THE SHORTENING OF SUSTAINABLE SUPPLY CHAINS IN HUNGARY AND EUROPE

A FENNTARTHATÓ ELLÁTÁSI LÁNCOK RÖVIDÍTÉSE MAGYARORSZÁGON ÉS EURÓPÁBAN

ZOLTÁN TAMÁS SZABÓ – ERDENEBAYAR CHULUUNBAATAR – B. LEVENTE ALPEK
zoltasz@gmail.com

Abstract

The study examines the impact of supply disruptions arising from the COVID-19 pandemic and the energy security challenges primarily resulting from the Russian-Ukrainian war on the re-evaluation of sustainability considerations and the European green transition, especially regarding the potential strategic importance of renewable energy sources. The justification for the shortening of the long supply chains can be argued from the perspectives of supply security and sustainability. Furthermore, the economic validation of sustainability considerations is receiving increasing attention in professional discourse, sparking public debate. One of the primary tensions underlying these polemics is the conflict between short-term economic interests and long-term sustainability and environmental considerations. These interests often contradict each other, and the ongoing professional debate surrounding the shortening of supply chains provides relevant insight into these conflicts. However, the supply disruptions resulting from COVID-19 have re-emphasized the importance of supply security, prompting many economic actors to reconsider their supply strategies. The growing significance of supply security is evident in surveys, expert analyses, and economic strategic documents. The energy challenges posed by the Russian-Ukrainian war have, in turn, prompted EU policymakers to reform the energy strategy. The risks associated with energy security highlighted the vulnerabilities stemming from dependency on external fossil-based energy sources. This article aims to answer the question of how short-term economic interests and longer-term sustainability goals can be reconciled in light of the supply disruptions experienced during COVID-19 and the Russian-Ukrainian war. It does this through a literature review of professional debates and relevant expert analyses, strategic EU documents, and by examining key indicators of the EU's energy dependence. The restructuring of the EU's energy policy demonstrates the feasibility of rapidly implementing major transformations in complex systems when necessary. Beyond facilitating professional discourse, the experiences from these events can also boost the European green transition, as a green Europe built on its renewable resources can be more resilient against challenges of the future. This is in line with both economic and environmental objectives. The main conclusion of the research is that the EU's successful transition to renewable energy sources, in addition to achieving environmental goals, can contribute to reducing external risks through the alleviation of energy dependence. Furthermore, energy security provided by its own energy sources facilitates the growth of the real economy and underpins the EU's geopolitical position.

Keywords: *Hungary, European Union, supply chains, COVID-19, sustainability*

Összefoglalás

A tanulmány a COVID-19 járvány nyomán fellépő ellátási zavarok, valamint az orosz-ukrán háború következtében jelentkező elsősorban energiabiztonsági kihívások hatását vizsgálja a fenntarthatósági szempontok átértkélődése, valamint az európai zöld átmenet, különösen a megújuló energiaforrások potenciális startégiai jelentősége szempontjából. A hosszú ellátási láncok az ellátásbiztonság és a fenntarthatóság szempontjából indokolt rövidítése, valamint a fenntarthatósági szempontok gazdasági érvényesítése egyre jelentősebb figyelmet kap a szakmai diskurzusban és számos vitát generál. A polémia mögött húzódó egyik fő feszültséget a rövid távú gazdasági érdekek és a hosszú távú fenntarthatósági, valamint a környezeti szempontok közötti ellentétek jelentik. Ezen érdekek ugyanis gyakran szemben állnak egymással, amelynek hátterében az ellátási láncok rövidítése körüli szakmai vita releváns betekintést nyújt. A COVID-19 nyomán fellépő ellátási zavarok azonban az ellátásbiztonság felértékelődését kiváltva az ellátási stratégiájuk újragondolására késztettek számos gazdasági szereplőt. Az ellátásbiztonság növekvő jelentősége megjelenik felmérésekben, szakértői elemzésekben és gazdaságstratégiai dokumentumokban is. Az orosz-ukrán háború okozta energetikai kihívások pedig az uniós energiastratégia reformjára ösztönözték a gazdaságpolitikai döntéshozókat. Az energiabiztonsággal kapcsolatban megtapasztalt kockázatok ugyanis megmutatták a külső fosszilis forrásból származó energiahordozóktól való függésből származó kockázatokat. A cikk a szakmai vita és releváns szakértői elemzések, uniós stratégiai dokumentumok szakirodalmi elemzésével és az uniós energiafüggőség főbb mutatószámainak segítségével arra a kérdésre keresi a választ, hogy a rövid távú gazdasági és a hosszabb távú fenntarthatósági érdekek miképpen egyeztethetőek össze a COVID-19 és az orosz-ukrán háború során fellépő ellátási zavarok tapasztalatainak a tükrében. Az uniós energiapolitika átszervezése bizonyítja, hogy szükség esetén lehetséges akár gyorsan nagy átalakításokat is megvalósítani komplex rendszerekben. Ezen események tapasztalatai a szakmai diskurzus felélénkülésén túl az európai zöld átmenetnek is lendületet adhatnak, ugyanis a saját megújuló erőforrásokra építő, zöld Európa rugalmasan alkalmazkodóképes lehet a jövő kihívásaival szemben. Ez pedig összhangban van mind a gazdasági, mind a környezetvédelmi célokkal. A kutatás arra a fő következtetésre jut, hogy az EU megújuló energiaforrásokra történő sikeres átállása a környezetvédelmi célok elérése mellett az energiafüggőség mérséklésén keresztül hozzájárulhat a külső kockázatok csökkentéséhez, valamint saját energiaforrásokkal nyújtott energiabiztonság hozzájárul a reálgazdaság növekedéséhez, ezzel együtt az EU geopolitikai helyzetének erősödéséhez.
Kulcsszavak: *Magyarország, Európai Unió, ellátási láncok, COVID-19, fenntarthatóság*
JEL kód: *Q01*

Introduction

The public debate about shortening sustainable supply chains and their role in building up a sustainable economy closely linked to decarbonisation and climate policy issues has gained new impetus worldwide, particularly in the European Union following the supply chain disruptions caused by the COVID-19 pandemic. Furthermore, the escalation of the Russian-Ukrainian war in 2022 and its effects on specific supply chains and energy security has put even more pressure on Europe and particularly the European energy policy. Due to the war Russian energy supply, on which the European economy highly depended, turned into not just unreliable, but also unwelcomed commodity. Along with its climate and emission goals, the EU should address energy security and dependency issues, amplified by factors such as the

aftermath of the COVID-19 pandemic, volatile energy prices, the Russian-Ukrainian war, and a general rise in political tensions and instability.

