemed to be important in the NELB countries’ transport equipment gross exports in the analyzed period. In 2015, we noticed the largest share of Chinese FVA in Poland and Czechia’s transport equipment gross exports (4.5% and 4.1%, respectively). These countries also notified the largest surge in Chinese FVA in 2005–2015. In other economies, these shares also stayed relatively high. Recently, China’s position among FVA suppliers improved significantly in all analyzed countries. The majority of this FVA went to motor vehicle, trailer, and semi-trailer exports. It is important to emphasize that Germany played a predominant role among ICT services’ FVA providers in transport equipment gross exports (23% in Hungary, 22% in Czechia, 18% both in Poland and Slovakia, and 14% in Slovenia). Beyond the geographic proximity to Germany, cultural similarities, and labor cost differentials, and the fact that these economies share a similar sectoral structure, suggest that they have adequate labor skills to support German production. Most of the differences among the relations between each economy and Germany in the character of their linkages can be explained by different trade and investment interdependencies. The forward linkages of the NELB countries with Germany in GVCs were weaker than their backward linkages [8,51].

In contrast to transport equipment gross exports, China played an important role in computers, electronic and electrical equipment in the NELB economies. The country always ranked behind Germany, however. In 2015, Germany realized 21% of total FVA between analyzed sectors in Hungary, 18% in Czechia, 16% in Poland, and 13% both in Slovakia and Slovenia. In 2015, the largest share of Chinese ICT services’ FVA in computers, electronic and electrical equipment exports occurred in Czechia and Slovakia: 10.5% in both. The figures revealed the lowest dependency on Chinese FVA in Slovenia (5.5%), and the most significant growth in Slovakia (Table 2).
|                          | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Change Between 2005 and 2015 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|----------------------------|
| **Total FVA share in the NELB countries** | 3.9  | 4.1  | 5.2  | 5.8  | 6.8  | 7.0  | 6.9  | 6.8  | 7.0  | 7.5  | 8.5  | 4.6                        |
| **ICT services in manufacturing** |      |      |      |      |      |      |      |      |      |      |      |                            |
| **Czechia**              | 1.9  | 2.3  | 3.0  | 3.3  | 3.8  | 3.4  | 3.4  | 3.4  | 3.3  | 3.6  | 5.0  | 3.10                       |
| **Hungary**              | 3.3  | 3.2  | 3.2  | 3.4  | 3.3  | 3.4  | 3.0  | 2.7  | 2.8  | 3.0  | 3.9  | 0.60                       |
| **Poland**               | 1.5  | 1.8  | 2.3  | 2.4  | 2.3  | 2.0  | 1.8  | 2.3  | 2.6  | 3.3  | 4.7  | 3.20                       |
| **Slovakia**             | 1.6  | 2.2  | 3.0  | 2.7  | 2.4  | 2.4  | 2.5  | 2.6  | 3.2  | 3.9  | 5.0  | 3.40                       |
| **Slovenia**             | 1.0  | 1.2  | 1.3  | 1.4  | 1.2  | 1.1  | 1.1  | 1.5  | 1.5  | 2.2  | 3.1  | 2.10                       |
| **Telecommunications in manufacturing** |      |      |      |      |      |      |      |      |      |      |      |                            |
| **Czechia**              | 3.4  | 4.0  | 5.7  | 6.5  | 7.9  | 7.7  | 7.8  | 8.6  | 9.1  | 10.3 | 13.3 | 9.90                       |
| **Hungary**              | 5.9  | 5.7  | 6.6  | 7.3  | 7.7  | 8.1  | 7.3  | 7.6  | 8.5  | 9.2  | 11.8 | 5.90                       |
| **Poland**               | 2.9  | 3.6  | 4.7  | 5.1  | 5.2  | 5.2  | 5.0  | 6.7  | 8.2  | 10.6 | 14.3 | 11.40                      |
| **Slovakia**             | 2.7  | 3.8  | 5.5  | 5.4  | 5.1  | 5.1  | 5.4  | 6.5  | 8.9  | 11.2 | 13.4 | 10.70                      |
| **Slovenia**             | 1.7  | 2.0  | 2.4  | 2.4  | 2.4  | 2.3  | 2.2  | 3.1  | 3.5  | 5.3  | 6.5  | 4.80                       |
| **IT and other information services in manufacturing** |      |      |      |      |      |      |      |      |      |      |      |                            |
| **Czechia**              | 1.0  | 1.2  | 1.4  | 1.4  | 1.3  | 1.0  | 1.0  | 0.9  | 1.0  | 1.7  | 0.7  | 0.7                        |
| **Hungary**              | 1.7  | 1.6  | 1.4  | 1.4  | 1.1  | 0.9  | 0.9  | 0.9  | 0.8  | 0.8  | 1.3  | −0.4                       |
| **Poland**               | 0.7  | 0.8  | 1.0  | 0.9  | 0.7  | 0.5  | 0.5  | 0.6  | 0.6  | 0.8  | 1.5  | 0.8                        |
| **Slovakia**             | 0.8  | 1.1  | 1.5  | 1.1  | 0.8  | 0.7  | 0.8  | 0.8  | 0.8  | 1.1  | 1.7  | 0.9                        |
| **Slovenia**             | 0.5  | 0.6  | 0.6  | 0.6  | 0.4  | 0.3  | 0.3  | 0.5  | 0.4  | 0.7  | 1.2  | 0.7                        |
| **ICT services in transport equipment** |      |      |      |      |      |      |      |      |      |      |      |                            |
| **Czechia**              | 1.2  | 1.4  | 1.9  | 1.9  | 1.8  | 1.7  | 1.9  | 2.1  | 2.1  | 2.2  | 2.7  | 4.1  | 2.90                       |
| **Hungary**              | 1.1  | 1.3  | 1.6  | 2.0  | 2.3  | 1.5  | 1.2  | 1.5  | 1.5  | 1.6  | 2.0  | 3.2  | 2.10                       |
| **Poland**               | 1.2  | 1.5  | 1.9  | 2.1  | 1.8  | 1.4  | 1.4  | 1.8  | 2.1  | 2.8  | 4.5  | 3.30                       |
| **Slovakia**             | 0.9  | 1.3  | 1.8  | 1.5  | 1.1  | 1.2  | 1.3  | 1.5  | 1.6  | 2.1  | 3.7  | 2.80                       |
| **Slovenia**             | 0.8  | 1.0  | 1.2  | 1.3  | 0.9  | 0.9  | 1.0  | 1.4  | 1.5  | 2.3  | 3.1  | 2.30                       |
Table 2. Cont.

