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ABSTRACT

Globalisation has influenced the creation of the GVC, surrounded by opportunities and risks. Some of these threats can be controlled, and their effect on the business involved in GVC can be minimised. However, besides the risks, GVC is also not protected from the influence of less controlled and predictable disruptive events. A global disruptive event, COVID-19, which occurred relatively recently, had a negative impact on international trade and national economies. The effects of COVID-19 were difficult for politicians and global corporations to address because of the many uncertainties in the world. However, the military confrontation between Russia and Ukraine at the start of 2022 became a new disruptive event for many global economic sectors, and the agricultural industry is no exception. The agriculture sector of Ukraine and Ukrainian involvement in the cereal AGVC serve as the setting for this study. The study's theoretical approach is based on Transaction Cost Theory (TCT) and New Trade Theory (NTT). Secondary data was gathered via interviews with policymakers and representatives of Ukraine's agricultural sector and from reports, industry magazines, newspapers, trade journals, and other sources to illuminate the context of the problem better. Based on a qualitative and content analysis, the study creates a conceptual framework that demonstrates the influence of the most recent disruptive event in AGVC sectors. The study adds to the body of GVC literature and offers important new insights into the state of the Ukrainian agricultural industry during times of crisis.

Keywords: GVC, disruptive events, military conflict, Ukraine, agriculture

LIST OF ABBREVIATIONS

GVC – Global Value Chain
AGVC – Agricultural Global Value Chain
AVC – Agriculture Value Chain
VC – Value Chain
GCC – Global Commodity Chains
FDI – Foreign Direct Investments
FTA – Free Trade Agreement
M&A - Mergers and acquisitions
R&D – Research and Development
GDP – Gross Domestic Product
TCT – Transaction Cost Theory
NTT – New Trade Theory
RSI – Relationship-specific investments
DCFTA – Deep and Comprehensive Free Trade Agreement between EU and Ukraine
TNC – Transnational Corporations
MNE – Multinational Enterprises
WTO – World Trade Organisations
OECD – The Organization for Economic Cooperation and Development
IMF – International Monetary Fund
IFC – International Finance Corporation
UN – United Nations
FAO – Food and Agriculture Organization of the United Nations
UNHCR – United Nations High Commissioner for Refugees
EU – The European Union
CIS – Commonwealth of Independent States
USSR – Union of Soviet Socialist Republics
NBU – National Bank of Ukraine
MAPF – Ministry of Agricultural Policy and Food of Ukraine
SCSU - State Customs Service of Ukraine
SSSU – State Statistics Service of Ukraine
PPP – Plant Protection Products
USD – United States Dollars
EUR – Euro
MY – Marketing Year
GMO – Genetically Modified Organisms
HS – Harmonized System Codes
Ha – Hectare
bln – billions
mln – millions
t – tones

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1. INTRODUCTION

1.1 Research background

One of the challenges related to the world economy in the XXI century is the global structural transformations of international economic relations. The main manifestations of these transformations include intensive scientific and technological development, which significantly impact internationalisation and integration processes in the context of the latest division of labour. It has formed a new attitude toward economic activity and created new stereotypes, models, relationships, and connections in business processes. It has also caused fragmentation of economic relations at different levels, which qualitatively changes the nature of the functioning of economic systems, giving them new opportunities and generating new risks in the process of structural transformation of the economy.

Today goods and services are often the results of the interaction of dozens or hundreds of suppliers of inputs, intermediate components and services located in different countries worldwide (Strange, 2020). As a result, the economic structure is multilevel and interdependence; the global and international levels of economic activity play an essential role in this structure (Amador and Cabral, 2014).

In the second half of the XX century, the world economy developed under the influence of several key factors. First, the intensification of competition in commodity markets has contributed to diversifying the geography of sales, and companies' procurement has expanded significantly (Lund-Thomsen et al., 2020). Second, liberalising foreign trade regimes has significantly reduced the costs of international trade in goods (Lund-Thomsen et al., 2020). Third, the reduced cost of transportation and logistics has led to increased availability and a greater variety of goods for customers (Amador and Cabral, 2014). Fourth, the rapid spread of information and computer technology has reduced the transaction cost between remote companies (Strange and Zucchella, 2017). According to Baldwin (2012), the world was transformed by the international flow of goods, services, knowledge, investments, and people connected to international production. As a result of this flow, international investments, trade, and production became conducted within global value chains (GVCs), where value-added processes occur across national boundaries throughout different stages of product production and consumption (Gereffi and Memedovic, 2003).