Outsourcing production capacity, a cornerstone of the global economic system, can be viewed as a rational cost-optimization decision, which often resulted in extended supply chains and an efficient international division of labour. While this short-term cost optimization may seem economically rational, it may overlook long-term consequences. The system frequently led to elongated shipping routes, associated increases in emissions due to extended transport routes, and the outsourcing of polluting activities to less developed economies. Despite numerous criticisms, economic interests often hindered efforts to reform the system. However, disruptions caused by their COVID-19 pandemic and the Russian-Ukrainian war prompted both market players and policymakers to undergo significant transformations to adapt to the new situation. The lessons from these events could potentially accelerate efforts to shorten supply chains for security reasons and boost the European Union's green transition. The energy security threats experienced underscored the several risks of reliance on external fossil fuel sources. Yet, Europe built on renewable resources could be more resilient to such challenges. This is crucial as short-term economic interests have often clashed with the long-term environmental and climate protection concerns. The growing emphasis on supply and energy security could greatly aid in recognizing the benefits inherent in shorter supply chains and renewable energy. The European Green Deal, the objectives set out in the new EU industrial policy, and the ongoing EU green commitment can significantly contribute to the EU's realization of a green transition, setting an example and aiding other economies in achieving climate goals. The research aims to point out the common ground and reconcile the differences between economic goals and sustainability.

In addition to the ex-post analysis related to the supply chain disruptions caused by the COVID-19 pandemic, the currently ongoing war-related challenges offer an opportunity to compare and analyse the similarities and differences regarding the economic impact of the two crises. In contrast to the relatively short-term, but powerful external shock of the pandemic, the long-term consequences of the Russian-Ukrainian war may pose a lasting adaptive challenge to the European economies. These challenges can significantly alter the operating environment of the Central European region, including Hungary, and the prospects for its future growth trajectory.

Methods and material

The possibilities of shortening supply chains and reaching sustainability objectives from the perspective of the European Green Deal and green transition is presented by conducting an analysis of the literature by contrasting and combining results from various studies and strategic documents of the European Community linked to supply chain-, operations, food-, energy- and environmental security and sustainable economy. The combinations of following terms were used to search relevant studies: short supply chains, sustainability, self-sustainability, green economy, food-, energy-, supply chain- and environmental security, renewable energy, COVID-19, outsourcing, de-globalization, reshoring, nearshoring, regionalization, EU. In addition, supplemental searches were conducted by examining bibliographies of articles and looking up relevant studies of international organizations and expert analyses for additional references.

The results are potentially biased because studies might differ in their focus and perspective, their use of different baselines, timeframe and approaches for comparisons and other background conditions. For example a long term sustainability goal like shortening of supply chains and relying more on local or nearby resources may reduce pollution by cutting back on

transport and transport-related emissions, may be interpreted by another study as a suboptimal use of resources. The literature on supply chains, sustainability, supply security and environmental issues, and on the impacts of the turbulences following the COVID-19 pandemic is already substantial, however, the effects of a potential shift in relation to supply chains and sustainability issues caused by the experiences of the disruptions during the COVID-19 pandemic and the currently ongoing Russian-Ukrainian war received much less attention. Furthermore, there is a lack of available publications related to the long term reconciliation of the European economic and environmental objectives: they are often misrepresented as two opposing force. The study aims to point out the connections and mututal benefits of the two set of objectives.

This study generally focuses on the professional discussion regarding the supply chains and expands to the dimensions of sustainability and supply security from this platform the investigation primarily focuses on sustainable development in the EU, including supply security, especially energy security issues as well. The issue of supply and energy security gained more headspace in the light of the disruptions and risks experienced due to the COVID-19 crisis and the currently ongoing Russian-Ukrainian war. The research is conducted by a review of the main arguments in the literature discussing the main pros and cons of supply chain shortening, as well as studies and strategic documents of the European Community aided by relevant economic strategic documents, industry and expert analyses. Due to the fact that the European Green Deal as a long-term objective is in progress, the study also elaborates on the goals and plans published in EU strategic documents and relevant publications of the European Community and international organizations. The literature used and processed consists predominantly of recently published materials, so the references of the paper covered mainly the period 2019 to 2023, but in case of supply chain and operations management or establishing theoretical or economic history background, some pre-2019 references were also cited.

After comparing, contrasting and combining results from various studies, supply chain scenarios and global economic models linked to supply chain management, supply-, energy- and environmental security and sustainability. The research investigates the connections and potential synergies between shorter supply chains, energy security and the European plans for reaching a sustainable, green and carbon neutral economy. The research also reflects on the opportunities, offered by shorter supply chains and European sustainability objectives, for a deeper integration of the Central European region, particularly the Hungarian economy into the international value chains. This part of the analysis primarily explores opportunities through the perspective of the EU sustainability and supply security objectives, and regionalisation, nearshoring and reshoring as community objectives. Additionally, the research examines the modernity and competitiveness of the Hungarian export structure using the "Economic Complexity Index" published by HARVARD UNIVERSITY (2023), putting it into and international and EU comparison.

The study also analyze and elaborate on databases that can illustrate and highlight the issues and challenges of the European energy policy. The dataset can also show the scale of the shift, which had to be implemented to handle the crisis. Thus, the study provides results that are relevant and capable of uncovering the issues and opportunities in the green transition and the recognition of European renewable energy sources as a startegic asset, that can become a cornerstone of the European energy security, providing resilience against the turbulences of the incresingly tense geopolitical environment.

Furthermore, considering the energy market turbulences that have emerged since the escalation of the Russian-Ukrainian war, the issue of energy security will also be reviewed. Because firstly, both the European Union and the Hungarian economy are significant net energy importers, and secondly, energy is a fundamental factor of production. Thirdly, a possible

solution to the energy issue is closely linked to the sustainability and climate objectives of the European Green Deal. As energy security is also a sustainability issue of the supply chain.

Literature review

The disruptions that arose in the wake of the COVID-19 pandemic, particularly those affecting supply networks, significantly amplified doubts about the sustainability and survival of the world trading system in its pre-pandemic form, based on global division of labour and cost-effective outsourcing (HAUSMANN, 2020). Scientific views and discourses regarding potential transformations, sustainability, and the survival of global production networks and systems, as well as arguments for shortening supply chains and upholding sustainability considerations are not new phenomena. However, these views have received renewed attention due to the turbulence arising from the COVID-19 pandemic. The disruptions in supply networks caused significant damage to the world economy (MCKIBBIN – FERNANDO, 2020; MCKENZIE, 2020), the European Union (DE VET et al., 2021), and to the Hungarian economy too (CZIFRUSZ, 2021).

Since then, the consequences of the escalated Russian-Ukrainian war from 2022 have significantly contributed to the re-evaluation of independent production capacities, and the issue of energy security has also emerged as a new challenge (EBRD, 2022a,b). The ongoing geoeconomical and geopolitical processes fit in many ways into the pattern of trends and processes induced by the turbulence arising from COVID-19. The escalation of the war and the subsequent increase in geopolitical tension, also generate in some sense similar phenomena to the pandemic: for example, turbulence in supply networks, shortages of certain raw materials, and logistics disruptions can be observed, also the rising prominence of security and supply security, self-sufficiency, and diversification, as well as a focus on reducing (external) dependencies. It should be highlighted that the two shocks also has numerous distinct and different characteristics too (EBRD, 2022a,b). The COVID-19 caused a severe and worldwide, but short-term supply chain crisis, which has affected almost all economies and supply networks (MCKIBBIN – FERNANDO, 2020; MCKENZIE, 2020; BRENTON et al., 2022).