|          | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Change Between 2005 and 2015 |
|----------|------|------|------|------|------|------|------|------|------|------|------|-----------------------------|
| Czechia  | 4.6  | 5.4  | 7.1  | 8.0  | 9.3  | 9.3  | 9.5  | 8.8  | 8.3  | 8.2  | 10.5 | 5.9                         |
| Hungary  | 5.4  | 5.4  | 5.5  | 5.8  | 5.4  | 6.1  | 6.2  | 6.0  | 6.7  | 6.8  | 7.4  | 2.0                         |
| Poland   | 3.4  | 4.4  | 4.7  | 5.2  | 4.9  | 5.2  | 4.8  | 6.0  | 7.0  | 8.2  | 9.3  | 5.9                         |
| Slovakia | 3.6  | 4.9  | 6.9  | 6.2  | 5.3  | 5.6  | 6.5  | 7.0  | 9.5  | 10.9 | 10.5 | 6.9                         |
| Slovenia | 1.9  | 2.1  | 2.2  | 2.4  | 2.5  | 2.2  | 2.0  | 2.3  | 2.6  | 4.0  | 5.5  | 3.6                         |

Source: Calculated by the author based on [8].

Table 3. China’s positions among ICT services’ FVA providers for the NELB countries’ manufacturing gross exports in 2005–2015.

