



Article The Importance of the New Silk Road in the Hungarian Automotive Supply Chain

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Abstract: The connection between Europe and Asia has always been important for the flow of materials and intellectual goods. Hungary is in an important position in Central Europe to connect different key ports and logistics hubs. Therefore, this article aims to analyse the opportunities and impacts of the New Silk Road initiative on the supply chain and transportation network in Hungary. This result showed that the existence of the New Silk Road gives huge opportunities for different supply-chain-related activities and initiatives, especially for the Hungarian automotive industry. Specifically, the New Silk Road has the potential to enable the advantages and positive impact of rail transport activities in Hungarian automotive supply chains by providing a long-term competitive solution as an alternative to maritime transport while mitigating several related risks and increasing the domestic supply chain's resilience. Consequentially, the New Silk Road initiative may affect the supply chains and transportation route networks of several European and Asian nations, including Hungary.

Keywords: supply chain; rail transport; automotive; New Silk Road; Hungary

1. Introduction

Long-distance transportation and the flow of goods have played a crucial role in fostering connections and trade between Europe and Asia for centuries. This dynamic process has not only facilitated economic growth, but also forged lasting bonds between the various parties involved. Throughout history, numerous initiatives have been undertaken to exploit the possibilities presented by these trade routes [1–4]. In this context, the New Silk Road has also emerged as a transformative force, offering immense opportunities for the European automotive supply chains. The revival of this trade route has opened up new horizons, enabling seamless trade and collaboration between Europe and Asia, and creating a favourable environment for the growth and development of the automotive industry in Europe.

This initiative plays an essential role in facilitating trade route connectivity and bolstering bilateral relations. It is worth taking a closer look at the situation of the New Silk Road initiative in Hungary, which is also involved in China-related processes. Hungary has been at the forefront in developing relations with China, which is the main country



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Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). in this endeavour, with the China–Central and Eastern Europe Cooperation Mechanism being established in Budapest in 2011; in 2015, Hungary was the first European country to join the "One Belt, One Road" initiative [5–8] and became one cluster in the New Silk Road countries [9]. Its cooperation has changed the structure of trade routes, logistics systems, and international economic relations between Europe and Asia [10,11]. As such, the emergence of the New Silk Road is driven by the significance of the bilateral relations between the European Union and China, alongside the European Union's plans for enhancing connectivity in Asia [12]. Therefore, the primary objective of the New Silk Road initiative is to foster and enhance bilateral trade ties between China and Europe [13,14].

Hungary is strategically positioned as it is crossed by four Trans-European Transport Network (TEN-T) corridors, all of which form connections with the country's capital. Hungary handles a total of four rail freight corridors, including the Orient–East Med, the Mediterranean, the Amber, and the Rhine–Danube. The region is positioned at the intersection of two ERTMS lines, consequently operating as a transport hub linking the European Union between southern (Serbia) and northeastern Europe (Ukraine) [15]. Additionally, Hungary has gained connectivity to the Euro-Asian Transport Links (EATL Corridor) through five distinct corridors [16]. Moreover, the Euro-Asian railroad network became the foremost destination for cargo journeys, including passing Hungary as a country with a strategic location in Central and Eastern European (CEE) [17], and was one of the first CEE countries to undertake diplomatic bilateral trade and investment [6,18,19]. Therefore, Hungary is one of the most important transport hubs, providing easy access to all parts of Europe by rail, road, air, and water [20]. It follows that Hungary has multiple intersections along the Silk Road, rendering it a strategically vital meeting location.

Numerous works of literature have been released in the preceding years, encompassing diverse perspectives concerning the New Silk Road [7,21–25]. The execution of this historical trade route has had intricate ramifications for the local regions situated along its route [26]. It route is regarded as having the potential to decrease transportation expenses, expand market access, and offer chances for addressing the supply of strategic resources [27]. Nevertheless, it is quite regrettable that literature has reported Hungary's new silk route to still be very restricted and hard to identify, even though Hungary has enormous potential and strategic advantages in creating a connecting route between Eurasian continents. These gaps in research and studies have created a knowledge limitation, and it is difficult to fully comprehend the role of opportunities and the impact of Hungary's New Silk Road on the automotive supply chain. Consequently, it is highly important to complete further research and analysis on this topic in order to fill this knowledge gap and offer insightful information. So, this study aims to highlights the presence of Hungary's New Silk Road as a promising domain for establishing an automotive travel supply chain connection in terms of opportunities and impacts.