The sustainable and green solutions developed in Europe, and the implementation of circular economies (OECD, 2021) are important not only from a European perspective but may also provide a good example and successful, functioning sustainable solutions to the rest of the world and especially for developing countries (EUROPEAN COMISSION, 2020b). One of the main challenges for global climate goals is the growing emission levels of developing countries. If they are going to follow the historical trajectory of developed countries, Europe will hardly be able to counterbalance their emissions, by cutting back on its own. However, it is not determined that every economy and society should follow the same path of development. Modern economic history has introduced practical examples, such as in the case of Japan, South Korea, Taiwan or Singapore, which followed their own unique pattern of development (GYÖRGY, 2019). If the European Union succeeds in implementing sustainable and efficient technologies, developing countries will not necessarily have to go through the resource and energy-wasting phase of historical Western economic development. The significant improvements in European solar and other renewable energy utilization (RABBI et al., 2022) and the use of biofuels (OLÁH et al., 2021; OLÁH – POPP, 2022) over the past few decades, for instance, can contribute to the energy supply of developing countries in the global south. Alongside technological development, however, addressing societal prejudices regarding sustainability and the green economy also seems to be necessary to underpin the goals with public support (KLAUSMANN-DINYA – DINYA, 2021). Transparency and provision of information can be crucial. For instance, regarding sustainable biofuels, some might be

concerned that the raw material may be supplied from food crops (OLÁH et al., 2021), hence the biofuels industry competes with the food industry for agricultural land (OLÁH – POPP, 2022). So proactive approach to educating and informing the public and the business community in order to avoid misunderstandings and misinformation should be a high priority.

In the professional discourse unfolding around the potential transformation of supply chains, two main poles seem to emerge. According to one school of thought, the global supply security was hit by such a shock in the form of the COVID-19 pandemic that highlights the vulnerabilities of the system. The scope of this shock is beyond the former or existing turbulences, such as natural disasters, logistical disruptions, rising geopolitical tensions, and trade wars. Based on this experience the entire system needs to be fundamentally reconsidered and a more transparent, sustainable, and safer supply and production model needs to be established, some signs of which are already visible (JAVORCIK, 2020). Research into supply chains that replace long, global supply chains with short ones, relying on local resources and connections, is also appearing in domestic literature (BOTOS et al., 2018).

Taking into account the evaluated characteristics and vulnerabilities of production systems, the arguments of professional discourses on shortening supply chains become meaningfully examinable and contextualized (JAVORCIK, 2020; SHIH, 2020a, b; HAUSMANN, 2020), and it becomes possible to weigh significant arguments for the survival and robustness of long global supply chains (MIROUDOT, 2020; WILLIAMSON, 2021). Additionally, it is possible to examine economic and sustainability arguments for and against the policy of reshoring, regionalization, and localization (EUROPEAN COMISSION, 2020a,b; SZALAVETZ, 2018a, b). BRENTON et al. (2022) however, points out that widespread reshoring may lead to a suboptimal system and the suboptimal use of the global resources.

However, criticisms towards long global supply chains are not new. The reasons and consequences of their vulnerability had been analysed in the literature on the topic long before the outbreak of the COVID-19 pandemic, for instance, by PECK (2007), POUNDER (2013), GEREFFI – LUO (2014) and Hungarian authors like VÖRÖS (2018), KOLTAI (2006), and GELEI (2010) have extensively dealt with the questions, and current challenges, of supply chain and network management. Other researchers examined the benefits achievable through their shortening or optimization years before the outbreak of COVID-19. For example, due to the works of MOLLENKOPF et al. (2010) or KIM – CHAI (2017a, b) arguments for shortening supply chains were well-known even before the pandemic has risen the awareness. Moreover, the European Union's new industrial strategy (EUROPEAN COMISSION, 2020b), with a primary focus on sustainability goals, moved in this direction from multiple aspects, raising the potential strategic opportunities in tighter EU cooperation, regionalization, and reshoring, as emphasized by specific EU strategy documents like the EUROPEAN PARLIAMENT'S COMMITTEE ON INTERNATIONAL TRADE (2021): Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy.

Furthermore critics have also highlighted other negative aspects of production outsourcing. For example as the transfer mechanism of environmental pollution and degradation into less developed economies, which were the main destinations of outsourcing (CHOI – YU, 2018). Although it should be noted that technological progress also played a significant role in the cleaner production of developed countries (BRUNEL, 2017), the increase in the volume of goods produced and the laxer environmental regulations in less developed countries significantly contributed to the increase in global emission of greenhouse gases (GHGs) and environmental pollution (CHOI – YU, 2018). On the other hand, outsourcing raises dilemmas related to employment and working conditions in the chosen target countries (ZWOLINSKI, 2007). The latter is gaining more attention in the European Union, as indicated by the principles set out in the revised European industrial policy (EUROPEAN COMMISSION, 2020a,b). As a recent example, the EU tied the permission of biofuel imports as an environmentally friendly

fuel to the implementation of EU social and labour protection criteria, primarily affecting Brazil (OLÁH et al., 2021).

The cheap production factors made available through outsourcing and the relatively low cost of transportation (RADOVIĆ-MARKOVIĆ, 2019; SHIH, 2020a) contributed to the waste of resources and rise of environmental pollution linked to both production and transportation (OECD, 2021). Regardless of the advancements in technology, the efficiency of machines, and the gradual, but increasing share of renewable energy and biofuels production (OLÁH – POPP, 2022), it is hardly sustainable to transport raw materials and energy carriers in large quantities from one continent of the planet to another continent, then ship finished products by cargo ships or cargo planes to the other side of the planet. It is well known, that the major culprit in terms of carbon dioxide emissions is transportation. Alongside passenger transport, cargo transport also represents a significant weight in fossil fuel use (CAMBRIDGE ECONOMICS, 2018).

Nowadays, it is increasingly expected that the main decision-making criterion for economic actors will not be the minimalization of costs, but the aspects of environmental awareness and sustainability will increasingly come to the fore (SZALAVETZ, 2018b). This approach is beginning to gain ground not only in professional circles (TSENG et al., 2018), but also at the practical, economic policy decision-making level and European Union industrial strategies (EUROPEAN COMISSION, 2020a,b). The experiences of the COVID-19 strengthened the concept of circular economy (OECD, 2021). It should be mentioned that there are several similar approaches to sustainable supply chain management with differential characteristics in sustainability paradigms and in levels of change. For example, environmental, sustainable, green, closed-loop and circular supply chain management (LENGYEL et al, 2021).