|          | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|----------|------|------|------|------|------|------|------|------|------|------|------|
| Czechia  |      |      |      |      |      |      |      |      |      |      |      |
| Hungary  |      |      |      |      |      |      |      |      |      |      |      |
| Poland   |      |      |      |      |      |      |      |      |      |      |      |
| Slovakia |      |      |      |      |      |      |      |      |      |      |      |
| Slovenia |      |      |      |      |      |      |      |      |      |      |      |
|             | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------|------|------|------|------|------|------|------|------|------|------|------|
| **ICT services in transport equipment** |      |      |      |      |      |      |      |      |      |      |      |
| Czechia     | 18   | 17   | 14   | 14   | 12   | 16   | 15   | 13   | 13   | 11   | 7    |
| Hungary     | 18   | 18   | 14   | 12   | 10   | 18   | 20   | 18   | 18   | 14   | 11   |
| Poland      | 17   | 17   | 13   | 12   | 14   | 17   | 16   | 16   | 14   | 10   | 6    |
| Slovakia    | 19   | 15   | 14   | 15   | 21   | 19   | 18   | 16   | 16   | 15   | 9    |
| Slovenia    | 22   | 22   | 19   | 18   | 24   | 24   | 21   | 19   | 18   | 11   | 7    |
|             |      |      |      |      |      |      |      |      |      |      |      |
| **ICT services in computers, electronic and electrical equipment** |      |      |      |      |      |      |      |      |      |      |      |
| Czechia     | 8    | 7    | 3    | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    |
| Hungary     | 7    | 7    | 5    | 4    | 6    | 3    | 3    | 3    | 3    | 2    | 2    |
| Poland      | 8    | 6    | 6    | 6    | 5    | 7    | 4    | 2    | 2    | 2    | 2    |
| Slovakia    | 9    | 5    | 3    | 4    | 6    | 4    | 3    | 3    | 2    | 2    | 2    |
| Slovenia    | 12   | 9    | 8    | 8    | 11   | 11   | 8    | 8    | 7    | 4    | 4    |

We took into consideration 64 countries that were available in a database. In 2015, we also added the leading providers of FVA. Source: Calculated by the author based on [8].
When we examined the NELB countries’ role in China’s total FVA inflows to the EU, an interesting phenomenon occurred—namely, a significant increase in these economies’ share until 2011. During the 2008 financial crisis, after a sudden rise of the NELB economies’ role among the EU recipients of the Chinese FVA in ICT services, it plunged back to its original level. These values fell, but compared to 2005, they remained high. Between 2005 and 2015, we noted the largest surge in ICT services in transport equipment (8.9%) and in telecommunications (3.6%). In 2015, ICT services in manufacturing, as well as in its subgroups directed to the NELB countries, constituted around one-fifth of the total Chinese FVA inflows to the EU. Furthermore, Chinese ICT services’ FVA in computers, electronic and electrical equipment was especially high: one-third of the total EU FVA inflows (Table 4). This proved that the density and the level of interactions between China and the NELB economies under the BRI are more active than many similar Chinese regional initiatives in Africa, Latin America, or Arab nations, at least at first sight [52]. Nevertheless, we should be aware that for the PRC, the NELB economies have become the gateway to Western Europe in the field of ICT services, which is visible in the slight decline in the absorption of Chinese ICT services’ FVA by these countries against the background of the EU in recent years (Table 4).

Looking at the growth rate of the Chinese ICT services’ FVA share targeted at the NELB manufacturing exports before and after the BRI introduction, there were considerable differences in intensity. Before the introduction of the BRI, we observed rather low levels of this participation. This is also demonstrated by China’s further places among the FVA partners (Table 3). The growth rate of the share of ICT services’ FVA in manufacturing did not exceed 10% in 2005–2012, which was a much lower result than in the case of the average growth rate of non-service sectors’ FVA inflowing to manufacturing (Table 4). Apart from telecommunications services, whose shares grew quite quickly and remained higher than Chinese FVA of non-service activities directed to manufacturing, the other subsectors were not characterized by high growth rates. However, since the official introduction of the BRI and the inclusion of the NELB countries into the “16 + 1” format, the situation has changed visibly. The growth rate of the Chinese ICT services’ FVA in manufacturing exceeded the average of non-service Chinese FVA inflows. This was visible not only in the overall values of ICT services in manufacturing but also in individual subgroups of ICT services (Table 5). Poland and Slovenia were characterized by the strongest increases in Chinese FVA, which was also reflected by China’s rapidly growing position among suppliers of ICT services FVA (Table 3). Similarly, we observed that telecommunications services grew in importance. FVA also performed well in IT and other information services directed to manufacturing, but China was still behind the most important FVA suppliers, including Germany and the UK. The rapid growth of China’s share in IT and other information services FVA in manufacturing may indicate the next stage in the development of value added flows between the PRC and the NELB economies—after winning the telecommunications market, China plans to improve its position in the IT services market (Table 5).
Table 4. Role of the NELB countries in Chinese FVA inflows to the EU in 2005–2015 [%].