Understanding Hungary's position in the New Silk Road is crucial for the integration structure of more substantial international and regional trade networks and for the country's economic development. Integration is an important element for achieving the goal of a sustainable logistics system [28], which this road provides as it connects the European and Asian continents to strengthen commercial or trade ties [29]. It allows for the improvement of economic potential in the surrounding countries [30]. Therefore, this paper conducts a comprehensive literature analysis to gain a profound understanding of the trajectory of sustainability stemming from the New Silk Road in Hungary. This study contributes to both economic growth and socio-cultural development, as Hungary's geographic location makes it an exceptionally central country in Europe. This development holds considerable promise for utilising the New Silk Road as an automotive route in Hungary—a topic that will be examined at great length.

Through a study of relevant literature, this study has clearly uncovered significant insights regarding the opportunities and implications associated with infrastructure needs, logistical complexities, and prospective partnerships that might strengthen Hungary's position within the New Silk Road. The insight gained can then be used to come up with

efficient policies, strategies, and investment plans with the aim of maximising the benefits that come from this cutting-edge trade route. This knowledge will not only provide an invaluable benefit to scholarly discussions but also offer practical insights for regulators and industry stakeholders, allowing them to make informed decisions and harness the complete potential of the New Silk Road to strengthen the Hungarian economy and its standing in the global trade arena.

2. Materials and Methods

In order to facilitate the delivery of results and the following analysis, this research uses a descriptive qualitative research method. This particular method was selected due to its potential to enhance the comprehensive understanding of the results discussed in references [31,32]; subsequently, it was conducted using an inductive approach, wherein we defined the topic and interpreted the information we collected [33]. In this specific instance, qualitative research plays a significant role in offering comprehensive coverage of the literature context and promoting a more profound conceptual understanding related to the New Silk Road in the Hungarian automotive supply chain. Therefore, it involves detailed examination of prior literature, including patches on emerging concepts that require additional research to verify the reliability of the findings [34], thereby highlighting the significance of the automotive supply chain that pertains to the set-up of the New Silk Road in Hungary.

It is important to note that our research was designed to perform robust data collection techniques and documentation by relying on document analysis as a stand-alone method [35]. Likewise, the current research covers a variety of sources [31], including primary data signed from multiple literature sources related to Hungary's New Silk Road. These sources of information include scientific literature, open statistical data, government reports, binding reputable web pages, and news media coverage. Overall, the data processes that have been addressed involve the following: first, investigations related to the geographical distribution and connectivity of car and engine factories in Hungary; second, regional population and rail connections; further information is underlined for information regarding the main automotive suppliers in Hungary, the geographical distribution of these suppliers, and the location of automotive companies in the country. Additionally, our paper reported the competitive landscape in rail transportation and the estimated size of the global rail freight market. Therefore, the current investigation aims to draw a connection between empirical findings obtained through document scrutiny in an attempt to highlight the importance of tackling unsettled topics [36].

3. Results

The starting point of the European section of the New Silk Road Hungary—Piraeus— BILK line (length 1030 km) is the Greek port of Piraeus. From there, it will pass through Serbia to reach Kelebië, the starting point of the 152 km Hungarian section of the Budapest– Belgrade railway line, which is already in the implementation phase after being previously engaged in lengthy negotiations under the Belt and Road umbrella [37]. Hungary is expected to take on an important role as a transit and logistics centre for trade between East Asia and Western Europe [38]. This development will likely be facilitated by the Budapest– Belgrade railway line [25], which is expected to play an important role in connecting the region with the Port of Piraeus [39]. In this case, the Hungary–Serbia connectivity and the construction of railroads is vital [40], and Hungary–Serbia have inked an agreement to construct a rail link between the two countries [41]. The planned upgrades will involve upgrading the line to double track, installing an ETCS (ETCS1 or ETCS2) rail signalling system of an appropriate level, and increasing the line load to 225 kn axle load, thus matching that of the main European lines, with a target speed of 160 km/h (design speed 200 km/h). The infrastructure investment will be built by Hungarian and Chinese companies, with a 50–50 split [42]; therefore, Hungary serves as a great instance [43]. It may be implied that Hungary has a significant role due to its strategic geographical position, serving as

a pivotal link between East Asia and the western regions of Europe. A network of road and rail infrastructure facilitates connection and enhances accessibility in the context of commerce flows.