Integration, sustainability and shorter supply chains

After the deindustrialization following the regime change in 1990, foreign direct investment (FDI) provided an opportunity for the Hungarian (and other regional) economy to reintegrate into the European economic system LUX (2017a). With the FDIs a high volume of capital, technology, and knowledge flowed in to the region, significant production capacities were built, and a large number of jobs were created. However, this growth and development highly depended on external resources, without strong domestic roots. At present specialization of vehicle manufacturing is high in the Central European region (HARVARD UNIVERSITY, 2023), which, on the one hand, may contribute to the efficiency of production, but on the other hand, it could make the domestic economy vulnerable. High inflow of foreign capital – besides its benefits – may increase the external vulnerability of the economy and may hinder the development of domestic large companies. Regarding the structure of the Hungarian economy, domestic, but internationally competitive, strategic large companies, so-called national champions are missing. KOVÁCS et al. (2017) underlined since that the room the development of national large companies, which could fill the gap in the economic structure within a foreseeable time is small due to the resource and capital shortage of the domestic economy. This role could partially be filled by domestic medium-sized enterprises based on the German Mittelstand model. However, this is hindered by the fact that the domestic medium-sized enterprise sector is also relatively small in numbers and weak in economic performance (KOVÁCS et al., 2017). LUX (2017b) draws attention to the importance of industry, and the maintenance of own domestic production capacities, and their strategic and economic-social significance. The authors also point out that the economic model adapted from the 1990s, which was build up on the domestic supply of workforce and FDI from abroad has reached its limits.

The labour supply is exhausting and it can be expected to be even more scarce in the future (LUX, 2017b).

The chances of the Hungarian economy catching up, and the integration of domestic companies into international value chains – adapting to the regionalization and sustainability goals of the EU (EUROPEAN COMISSION, 2020) and German (FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND ENERGY OF GERMANY [BMWI], 2019) industrial strategy – can be significantly aided by the following macroeconomic competitiveness factors. Strategic geographical location, as the country is located in the middle of Europe, along major transport routes. The country is also close to advanced European markets, and furthermore can also provide connections towards other regions. The Hungarian workforce is relatively skilled, characterized by high education, discipline, and expertise. Both school enrollment and the availability and quality of higher education and vocational training in Hungary represent a high standard, however, recent years have seen a growing shortage of skilled labour in the domestic economy (MCKINSEY, 2020).

According to the "Economic Complexity Index", a scientific-based indicator of competitiveness regularly published by HARVARD UNIVERSITY (2023), the Hungarian economy shows high complexity and export competitiveness. Based on the latest available data from 2020, with an index of 1.54, the Hungarian economy ranks 9th among the 133 countries examined and ranked by the research institute. For comparison, Japan leads with an index of 2.27, Germany follows with 1.96, while Romania has an index of 1.27 (HARVARD UNIVERSITY, 2023). However, it should be noted that this outstanding export activity is primarily based on the manufacturing capacities of foreign corporations, although their success is also largely based on the skilled and relatively cheap Hungarian workforce (MCKINSEY, 2020).

The cost environment in Hungary is also competitive, as the cost level is lower than in most EU economies, and skilled workforce is available at a cost level more favourable than the EU average (EUGO, 2022). Additionally, one of the lowest corporate tax rates contributes to creating an investor-friendly environment. The Hungarian economy has significant experience in certain sectors and these sectors have a strong presence and established network of relationships. Such sectors with a significant role in Hungary include vehicle manufacturing, which is a known and characteristic feature of the Visegrád Group, pharmaceutical manufacturing, and the production of computers and electronic products. Lastly, in addition to its favourable geographical position, the developed and reliable infrastructure also positively influences the competitiveness of the domestic economy, although there is still room for development in EU comparison, especially in terms of transport infrastructure (MCKINSEY, 2020). In the absence of large national companies, the successful integration of domestic companies into international value chains is particularly important (VAKHAL, 2020).

In addition to the need to manage and mitigate supply security and operational continuity risks associated with the rethinking of supply chains (ALICKE et al., 2020), strategies approaching the issue from the perspective of sustainability are becoming increasingly prominent, such as the European Union's new industrial strategy (EUROPEAN COMISSION, 2020a,b). In addition to reducing pollution and greenhouse gas emissions caused by transport, the document also emphasizes regionalization, and promotes more reliance on local resources and suppliers (EUROPEAN COMISSION, 2020 a,b). Advancement of these policies could offer significant opportunities for the Hungarian economy by facilitating the development of domestic production capacities and enhanced integration into global value chains.

Results

Energy security versus climate neutral Europe by 2050

Due to the high dependency of the EU on imported energy carriers, mainly fossil fuels, the issue of European energy security is both a sustainability issue and a strategic issue effecting both the economy and the society. The methods and policies applied to manage the energy need of Europe have a direct effect on the sustainability of the continent. The escalation of the Russian-Ukrainian war at the end of February 2022 has caused further disruption of supply chains inducing significant turbulence in the energy sector and global food supply as well (EBRD, 2022a,b).

The European Union covers almost all of its crude oil needs from imports (EUROSTAT, 2023a), within which, in 2021, Russia was the number one supplier (EUROSTAT, 2023c), providing a quarter of the total imports (Table 1). As a result, the EU's exposure to oil market turbulence is significant.

Table 1. The top 10 crude oil suppliers of the European Union in 2021 (in thousand tons and percent of the total import)

Ranking	Supplier	Volume	Percent
	Total imports	*446 454*	*100%*
1	Russia	112 343	25%
2	Norway	43 614	10%
3	USA	37 446	8%
4	Kazakhstan	35 751	8%
5	Libya	35 569	8%
6	Iraq	32 410	7%
7	Nigeria	29 091	7%
8	Saudi Arabia	23 880	5%
9	United Kingdom	20 944	5%
10	Azerbaijan	20 337	5%

Source: Own construction (2023) based on EUROSTAT (2023c) Database

However, the situation outlined above changed significantly since 2022, following the escalation of the war and the adoption of sanctions on Russian oil (PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS, 2023).

Crude oil is of vital importance to the European economy, both as an energy carrier and fuel, and as a raw material, primarily for the chemical industry. It constitutes the main raw material for numerous plastics and other chemicals. The economy of the European Union in general, but especially the Central European member states and Germany, relied heavily on Russian energy carriers (EUROSTAT, 2023b). This is well illustrated by the fact that in 2021 34, 66, and 34 percent of German crude oil, natural gas, and solid fossil fuels[1] (hereinafter: coal) imports respectively came from Russia.

[1] The data collection referenced by EUROSTAT pertains specifically to solid fossil fuels, which however, almost exclusively represent types of coal (anthracite, black and brown coal, lignite, etc.). In the EUROSTAT database, data on individual types of coal can be viewed separately. For the sake of simplicity, in the following, when referring to data on solid fossil fuels, it will be referred as coal.