|                        | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  |
|------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ICT services in manuf. | 16.2  | 16.7  | 18.3  | 20.5  | 23.5  | 23.6  | 22.1  | 20.5  | 20.8  | 20.3  | 19.4  |
| Telecommunications     |       |       |       |       |       |       |       |       |       |       |       |
| in manuf.              | 16.4  | 16.7  | 18.5  | 21.0  | 24.6  | 24.7  | 23.3  | 21.6  | 21.8  | 21.0  | 20.0  |
| IT and other          | 16.6  | 17.2  | 19.0  | 21.5  | 23.7  | 24.2  | 22.4  | 20.4  | 20.7  | 20.4  | 20.1  |
| information services  |       |       |       |       |       |       |       |       |       |       |       |
| in manuf.              | 30.1  | 30.3  | 33.4  | 36.2  | 41.4  | 44.8  | 43.2  | 40.1  | 39.4  | 37.6  | 33.3  |
| ICT services in        |       |       |       |       |       |       |       |       |       |       |       |
| computers, electronic  | 11.1  | 13.2  | 16.1  | 19.1  | 19.9  | 16.5  | 16.9  | 17.0  | 18.4  | 19.3  | 20.0  |
| and electrical         |       |       |       |       |       |       |       |       |       |       |       |
| equipment              |       |       |       |       |       |       |       |       |       |       |       |
| ICT services in        |       |       |       |       |       |       |       |       |       |       |       |
| transport equipment    |       |       |       |       |       |       |       |       |       |       |       |

Source: Calculated by the author based on [8].

Table 5. The dynamics of China’s share of the inflows of FVA to the NELB countries in 2005–2015 [%].

|                        | Non-Services Value Added in Manufacturing | ICT Services in Manufacturing | Telecommunications Services in Manufacturing | IT And Other Information Services in Manufacturing | ICT Services In Transport Equipment | ICT Services in Computers, Electronic and Electrical Equipment |
|------------------------|------------------------------------------|-------------------------------|-----------------------------------------------|-------------------------------------------------|-----------------------------------|-------------------------------------------------------------|
|                        | 2005–2012 2013–2015 | 2005–2012 2013–2015 | 2005–2012 2013–2015 | 2005–2012 2013–2015 | 2005–2012 2013–2015 | 2005–2012 2013–2015 |
| Czechia                | 14.3 3.0 | 9.4 15.0 | 15.0 16.0 | 0.9 23.7 | 9.1 26.4 | 10.4 7.1 |
| Hungary                | 1.7 1.6 | -2.6 13.6 | 4.0 16.1 | -9.9 21.4 | 7.4 30.6 | 1.7 7.3 |
| Poland                 | 12.6 13.2 | 7.5 27.5 | 13.6 28.9 | -0.2 40.3 | 7.8 36.9 | 9.2 15.7 |
| Slovakia               | 13.6 12.5 | 8.7 24.4 | 14.9 27.5 | 3.1 30.7 | 10.3 38.0 | 11.7 15.6 |
| Slovenia               | 11.8 11.1 | 7.1 29.2 | 10.0 29.0 | 4.0 42.1 | 10.5 31.6 | 3.2 34.8 |
| AVERAGE                | 10.8 8.3 | 6.0 21.9 | 11.5 23.5 | -0.4 31.6 | 9.0 32.7 | 7.2 16.1 |

Source: Calculated by the author based on [8].
As can be seen from Table 3, China ranked second in ICT services' FVA in computers, electronic and electrical equipment gross exports (except for Slovenia). Only Germany provides more ICT services FVA to this industry. However, the growth rate of China's share in ICT services FVA in computers, electronic and electrical equipment is relatively low (below the value of ICT services FVA in manufacturing). One can interpret the figures as market saturation in the NELB economies and a tendency to keep China at the forefront of suppliers. China's high position in the supply of ICT services to computers, electronic and electrical equipment industry is not surprising, but the fact that ICT services directed to manufacturing exceeded the growth rate of non-service value-added going to manufacturing in the NELB economies might be a new phenomenon in the industry.