In this moment, Hungary has emerged as one of the pioneering European nations in establishing bilateral relations with China, with the primary objective of fostering and augmenting trade and investment opportunities [11], and this country has an attractive investment geography [44]. In this regard, over the period of the prior decade, Hungary has demonstrated commendable achievements in its economic engagements with China [45]. The costs of the line will be covered by a loan from the Chinese financial funds established at the start of the programme [46]. For the Chinese companies involved in the construction, the line will provide a European reference and the opportunity to participate in EU tenders, from which they cannot be excluded for 3 years. Since the initial proposal, both the completion date and the cost of the project have changed and increased. As of September 2020, the total cost is estimated at HUF 700 billion, with the start of operations expected in 2025. Hungary stands as the nation that has attracted the greatest influx of capital from China, with a substantial sum of over EUR 2 billion having been invested in the country [7,47]. The recovery cost of the project and the completion of the project is hampered by the fact that the rail link between Belgrade and Piraeus in its current form requires extensive and comprehensive upgrading, which is made difficult by the geographical conditions and terrain. This also implies that the first beneficiaries of the Budapest–Belgrade line will be freight and passenger transport between the two countries [48]. It shows that Hungary has made major investments in the enhancement of its logistics transportation infrastructure. Hungary reflected on the opportunity to enhance its national trade infrastructure. By leveraging foreign investment from China, the effort could accelerate its development as a hub for significant trade routes.

Implementation on the Budapest–Belgrade line started in summer 2020 with the adoption of Law XXIX of 2020. Preparatory work is currently underway and traffic is scheduled to start in 2025, in line with the European Union's 2021–2027 objectives, for which the development of freight transport has been made a priority. The existence of these adequate regulations provides a strong basis for indicating a common interest in strengthening the sustainable development of land routes to transport supply chains and triggering increased connectivity between regions in Europe, including Hungary.

The line's domestic terminus is the Budapest Intermodal Logistics Centre (BILK) and the associated Soroksár-Terminál MÁV station. The BILK is located at the intersection of the Trans-European Networks and is served by the Soroksár-Terminál railway station owned by MÁV Zrt. The founders are major players in Hungarian rail and road freight transport. Waberer's owns 70% of the site and Rail Cargo Terminal-BILK Zrt owns 30%. The terminal operates 55 to 60 scheduled trains per week, supplemented by occasional additional trains. In addition, its related services are provided by Eurogate Intermodal GmbH, Rail Cargo Operarot-Hungaria Kft. and Hupac Intermodal SA. Combined transport, terminal-to-addressee, consignor-to-terminal, as well as pre- and on-carriage—the transport one-stop-shop principle—are decisive. Therefore, Hungary has the potential to enhance its role as a transit and logistics hub along the new Silk Road, thereby facilitating the efficient transportation of goods and services, fostering economic expansion, and reinforcing both regional and international trade connections.

BILK currently has direct connections to the following seaports: Hamburg, Bremenhaven, Koper, Rijeka, Piraeus, and Halkali. It operates scheduled container trains to the following intermodal terminals: Neuss, Duisburg, Curtici, and Ploiesti. BILK's services include closed container traffic to Hamburg, Bremenhaven, the ARA ports, Koper, Vienna, Wels, and Duisburg for road transport, financial (customs and barging), and maintenance and technical (repair, cleaning, and weighing) services [49]. There is a direct rail link to the Budapest Dock Free Port Logistics and Industrial Park in Csepel. The distance between these two logistics centres by rail and road is 9 km. Rail export flows are mainly from the central and northwestern regions of Hungary, primarily from the Budapest region to Austria and Croatia. Import flows are dominated by Záhony from the northwest and southeast, and to a lesser extent from Slovakia and Austria. The main inbound transit routes are Austria, Ukraine, and Romania, and the main outbound routes are Austria, Serbia, and Romania. In addition, Slovakia and Hungary compete for Central Europe's 'hub' status [50]. Its volume is well above the domestic export and import flows. In terms of products transported, there is a strong presence of chemicals, construction products, energy carriers, and combined transport. Table 1 summarises the major automotive companies in Hungary and their road transport activities.