Examining the Russian share within energy imports in 2021 (EUROSTAT, 2023b), the last full year before the escalation of the war in 2022, it can be concluded that Hungarian exposure, with the exception of coal, is significant, exceeding half of the total imports of Crude Oil and especially in case of Natural Gas (Table 2.).

Table 2. Share of energy carriers imported from Russia in percentage of total imports of selected countries (2021)

	Crude Oil	Natural Gas	Solid Fuels (Coal)
Germany	34%	66%	34%
Italy	10%	40%	58%
Poland	63%	65%	65%
Hungary	58%	95%	17%

Source: Own construction (2023) based on EUROSTAT (2023b) Database

Examining the EU oil consumption data of the year 2021, it should be highlighted that the most significant item in the EU's oil and oil derivative usage (excluding biofuels) was road transportation with a share of 48.72% (47.56% in 2020), followed at some distance by industrial use as raw material at 15.46% (15.41% in 2020), then air transport 9.01% (4.55% in 2020), water transport with 5.25% share (9.12% in 2020), households 5.05% (6.60% in 2020) (EUROSTAT, 2023a). In other words, about two-thirds of EU oil consumption is associated with transportation. It should also be highlighted, that the effect of the COVID-19 can be clearly observed on the low share of consumption by air transport in 2020 compared to 2021. An increase in the role and share of biofuels, as targeted in the EU Renewable Energy Directive for 2020-2030, could aid in offsetting the EU's fossil oil requirements. By 2030, 14 percent of the energy needs of the transport sector should be met from renewable sources, of which at least 3.5 percent from biofuels. The directive, however, significantly restricts the share of biofuels that can be produced from feed or food crops (OLÁH – POPP, 2022). Overall, the escalation of the Russian-Ukrainian war, resulting in energy security disturbances, could facilitate the further expansion of biofuel use, while the rise in food prices could hinder it. The degree and strength of the latter relationship are disputed, but due to the two sectors in part using the same or similar resources, the correlation seems to be positive (OLÁH – POPP, 2022).

The study by CAMBRIDGE ECONOMICS (2018) on the European Union's oil dependency highlights that, with the exception of Denmark and the United Kingdom (the latter is no longer member of the EU), the union relies heavily on oil imports and most member states typically depend on one or two countries for their needs, which represents a significant partner risk. Particularly considering that many oil-producing regions can be viewed as geopolitically quite risky (CAMBRIDGE ECONOMICS, 2018). The analysis also emphasizes the vulnerability of landlocked Central European member states, such as the Czechia, Slovakia, and Hungary, who, due to a lack of seaports and adequate transport infrastructure, are unable to significantly diversify their procurements (CAMBRIDGE ECONOMICS, 2018).

Due to the crisis of the Russian-Ukrainian war the EU policymakers were alerted to the need for reforming the EU's energy policy. It became clear that the exposure to imported fossil fuels represent a significant economic and geopolitical vulnerability to the European Community. Therefore, under the REPowerEU Plan, the European Commission announced a program to reduce dependence on Russian fossil fuels, which it aims to support through accelerating the green transition and endorsing investments in European renewable energy sources (EUROPEAN COMMISSION, 2022c). The European Recovery and Resilience Facility, with its more than 700 billion EUR worth of financial capacity, also provides dedicated funds to help the accomplishment of the European green transition (EUROPEAN COMMISSION, 2022d).

Hence, this swift change in policy goals has the potential to facilitate up investment in renewable and sustainable energy sources. Contributing to the realization of the European Green Deal and the resilience of Europe at the same time.

It should be also mentioned, that on the short term some backsliding was experienced in the green goals due to the supply security issues caused by tensions of the Russian-Ukrainian war. The crisis increased the sentiment in some areas to put climate considerations in the background and return to the safety of locally extracted fossil fuels, for example Germany has extended the operation of its old coal power plants, which were scheduled to close down, to manage the energy security issues (REUTERS, 2022). In this sense, the energy crisis hindered the green transition in short term, but in a medium and long term the positive incentives can be expected to overcome the short-term backsliding.

Signs of shifting paradigms

The reduction in the weight of fossil fuels and the transition to a climate-neutral economy had already been planned in the EU, but not this rapidly, rather as a result of a multi-decade process with a target date of 2050. The Russian invasion in 2022 and the subsequent sanctions policy and energy uncertainty led to the unique situation where, due to increased energy prices, Russia's trade balance significantly improved. Ironically, the country initially reaped considerable benefits from a situation intended to penalize it. However, this scenario later shifted dramatically from the second half of 2022. From this period, based on the estimates of the EUROPEAN COUNCIL (2023) the energy carrier revenues of the Russian economy has been significantly decreased.

The European Union had managed to handle turbulences caused by the COVID-19 quite well compared to the measures taken during the financial crisis of 2008. The EU has applied a countercyclical policy, which proved to be more effective for recovery than the policies applied in 2008. This conclusion can be underpinned by comparing the fast recovery of the EU economy in 2021 (EBRD, 2022a) compared to the weak and long recovery after 2008. So, the policymakers have learned from their past mistakes.

Conclusions

The sustainability and environmental friendliness of the EU industry, as well as environmental, human rights, and occupational safety expectations concerning suppliers, can both help domestic and regional enterprises to integrate into EU value chains and have a positive impact on the quality of life of people in a third party, non-EU countries and on the state of the environment. A green Europe built on sustainable and increasingly circular economy may help the developing countries to meet their growing energy needs in a sustainable way, both by setting a good example and by developing sustainable procedures. The realization of such a scenario would constitute a significant turning point from a global perspective.

Regarding the regionalization, sustainability and shortening of supply chains the goal of the EU policy makers clearly shows intention to facilitate cooperation within the EU and to keep out potentially dangerous and unfair competitors from the European market. These goals together with the strong commitment to the environmental issues can be found in main Community policy documents (EUROPEAN COMISSION, 2020a, b). The rising geopolitical tensions together with the European sustainability goals may contribute to the success of nearshoring and reshoring initiatives. These changes can be beneficial for the development of the Central European economies including Hungary. The consumer preferences in the developed markets often include other factors, than prices, like environmental issues (like

carbon footprint, waste handling), moral issues (for example child or slave labour), fair trade and consciousness about the importance of sustainability together with the increasing importance of supply security may contribute to the shortening of supply chains in the future. As a geopolitical factor the ongoing trade war between the USA and China may also contribute to this change. From an environmental perspective, the shorter supply chains would be welcomed because local production based on local resources reduces waste and pollution emitted by transport of the materials and goods.