Interestingly, the role of Chinese ICT services going to transport equipment gross exports started climbing steadily. Although China is quite far among the most important value-added suppliers for this industry, it can be seen that the PRC's role is growing rapidly. Even in 2005, China remained in the top 20, and in 2015, it was among the top 10 suppliers of ICT services' FVA for transport equipment (only in Slovenia it ranked 11th). The growing importance of China in this industry seems to be particularly significant for the NELB economies, as transport equipment is their flagship industry. Hence, with the rapidly climbing share of Chinese FVA in this industry, automotive companies operating in the NELB have become more and more reliant on Chinese value added.

When analyzing the statistics on ICT services trade, the data suggest that the imports from China to the NELB have climbed since the introduction of the BRI. The largest increase was noticed in Czechia and Hungary between 2013 and 2015. Poland also intensified cooperation with China in ICT fields, however not as much as Czechia or Hungary. These years characterized intensified cooperation with Chinese companies. China Mobile Communications Corporation, Huawei, Lenovo, ZTE, Tencent, Alibaba, Tsinghua Tongfan, Neusoft, and other Chinese IT and telecom companies established branches or started to cooperate with the NELB countries. Generally, telecommunications equipment, automatic data processing machines, and electrical machinery and apparatus are the most traded products between the EU and China recently, especially Czechia, Poland, and Hungary. Moreover, these products characterized the largest trade deficit with China. These product groups are connected to ICT services, whose value also increased [53]. The Chinese ICT services' FVA in the NELB's manufacturing is delivered through three main channels.

First, ICT services flow through Chinese foreign investments in these areas. It can also be seen that more capital flows from China to more advanced industries. Over the past decade, Wahua Industrial and Huawei invested in Hungary, Guanxi Liugong Machinery, Power Construction Corp., and Ex-Im Bank invested in Poland, CITIC opened its branch and CEFC entered into cooperation with J&T Finance in Czechia, and Hisense Group invested in Slovenia. These companies rely to a large extent on technological solutions from China and are particularly active in importing ICT services from the PRC.

Second, the Chinese ICT services flow through the NELB countries' procurements. The NELB countries established technological cooperation with China. They have built ICT clusters supported by Chinese technology and signed agreements in telecommunications. For example, Hungary has been the most engaged in technological cooperation with China. Huawei has won the tender for administering the emergency helpline. Moreover, the firm claimed to meet two-thirds of Hungary’s total demand for mobile telephony equipment. Another Chinese manufacturer ZTE offers Internet services and plans to provide a full 5G service [54]. Chinese technology companies already operating in Czechia include, inter alia, Changhong, Shanxi Yuncheng Plating Group, Huawei or ZTE. The high positions of China's FVA in Czechia's gross exports could be also explained by cooperation (since 2015) between countries in biotechnology and IT solutions in this field (PrimeCell Therapeutics and SCL Biotechnology formed a joint venture, SCL Biological Czech). Poland focused its cooperation with Chinese technology companies in consulting services, installation and maintenance of computer hardware, etc. Some of these procurements or collaborations have been problematic, for example, Huawei and the construction of the 5G network [55].
Third, the Chinese ICT services flow through foreign multinational corporations located in the NELB countries. Many of these corporations use, to some extent, the Chinese services and also are responsible for the greater dependence of the NELB countries on Chinese services. Multinationals import Chinese services both from Chinese companies directly or from multinationals’ affiliates located in the PRC. They import technological equipment and software as well as IT support services in automotive, telecommunications, and electronics. Many automotive companies launched facilities in the NELB countries, for example, Volkswagen in Czechia Republic, Hungary, and Slovakia; Daimler in Hungary; Peugeot, Toyota, and Kia in the Czechia; General Motors in Poland; and Hyundai in Slovakia. Among global technology companies located in the NELB countries are: Foxconn Electronics Inc., Jabil Circuit Inc., Flextronics Corp., Elcoteq Network Corp., Royal Philips Electronics, Sony Corp., Bosch, Ericsson AB, and Siemens AG. Multinationals import Chinese ICT services and solutions with the devices or semi-products assembled in the factories located in the NELB countries.