Table 1. The location of car and engine manufacturing plants in Hungary and their regional population and railway connections [51].

Municipality	Population (Persons)	Manufacturer	Industrial Tracks	Railway Line
Esztergom	94,00	Suzuki	yes	nt.4. Bp–Komárom
Győr	190,000	AUDI	yes	nr.1. Bp–Hegyeshalom
Kecskemét	155,000	Mercedes	yes	nr140. Bp–Cegléd–Szeged
Szentgotthárd	15,000	PSA	yes	nr.21. Szombathely–Gyanafalva (A)
Debrecen	225,000	BMW	planned	nr.100. Budapest–Szolnok– Debrecen–Nyíregyháza–Záhony

This allowed net exports to make a positive contribution to the growth of the Hungarian economy. Investment in sectors that produce mainly for foreign markets has been significantly boosted by investment in the automotive sector, which plays a major role in the country's economic growth. The net turnover of logistics service providers (HUF 3400 billion) accounts for almost 5% of the total net turnover of the national economy. Hungary has 40,000 logistics companies, a significant proportion of which are small and medium-sized enterprises. The Hungarian logistics sector employs 259,000 people, making up 6.5% of total employment, and accounts for 6.3% of Hungary's gross domestic product [20]. The situation of foreign-owned large enterprises and domestically owned SMEs supplying the automotive industry in Hungary, which were not included in the survey, was outlined in a PWC survey conducted in 2018 (Figure 1). The number of people employed amounted to 170,000, but further investment by industry players is threatened by the labour shortage. This is partly due to the labour-sucking effect of neighbouring countries with a strong automotive industry (mainly Slovakia). Labour shortages were not fully addressed in 2018 and 2019.

Companies planning to relocate part or all of their production capacity from Hungary cited logistics and location disadvantages as 10% of the reasons. Consequently, some regions in Hungary with appealing activity can accommodate adequate capacity utilisation. Table 2 summarises the location and scope of activities of the major players in the automotive supply chains in Hungary.

Nr.	Manufacturer	Municipality	Activity
1.	Aventics Hungary Kft.	Eger	engine parts, pneumatics
2.	Bosch	Miskolc	tool manufacturing
3.	BPW-Hungária Kft.	Szombathely	vehicle engine parts
4.	Continental	Budapest, Szeged, Nyíregyháza, Makó, Vác, Veszprém	electronics, tyres, heavy technical rubber products, air suspension systems, fuel hoses, radiator hoses
5.	Denso	Székesfehérvár	component production

Table 2. Main automotive suppliers in Hungary [52,53]. Compiled by Gábor Heizler.

Nr. 6.

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8. 9.

10.

11. 12. 13.

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Schoeffler Savaria Kft.

SMR Automotive Mirror

Technology Hungary Bt.

Takata

Veritas

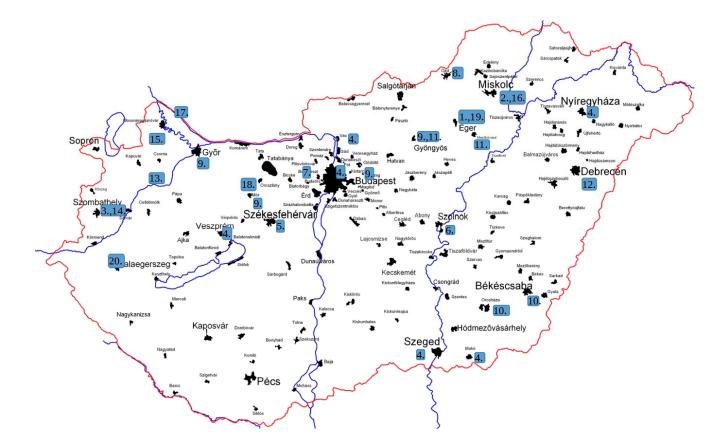
Wescast

ZF

Autóipari Próbapálya Zala

Kft.