The EU energy crisis of 2022 has taught numerous lessons for us. First of all, it has turned out that even a complex system like the EU energy supply can be reformed within a comparatively short period of time if it is urgently needed and the decision makers are committed to finding solution. A similar approach to the issue of sustainability and the European Green Deal would be very much welcomed. The REPowerEU Plan, launched in May of 2022, managed to achieve significant impact on the European energy mix. For example, the share of renewables in electricity has reached 39% in 2022 (EUROPEAN COMMISSION, 2022e). The crisis has also highlighted the vulnerability of Europe due to its dependence on imported fossil fuels. The EU consumes a significant amount of fossil fuels, but depends on imports, especially on oil imports covering more than 90% of its oil needs from external sources (EUROSTAT, 2023a). The European dependence on fossil fuels is a significant economic and geopolitical vulnerability what can be abused by geopolitical actors or can threaten the whole European socio-economic system in case of a major supply chain disruption. The energy crisis following the escalation of the Russian-Ukrainian war should be considered a wake-up call for building up the European energy supply capacities, based on local renewable energy sources. In the successful management of the 2022 energy crisis, the renewables had a less known, but significant role. Despite having an easy and relatively cheap access to fossil energy carriers during the previous years, the EU green policies led to a buildup of local renewable energy production capacities. The EU directive set the targets for 20% share of renewable energy from final energy consumption for 2020 and 42.5% for 2030. The 2020 goal has been reached by consuming 21.3% of energy from renewable sources in 2021 the renewables maintained a similar share (EUROPEAN ENVIRONMENTAL AGENCY, 2023). Despite the high import-dependency of the EU, thanks to this green directive, during the 2022 energy crisis Europe already had a domestic renewable energy production capacity covering more than 20% of its needs.

In case of Hungary, the country lags behind in the share of renewables in energy consumption compared to the majority of EU members (EUROPEAN ENVIRONMENTAL AGENCY, 2023). Hungary as an energy importer is actually situated on top of huge untapped natural, renewable geothermal resources (INTERNATIONAL ENERGY AGENCY, 2022). Hungary also would be advised to put more emphasis on renewables, especially the better utilization of its rich geothermal resources. The shortening of European supply chains and the spread of nearshoring and reshoring operations can offer an opportunity for the Hungarian economy for deeper integration into the EU value chains, but this opportunity could be better exploited but mitigating the energy import-dependency of the country, because it poses an operational security risk. The expansion of Hungarian renewable capacities could also support the performance of the real economy by providing energy security and reducing operational risk of the economy. Due to the signs of exhaustion in the Hungarian FDI-based economic model, the national economic policy should address the situation and design a framework of a new way to contribute to the European economy. The change in European energy policy and presence of renewable resources in Hungary may offer an opportunity to diversify the economy and construct a new model. Hungary has good qualities for both solar power and biofuel production, but the geothermal resources are very much underutilized.

Further research into the possible sustainable tapping and use of the significant geothermal energy potential in Hungary can be a suggested and encouraged. Also rising the share of renewables in the energy mix of the EU members, especially Hungary and other Central European economies can be encouraged.

However, the European society is to some extent divided, which could undermine the social basis for the shift towards sustainability. Therefore, it is crucial to place emphasis not only on economic and scientific results but also on winning the support of the society and sound information delivery for the public (KLAUSMANN-DINYA – DINYA, 2021). Mixed opinion, misinformation and prejudice about renewable and clean energy amongst Hungarian and EU citizens may hinder the development of green policies. Both the citizens and economic entities should be educated and informed about the process and long-term benefits of the success of the green transition. Applying a proactive approach to educating and informing the public and the business community can be useful to help build public acceptance and support for the issue.

The successful implementation of this European renewable energy plan would contribute to the geopolitical independence, the energy security and the sustainability of Europe. This could fulfill the economic (energy security) and the environmental goals in the same time. In short term these two goals often contradict each other, but on a long term, in a strategical perspective the economic and the environmental approaches align, they can be consolidated. Because a green Europe is a geopolitically independent and resilient Europe.

The study draws the conclusion that the European economy may and should transition to a clean and renewable energy based sustainable economy, which transition would provide reliable, local and clean energy supply and energy security, protection from price swings and external vulnerabilities, create jobs, facilitate R&D and innovation, diversify the economies, while reducing import dependency and GHG emissions. Moreover, having its own energy production capacities could strengthen the international geoeconomic and geopolitical positions of the EU. Furthermore, a successful green transition in Europe and the development of these sustainable technologies can help other, especially developing and poor countries to meet their emission goals and energy needs at the same time. The success of the European Green Deal may facilitate the global green transition which is very much needed due to the rising global emission levels and the escalating risks of major and permanent damages caused by the climate change.

References

ALICKE, K. – AZCUE, X. – BARRIBALL, E. (2020): Supply chain recovery in coronavirus times – plan for now and the future. https://www.McKINSEY.com/business-functions/operations/our-insights/supply-chain-recovery-in-coronavirus-times-plan-for-now-and-the-future#. (Accessed: 2023.10.03.)

BAKER MCKENZIE (2020): Beyond COVID-19 Supply Chain Resilience Holds Key to recovery.https://www.bakermckenzie.com/-/media/files/insight/publications/2020/04/covid19-global-economy.pdf?la=en (Accessed: 2023.06.27.)

BOTOS, SZ. – FELFÖLDI, J. – VÁRALLYAI, L. – PÉNTEK, Á. – SZILÁGYI, R. (2018): Analysis the advanced ict usage of the hungarian sme sector for preparing a domestic agri-food research. Apstract - Applied Studies in Agribusiness and Commerce Vol. 11. No. (3-4) pp. 147–154. https://doi.org/10.19041/APSTRACT/2017/3-4/20

BRENTON, P. – FERRANTINO, M. J. – MALISZEWSKA, M. (2022): Reshaping Global Value Chains in Light of COVID-19: Implications for Trade and Poverty Reduction in

Developing Countries. Washington, DC: World Bank. 167p. http://hdl.handle.net/10986/37032 License: CC BY 3.0 IGO (Accessed: 2023.09.30.)

BRUNEL, C. (2017): Pollution Offshoring and Emission Reductions in European and US Manufacturing. In: Environmental and Resource Economics 68(3): pp.621–641. https://doi.org/10.1007/s10640-016-0035-1

CAMBRIDGE ECONOMICS (2018): Oil Dependency in the EU. https://www.camecon.com/wp-content/uploads/2020/07/2018-TE-Oil-Dependency-report.pdf (Accessed: 2023.05.22)

CHOI, J. Y. – YU, E. S. H. (2018): International Outsourcing, Environmental Costs, and Welfare. In: Asian Development Bank Institute, Working Paper No. 848. 16p. https://www.adb.org/sites/default/files/publication/428606/adbi-wp848.pdf (Accessed: 2023.06.16.)

CZIFRUSZ, M. (2021): A COVID-19-válság és a térbeli munkamegosztás változásai Magyarországon. Területi Statisztika, 61(3), pp. 320–336. https://doi.org/10.15196/TS610303

EBRD – EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT (2022a): In the shadow of the war – The economic fallout from the war on Ukraine. EBRD, London. https://www.ebrd.com/rep-ukraine-war-310322.pdf (Accessed: 2023.10.12.)