5. Conclusions

When analyzing the inflows of Chinese ICT services’ FVA to the NELB’s manufacturing gross exports, the data suggest that the share was climbing every year. This means that China is not only transforming its domestic economy from industry to services, especially into more advanced technology services, but these changes are also reflected in foreign trade and value-added flows. The BRI can be treated as one of the most important diffusion channels of Chinese services, especially ICT services. It turns out that the introduction of the initiative boosted the inflows’ intensification of ICT services’ FVA to manufacturing in the NELB countries as well. Generally, the more intensified the trade between China and the NELB economies in terms of FVA, the greater the dependence of the NELB countries on Chinese FVA and closer the integration within GVCs. Unfortunately, this integration mostly occurs in backward linkages [47]. Even though, this phenomenon seems to be more visible in terms of services, especially in ICT services.

Taking into account the above observations, there are no grounds to reject the hypotheses set out in the article: (1) as a result of the introduction of the BRI, the role of Chinese ICT services’ FVA diverted to the NELB countries’ manufacturing gross exports increased; (2) the growth rate of Chinese ICT services’ FVA directed to the NELB manufacturing gross exports exceeds the growth rate of non-services’ FVA diverted to their manufacturing; (3) the NELB countries have become more dependent on Chinese ICT services’ FVA in their manufacturing gross exports.

These findings reinforce the assertion that after the introduction of the BRI, the inflows of Chinese ICT services’ FVA to the NELB countries’ manufacturing exports have intensified. This can be seen both on the side of China’s share of ICT services FVA and in the dynamics of these shares (Tables 2 and 3).

China’s rapidly growing share in ICT services’ value-added diverted to manufacturing does not mean a decrease in non-service sectors’ FVA that end up in the NELB manufacturing. Generally, the dependence of the NELB economies on China’s FVA is climbing steadily, both in regards to service and non-service value-added (Table 5). Nevertheless, our study has presented that the dynamics of services’ FVA rose faster. Moreover, the role of the NELB countries in the EU as recipients of Chinese FVA in ICT services’ FVA is also important. Even though, it does not mean an exchange between Chinese FVA and the EU’s FVA. As predicted, the EU countries, especially the EU-15, still remain the most important suppliers of ICT services’ FVA for manufacturing (Table 3). However, after the accession of the analyzed nations in the EU, the position of the EU-15 countries was unwavering, but now the Chinese ICT services’ FVA seriously threatens the position of the EU economies. For China, countries have become the gateway to Western Europe in the field of ICT services, which is visible in the declining absorption of Chinese ICT services’ FVA by the NELB economies against the background of the EU in recent years (Table 4).

The study is consistent with the third hypothesis, that the NELB economies’ manufacturing has become more dependent on Chinese ICT services’ FVA, especially in: manufacturing of computer,
electronic and electrical equipment, as well as in transport equipment gross exports. According to Tables 2 and 3, China was among the leaders that provided FVA to the NELB countries. Furthermore, the NELB economies’ dependence on Chinese ICT services FVA is growing. According to our study, the fast-growing dependence of the flagship industry of the NELB countries—the automotive industry—on Chinese ICT services was noticed as well. It leads us to the conclusion that the PRC is targeting the most important industries of the NELB countries.

The transformations in the position of the NELB countries in GVCs should be ascribed predominantly to the effects of the global crisis in 2008 and the COVID-19 pandemic, with the dispute between the US and China, which redefined the conditions of the global economy, having a less harmful impact. These crises also resulted in changes in global production fragmentation, closer regional economic cooperation (increased the importance of regional value chains), as well as the growing influence of Asian economies (mainly Chinese, described in this article). Thus, it influenced new trends in the economies of the NELB countries, which, due to their geopolitical location and degree of involvement in global trade exchange, should be the subject of further, deeper research.

To conclude, the study has practical implications as well. We feel that our study enhances academic understanding of trade relations of the NELB countries’ manufacturing and the PRC, and in a broader dimension, might suggest some changes in the foreign policy of these economies (e.g., the attitude of a given nation to the role of trade with China, as well as the role of FDI connected to FVA inflows, fields of trade cooperation under the BRI that should be developed or limited due to great dependence, etc.).

Certainly, a number of restrictions on our study and areas for future research should be mentioned. First, we were limited by the availability of statistical data, especially value-added flow statistics. Second, we relied on particular methods and cannot rule out that applying different methodologies would lead us to different conclusions. Third, this study should be repeated in the following years in order to confirm our results, especially after COVID-19. Four, our study needs a more detailed examination of GVCs’ interconnectivity between manufacturing and services, structural factors of the NELB manufacturing, such as the size of the market and stage of development, trade and investment policy, logistics, infrastructure, IPRs, etc.

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