Table 2. Cont.				
Manufacturer	Municipality	Activity		
F Segura	Szolnok	manufacture of vehicle and engine parts		
Gentherm	Pilisszentiván	cooling and heating systems, electronics, logistics		
Johnson Electric	Ózd	engine subsystems		
Lear	Gödöllő, Gyöngyös, Győr (Mór)	vehicle seats		
Linamar	Orosháza, Békéscsaba	automotive, agricultural, construction machinery		
Modine	Gyöngyös, Mezőkövesd	heat-exchange systems		
NI Hungary Kft.	Debrecen	electronic circuit boards		
Provertha Electronic Beled Components Kft.		electronic components		



Szombathely

Mosonszolnok

Miskolc

Dunakiliti

Oroszlány

Eger

Zalaegerszeg

Figure 1. Geographical distribution of automotive suppliers) [54]. Location of automotive companies in Hungary (compiled by Gábor Heizler).

vehicle engine parts

bodywork and trailer production

safety equipment

fuel systems, oil and air lines

exhaust systems

transmissions

R&D, education

Of the responding companies, 40% had more than 1000 employees, 35% had between 100 and 500, and 25% had less than 100. In terms of the supplier value chain, Tier 1 is 53%, Tier 2 is 23%, and Tier 3 is 14%. At the two ends of the scale in terms of products and services produced, the share of powertrains and related components is 35%, software and data analysis is 4%, and research and development is 7%. Data on the upstream markets show that 19% of companies produce exclusively for the domestic market while 45% produce for neighbouring countries (mainly Slovakia and the Czech Republic). Western Europe is the destination for 75% of companies, Eastern Europe (Ukraine and Russia) for 19%, and China for 16%.

Unsurprisingly, given the domestic context, VW (61%), AUDI (56%), Daimler (51%), PSA (37%), and Suzuki (37%) are the most frequent partners, with Chinese partners accounting for 4%. The survey also looks at transport distances, where 24% of products travel more than 1000 km, 29% between 501 and 1000 km, and 32% less than 500 km. In 2017, 13% of the cost reduction measures implemented concerned logistics and transport [55].

4. Discussion

It is crucial to highlight the significant opportunities and impact of the Hungarian New Silk Road. This ambitious project, which aims to revive the historical Silk Road trade route, presents numerous opportunities and potential implications for Hungary and the wider region. Rail solutions have emerged as an alternative to sea and regular air container transport for Far East sourcing activities among automotive suppliers in Hungary [56]. In this case, the railroad has more power over most of the supply than other lines, such as maritime [12]. Among the advantages offered by rail transport are that the implications of the New Silk Road spur increased opportunities to invest in transportation infrastructure, logistics hubs, and long-term global networks of interaction and communications [23,25,56–58]. Also, this initiative is an endeavour to create a dense network of scheduled goods trains to facilitate and promote long-distance commerce along the route [16]. This can optimise supply chain operations, thereby revolutionising the way goods are transported and transforming the sourcing landscape in the automotive industry within the country and across it. As a result, Hungary will receive income as a direct benefit of the New Silk Road [25]. Additionally, Hungary handles a vital part and has taken actionable steps to establish New Silk Road line measures that provide economic benefits for the country [7,38,59]. Consequentially, the pattern of cooperation in creating economic networks among European regions generates national income openness. It is important to note that the structure of the freight market before the pandemic was different from the one during the pandemic, especially in terms of transport costs and delivery times [60], along with the escalation of security risks [61]. By leveraging its central location within Europe, Hungary can serve as a crucial gateway for goods travelling between Asia and Europe. This not only enhances Hungary's connectivity but also positions it as a key player in regional and global supply chains.

Figure 2 elucidates the transport selection scenario for commerce routes, whereby the utilisation of air routes entails exorbitant transportation expenses, while sea routes necessitate significantly longer transportation durations to reach the intended endpoint. A notable aspect to highlight is the cost-effectiveness of rail transport on land routes, which offers the potential to reduce costs and enhance the efficiency of trade routes. One notable advantage is that it gives Hungary the chance to use a network of economic partnerships and cooperative projects that could improve stability in the region, help build diplomatic ties, and encourage more economic growth.

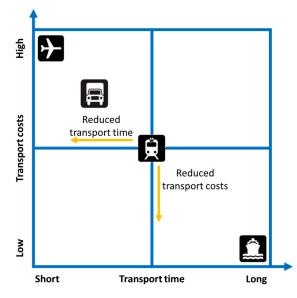


Figure 2. The competitive situation in rail transport. Source: own editing [62].