DE VET, J. M. – NIGOHOSYAN, D. – NÚÑEZ FERRER, J. – GROSS, A-N. – KUEHL, S. – FLICKENSCHILD, M. (2021): Impacts of the COVID-19 pandemic on EU industries. ISBN 978-92-846-7937-9. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662903/IPOL_STU(2021)662903_EN.pdf (Accessed: 2023.06.27.)

EBRD – EUROPEAN BANK FOR RECONSTRUCTION AND DEVELOPMENT (2022b): Business Unusual. EBRD, London. ISBN:978-1-898802-54-9 https://www.ebrd.com/documents/oce/transition-report-202223-pdf.pdf (Accessed: 2023.10.13.)

EUGO (2022): Doing Business in Hungary. http://eugo.gov.hu/doing-business-hungary (Accessed: 2023.06.27.)

EUROPEAN COMISSION (2020a): Making Europe's businesses future-ready: A New Industrial Strategy for a globally competitive, green and digital Europe. Press Release, EUROPEAN COMISSION. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_416 (Accessed: 2023.06.27.)

EUROPEAN COMISSION (2020b): A New Industrial Strategy for Europe. https://commission.europa.eu/document/a0dfe54f-f8bb-46f7-8828-d58c1cd8efa8_en (Accessed: 2023.06.27.)

EUROPEAN COMMISSION (2022c): REPowerEU: A plan to rapidly reduce dependence on Russian fossil fuels. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131 (Accessed: 2023.10.14.)

EUROPEAN COMMISSION (2022d): Recovery and Resilience Facility. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en#the-recovery-and-resilience-facility (Accessed: 2023.10.14.)

EUROPEAN COMMISSION (2022e): REPowerEU at a glance. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en (Accessed: 2023.10.15.)

EUROPEAN COUNCIL (2023): Impact of sanctions on the Russian economy. https://www.consilium.europa.eu/en/infographics/impact-sanctions-russian-economy/ (Accessed: 2023.10.03.)

EUROPEAN ENVIRONMENTAL AGENCY, EEA (2023): Share of Energy Consumption from Renewable Sources in Europe. https://www.eea.europa.eu/ims/share-of-energy-consumption-from (Accessed: 2023.10.15.)

EUROPEAN PARLIAMENT'S COMMITTEE ON INTERNATIONAL TRADE (2021): Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy. ISBN 978-92-846-7832-7 https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU(2021)653626_EN.pdf (Accessed: 2023.06.27.) doi: 10.2861/118324

EUROSTAT (2023a): Oil and petroleum products - a statistical overview. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Oil_and_petroleum_products_-_a_statistical_overview#Imports_of_crude_oil (Accessed: 2023.10.03.)

EUROSTAT (2023b): Energy imports dependency. https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_ID__custom_7659462/default/table?lang=en (Accessed: 2023.10.03.)

EUROSTAT (2023c): Imports of oil and petroleum products by partner country https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_OIL__custom_7659503/default/table?lang=en (Accessed: 2023.10.03.)

FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND ENERGY OF GERMANY [BMWI] (2019): Industrial strategy 2030. Made in Germany. Federal Ministry for EconomicAffairs and Energy (BMWi). https://www.bmwk.de/Redaktion/EN/Publikationen/Industry/industrial-strategy-2030.html (Accessed: 2023.06.18)

GELEI, A. (2010): Az ellátási lánc menedzsmentje. In: Czakó Erzsébet – Reszegi László (Eds.) (2010): Nemzetközi vállalatgazdaságtan. pp. 413–441. Alinea Kiadó, Budapest.

GEREFFI, G. – LUO, X. (2014): Risks and opportunities of participation in global value chains. Policy Research Working Paper No. 6847. World Bank. 25p https://doi.org/10.1596/1813-9450-6847

GYÖRGY, L. (2019): Creating Balance – The Mission of Economic Policy. Budapest, Századvég Foundation. 295p ISBN 978-615-5164-46-0. pp.154–165.

HARVARD UNIVERSITY (2023): Center for International Development: The Atlas of Economic Complexity. https://atlas.cid.harvard.edu/rankings (Accessed: 2023.10.03.)

HAUSMANN, R. (2020): A globális ellátási láncok átalakulása a feldolgozóiparban a koronavírus-járvány következtében. HITELINTÉZETI SZEMLE / FINANCIAL AND ECONOMIC REVIEW, 19 (3). pp. 130–152. ISSN 1588–6883 https://doi.org/10.25201/HSZ.19.3.130153

INTERNATIONAL ENERGY AGENCY (2022): Hungary 2022. IEA, Paris https://www.iea.org/reports/hungary-2022, License: CC BY 4.0 (Accessed: 2023.10.04.)

JAVORCIK, B. (2020): ‘Global supply chains will not be the same in the post-COVID-19 world‘, in Baldwin, R and S Evenett (Eds.), COVID-19 and Trade Policy: Why Turning Inward Won’t Work, CEPR Press, Paris & London. pp.111–116. ISBN: 978-1-912179-30-5

https://cepr.org/publications/books-and-reports/covid-19-and-trade-policy-why-turning-inward-wont-work (Accessed: 2023.10.13.)

KIM, M. – CHAI, S. (2017a): The impact of supplier innovativeness, information sharing and strategic sourcing on improving supply chain agility: Global supply chain perspective. In: International Journal of Production Economics, Volume 187 pp. 42–52 https://doi.org/10.1016/j.ijpe.2017.02.007

KIM, M. – CHAI, S. (2017b): Implementing Environmental Practices for Accomplishing Sustainable Green Supply Chain Management. Sustainability, Volume 9, pp. 1–17. https://doi.org/10.3390/su9071192

KLAUSMANN-DINYA, A. – DINYA, L. (2021). Társadalmi marketing feladatok a komplex fenntarthatósági kihívások kapcsán. Journal of Central European Green Innovation, 9(2), 3–18. https://doi.org/10.33038/jcegi.2908

KOLTAI, T. (2006): Termelésmenedzsment. Typotex, Budapest. 279 p

KOVÁCS, S. – LUX, G. – PÁGER, B. (2017): A középvállalatok szerepe a feldolgozóiparban: egy magyarországi kutatás első eredményei. Területi Statisztika. 57. évf. 1. sz. pp. 52–75. https://doi.org/10.15196/TS570103

LENGYEL, P. – BAI, A. – GABNAI, Z. – MUSTAFA, O.M.A. – BALOGH, P. – PÉTER, E. – TÓTH-KASZÁS, N. – NÉMETH, K. (2021): Development of the Concept of Circular Supply Chain Management—A Systematic Review. Processes, 9(10), 1740. https://doi.org/10.3390/pr9101740

LUX, G. (2017a): A külföldi működőtőke által vezérelt iparfejlődési modell és határai Közép-Európában. Tér és Társadalom, 31(1) sz. pp. 30–52. https://doi.org/10.17649/tet.31.1.2801

LUX, G. (2017b): Újraiparosodás Közép-Európában. Studia Regionum. Dialóg Campus Kiadó, Budapest - Pécs. 327p

MCKIBBIN, W. – FERNANDO, R. (2020): The Global Macroeconomic Impacts of COVID-19: Seven Scenarios. In: Asian Economic Papers 20(2) pp.1–55. https://doi.org/10.1162/asep_a_00796 https://www.brookings.edu/wp-content/uploads/2020/03/20200302_COVID19.pdf (Accessed: 2023.10.15.)