Its assertion aligns with previous research that provides evidence supporting the notion that rail transport offers intermediate solutions that are preferable to waterborne and airborne methods in certain situations, with shorter delivery times than maritime transport and lower costs than airborne solutions [62,63]. In other instances, when a European company has to decide on the long-term containerised procurement of raw materials from an Asian supplier, in most cases, maritime transport is preferred due to its low cost [64]. Even before COVID, minimisation and prevention of risks ware important issues, and maritime transport has been associated with many uncertainties [37,59]. Problems can arise with scheduling bookings, vessel departures, delays, transhipments, port capacity, difficulties with port rail transport, etc., which can complicate the operations of individual producers. An illustrative example of this was the Ever Given ship blocking the Suez Canal in 2021, which kept almost the entire world in uncertainty for several days, putting enormous pressure on the companies involved [65]. Thus, the efficiency of the New Silk Road can be accelerated and significantly reduce the cost of shipping products for a region's economic order in certain situations [66–69]. As a result, it demands a long-term planning strategy that incorporates economic, environmental, and cultural considerations.

Delays in the arrival of certain raw materials can result in huge additional costs [70] for automotive suppliers, which they cannot pass on to the shipping party in many cases, nor can they pass on the associated loss of profit in the product price. The high costs of air freight do not allow sustainable and profitable operations for individual automotive suppliers for commodities where large and heavier goods need to be moved, such as metal and plastic products.

When a predictable material supply is of paramount importance for finished goods or critical manufacturing activities, or in urgent cases where stock replenishment is required in the shorter term, rail solutions can be an excellent alternative. It is important to highlight that electric railways can deliver goods from China to Europe in a less polluting way [71]. Therefore, behind the New Silk Road railway that connects continents, it is possible to create a potentially massive transportation revolution [72], and it emphasizes economic, diplomatic, and educational intra-region relations [73,74]. Moreover, cooperation in essential physical infrastructure development, such as between the borders of Hungary and Romania, might significantly advance regional potential and enhance economic competitiveness [75], as the land–road connection between Europe and Asia is an excellent opportunity for international supply chains to increase their agility and responsiveness to market needs [76]. Figure 3 illustrates that some forecasts [77] show that demand for rail freight is growing, with the New Silk Road offering a competitive rail solution alongside water and air transport. For these reasons, many automotive suppliers are also opting for

rail transport as part of their sourcing strategy for raw materials from the Far East, either as an ad hoc or long-term solution [78]. When starting a project, where time criticality is key to meet customer demands, rail freight is also a common option to avoid extremely high air freight costs, and the New Silk Road will create additional opportunities not only for the automotive industry but for all industries involved [79]. Therefore, in response to evolving market demands, the New Silk Road will have a positive impact on economic activity between the continents of Europe and Asia, especially regarding the export and import of manufactured goods, machinery and transportation equipment, as well as other manufactured goods including food and live animals [73].

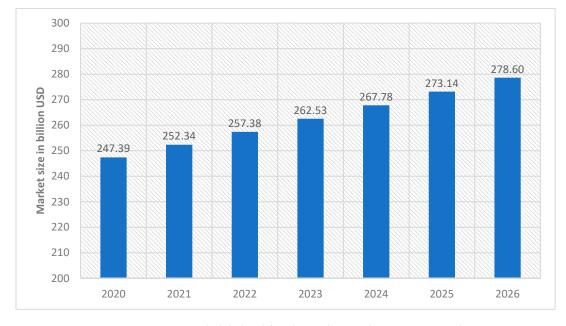


Figure 3. Expected global rail freight market size between 2020 and 2026. Source: own editing based on [71].

The majority of commerce routes are predominantly conducted via maritime means, with just a limited number of routes being controlled by land transportation. The advent of the Silk Road is anticipated to have a significant economic influence on the forthcoming trajectory of Central and Eastern Europe [80]. Therefore, the New Silk Road, along with the railroad track, represents a sizeable market niche and cost savings for certain types of transport where air freight is too expensive and maritime logistics is too slow [79], and Hungary may offer exporters from Eastern European country realistic exchange rate offers [81]. Moreover, the New Silk Road could be advantageous to the majority of CEE nations and generate more and cheaper goods due to increased delivery speeds and decreased delivery times [39]. As a result, Hungary has benefited from the trade flow from the New Silk Road among participating countries, especially in the CEE region [82]. Likewise, China has demonstrated a growing inclination towards establishing strategic collaborations pertaining to trade channels with the CEE region, which includes Hungary [83,84].