MCKINSEY & COMPANY (2020): Repülőrajt – A magyar gazdaság növekedési pályája 2030-ig. McKINSEY & Company, Budapest. https://www.McKINSEY.com/~/media/McKINSEY/Locations/Europe%20and%20Middle%20East/Hungary/Our%20Insights/Flying%20start%20Powering%20up%20Hungary%20for%20a%20decade%20of%20growth/McKINSEY-Hungary-2030-Report-HU.pdf (Accessed: 2023.10.03.)

MIROUDOT, S. (2020): Resilience versus robustness in global value chains: Some policy implications‘, in Baldwin, R and S Evenett (eds), COVID-19 and Trade Policy: Why Turning Inward Won’t Work, CEPR Press, Paris & London. pp.117–130. ISBN: 978-1-912179-30-5 https://cepr.org/publications/books-and-reports/covid-19-and-trade-policy-why-turning-inward-wont-work (Accessed: 2023.10.14.).

MOLLENKOPF, D. – STOLZE, H. J. – TATE, W. L. – MURFIELD, M. L. (2010): Green, lean, and global supply chains. In: International Journal of Physical Distribution & Logistics Management, Vol. 40, No. 1–2. pp. 14–41. https://doi.org/10.1108/09600031011018028

OECD (2021): Towards a more resource-efficient and circular economy – The role of the G20. A background report prepared for the 2021 G20 Presidency of Italy.

https://www.oecd.org/environment/waste/OECD-G20-Towards-a-more-Resource-Efficient-and-Circular-Economy.pdf (Accessed: 2023.06.27.)

OLÁH, J. – ERDEI, E. – POPP, J. (2021): FENNTARTHATÓ FOLYÉKONY BIOÜZEMANYAGOK KILÁTÁSAI. Journal of Central European Green Innovation, 9(1), 13–29. https://doi.org/10.33038/jcegi.2648

OLÁH, J. – POPP, J. (2022). Sustainable Liquid Biofuels (Bioethanol, Biodiesel) Production and Their Multifunctional Impacts. Journal of Central European Green Innovation, 10(1), 3–20. https://doi.org/10.33038/jcegi.3276

PECK, H. (2007): Reconciling supply chain vulnerability, risk and supply chain management. International Journal of Logistics Research and Applications 9(2), pp.127–142. https://doi.org/10.1080/13675560600673578

PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS (2023): https://www.piie.com/blogs/realtime-economics/russias-war-ukraine-sanctions-timeline (Accessed: 2023.05.22)

POUNDER, P. (2013): A Review of Supply Chain Management and Its Main External Influential Factors. Supply Chain Forum. Vol. 14 No. 3. pp. 42–50. https://doi.org/10.13140/2.1.3787.3289

RABBI, M.F. – POPP, J. – MÁTÉ, D.– KOVÁCS, S. (2022): Energy Security and Energy Transition to Achieve Carbon Neutrality. Energies 2022, 15(21), 8126. https://doi.org/10.3390/en15218126

RADOVIĆ-MARKOVIĆ, M. – BRNJAS, Z. – SIMOVIĆ, V. (2019): The impact of globalization on entrepreneurship. Economic Analysis, 52(1), pp.56–68. https://doi.org/10.28934/ea.19.52.12.pp56-68

REUTERS (2022): Germany fires up extra coal power capacity to plug winter supplies. November 2, 2022. https://www.reuters.com/business/energy/germany-fires-up-extra-coal-power-capacity-plug-winter-supplies-2022-11-02/ (Accessed: 2023.10.14.)

SHIH, W. (2020a): Is it time to rethink globalized supply chains? MIT Sloan Management Review. https://sloanreview.mit.edu/article/is-it-time-to-rethink-globalized-supply-chains/ (Accessed: 2023.05.23.)

SHIH, W. (2020b): Global Supply Chains in a Post-Pandemic World: Companies Need to Make Their Networks More Resilient. Here's How. Harvard Business Review Vol. 98, No. 5 (September–October 2020). pp.82–89. https://hbr.org/2020/09/global-supply-chains-in-a-post-pandemic-world (Accessed: 2023.06.20.)

SZALAVETZ, A. (2018a): Úton az energiahatékonyságtól az energiarugalmasságig. Magyarországi iparvállalatok tapasztalatai. Vezetéstudomány, 49(6) pp. 13–21. https://doi.org/10.14267/VEZTUD.2018.06.02

SZALAVETZ, A. (2018b): Digitális átalakulás és fenntarthatóság. In: KÖZGAZDASÁGI SZEMLE, 65 (10). pp. 1067–1088. ISSN 0023-4346. https://doi.org/10.18414/KSZ.2018.10.1067

TSENG, M. L.– WU, K. J.– HU, J.– WANG, C. H. (2018): Decision-making model for sustainable supply chain finance under uncertainties. International Journal of Production Economics, Vol. 205. pp. 30–36. https://doi.org/10.1016/j.ijpe.

VAKHAL, P. (2020). Magyar kis- és középvállalkozások a globális értékláncokban. Külgazdaság, 64, 30–59. https://doi.org/10.47630/KULG.2020.64.5-6.30

VÖRÖS, J. (2018): Termelés- és szolgáltatásmenedzsment [Digital Edition] Budapest: Akadémiai Kiadó, 2018. ISBN: 978 963 454 216 2 https://doi.org/10.1556/9789634542162, (Accessed: 2023.10.13.)

WILLIAMSON, P. (2021): De-Globalisation and Decoupling: Post-COVID-19 Myths versus Realities. Management and Organization Review, 17 (1): pp.29–34. https://doi.org/10.1017/mor.2020.80

ZWOLINSKI, M. (2007): Sweatshops, choice, and exploitation. Business Ethics Quarterly, 17(4), pp. 689–727. https://doi.org/10.5840/beq20071745

Authors

Szabó Zoltán Tamás
PhD-hallgató
Pécsi Tudományegyetem, Földtudományok Doktori Iskola
H-7624 Pécs, Ifjúság u. 6.
zoltasz@gmail.com

Chuluunbaatar Erdenebayar
PhD-hallgató
Ihrig Károly Doctoral School of Management and Business, University of Debrecen,
4032 Debrecen.
erdenebayar.ch@gmail.com

Dr. Alpek B. Levente, PhD
egyetemi adjunktus
Pécsi Tudományegyetem, Földrajzi és Földtudományi Intézet
H-7624 Pécs, Ifjúság u. 6.
alpeklevente@gamma.ttk.pte.hu