The rail connectivity in Hungary is quite remarkable. It is worth discussing how this benefits the country's transportation network. The significance of Hungary's New Silk Road lies in its role as a crucial link for automotive transportation, owing to its strategic geographical position. It is evident that the New Silk Road's emphasis on logistics infrastructure development has resulted in a significant decrease in the supply chain barrier, as mentioned in [85]. As the need for efficient transportation grows, the transportation service facilitates the efficient and seamless operation of logistics supply chains between the east and west, or vice versa, as required. To ensure the viability of this railway, multiple routes have been established to cater to diverse interests. The connectivity established by Hungary's New Silk Road has enhanced export and import operations. Consequently,

Hungary, as the country that launched this initiative, has significantly contributed to its own development and augmented the region's potential by establishing this trade channel.

Moreover, European governments and regions have engaged in the production of goods and services for global markets, while also fostering collaborative efforts among themselves. In this moment, Hungary's New Silk Road has a significant presence that has yielded positive effects on transitional transportation and emerged as the primary choice for commercial routes. A key benefit to consider is that it may promote economic growth, scientific advancement, and cultural exchange among the regions of the Eurasian continent, as mentioned [67]. A critical aspect to consider is that the potential benefits of the region's involvement in the New Silk Road could perhaps aid in mitigating its historically marginalised status within Europe over an extended period of time [27]. Therefore, it is imperative to allocate resources towards the enhancement of the New Silk Road, focusing on robust infrastructure and establishing a sustainable communication network that spans across different regions inside the nation. Furthermore, in today's interconnected global economy, the significance of this transportation route contributes to the augmentation of Hungary's economic revenue. Undoubtedly, the New Silk Road epitomises a substantial market segment and holds the potential for cost reduction in certain transportation requirements. Eventually, as mentioned in Ref. [86], the emergence of the New Silk Road will not only generate impacts on economic growth and trade across the supply chain but will also be interconnected with various other factors including monetary, financial, political, and safety issues.

5. Conclusions and Future Directions

Rail transportation plays a significant role and results a positive impact in enhancing regional and international connectivity, which allows for the rapid movement of trade commodities. It offers a more cost-effective alternative to air transportation and is also effective in reducing the duration required for maritime transportation. Therefore, it can lead to improved resilience and flexibility in the face of disruptions or capacity constraints in other transportation channels. The construction of railway infrastructure in Hungary's New Silk Road has demonstrated effectiveness in fostering economic growth by enhancing economic ties within and beyond regional boundaries, including the expansion of connections between Europe and Asia. The competitive edge arises from Hungary's strategic geographic location, which presents significant opportunities for enhanced economic collaboration and offers an opportunity to invest in building up railway infrastructure for the encouragement of logistics trade routes. This investment is projected to strengthen the automotive industry and domestic supply chains, consequently supporting the progress of the Silk Road in the future. Overall, Hungary has a unique chance to become a major country in the New Silk Road, which could have a big impact on the long-term success of economic growth, trade routes, and relationships between governments or nations.

Theoretically, as Hungary's New Silk Road connects Europe and Asia, along with the Hungarian railways, they are prepared to strengthen the supply chain lines of automotive services and logistics to collaborate stronger. Through cooperation, they can develop integrated supply chain solutions, improve coordination, and share the best practices. In practical terms, this study implies that Hungary has the potential to take advantage of this opportunity to seek out its trade partners to ensure it can invest along the New Silk Road and boost the value of its exports. If Hungary commits earnings to modernising its railways, it can make it easier to move both inside and outside of the region's borders. Additionally, it will make transactions more efficient, and also include foreign investment, ultimately making Hungary a major logistics hub in Europe. This will boost Hungary's "soft power" and make global trade more inclusive and cooperative, which may contribute to its long-term economic growth and standing in the global economy.

Future initiatives should include an in-depth economic analysis of the New Silk Road's bearing on the Hungarian automotive supply chain, particularly cost reduction and growth in local market potential, from a quantitative perspective. An additional recommendation is to look at mitigating risks related to utilising the New Silk Road for the Hungarian automotive supply chain by conducting contingency planning and transportation diversification. Last but not least, connections between the New Silk Road and blockchain, IoT, and AI might maximise its role in the Hungarian automotive supply chain and offer valuable insights for industry stakeholders, policymakers, and academics.

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