Participation in GVCs creates certain advantages for the companies that participate in it. Such advantages include creating various products and reducing production costs by supplying cheaper production inputs (semi-finished goods, services, and labour). GVCs can also enhance risk resilience, especially for supply chain disruptions (Strange, 2020).

Since the first industrial revolution, waves of technological advancement have dramatically changed production boundaries in the framework of integration and modernisation. Participation in GVCs, which show how new patterns of international commerce, manufacturing, and employment impact development and competitiveness, provides firms with both opportunities and challenges. On one side, it opens new profit prospects and broadens the market horizons. Conversely, it raises the degree of possible information asymmetry and mostly puts the enterprise in danger previously sheltered by market boundaries and geographic distance (Gereffi and Luo, 2015).

Indeed, according to Strange (2020), GVCs face several challenges. GVCs already involve high expenses such as increased costs of logistics, longer shipping times, and increased complexity. Firm interconnection results in a more complicated value chain, raising the reliance ratio in the GVC and making it vulnerable to disturbances such as the financial crisis, terrorism, and pandemic.

1.2 Problem Statement

According to Atan and Rousseau (2015), despite their management level, supply chains are often vulnerable to disruptions. Elkins et al. (2007) state that disruptions in the supply chain are events that create substantial breaches in some regions of the supply chain, affecting its further links. Throughout the last 50 years, the world has faced numerous supply chain disruptions. One of the latest was the COVID-19 pandemic. However, prior to the pandemic, GVCs were already jeopardised by financial crises, natural disasters (like earthquakes in Japan), the USA-China trade tensions and sanctions policy, the rise of economic protectionism (such as Brexit) and telecommunication disruptions like cyberattacks and data breaches (Palit, 2022; Olson and Wu, 2017; The Economist, 2020). At the beginning of 2022, another geopolitical crisis occurred, connected with Russia's military attack on Ukraine (Orhan, 2022, Ruta, 2022). This occurrence highlighted the hazards involved with the interdependent structure of GVCs and global trade as it has directly affected the firms operating in both countries and the companies relying on suppliers from these markets (Ruta, 2022). In addition, the recovery of growth after the COVID-19 pandemic has been called into doubt (Orhan, 2022).

1.3 Research question

There are many uncertainties in the world presently. Terrorism, cyber security, financial crisis, local and regional conflicts and a pandemic are growing geopolitical hazards with low probability and high effects. These developing dangers frequently lack the forecasting data that would predict them to any degree. They are also substantial enough in terms of the harm they cause to set off other risks or crises later in the timeframe. Furthermore, their origin, evolution, and eventual magnitude and shape are usually unclear, resulting in a developing collection of dangers that must be addressed lately (Smith and Fischbacher, 2009).

From the international business perspective, it is urgent to investigate the impact of these past events to develop diverse coping approaches for dealing with other potential future crises. Considering the above, this research aims to assess the influence of recent geopolitical disruptive events on the GVC in the context of the global agricultural market.

The thesis intends to investigate the following research problem:

"What are the effects from geopolitical disruptive events on AGVC in the case of Ukraine?"

As we study the research problem, we decided to use the context of Ukrainian agricultural sector and its participation in the agricultural GVC (AGVC). The specific major geopolitical disruptive event is the military conflict ignited by Russia in Ukraine.

To answer this research problem, this thesis attempts to answer the following research questions:

1. What major political crises have influenced the GVCs?
2. How were the GVCs affected by these disruptive events?
3. Why geopolitical disruptive events are a crucial risk factor for AGVCs?
4. What were the main challenges faced by Ukrainian farmers in AGVC during the military aggression of Russia?

The four research questions mentioned above aim to provide a step-by-step investigation and answer to the overall research problem. The research authors acknowledge that there are certain time limitations for the project. Thus, the study cannot investigate all disruptive events during the last 15 years, so it focuses on the most prominent events.

1.4 Methodology

The eclectic methodology was used for the preparation of this study. The general method is qualitative, with interviews used to demonstrate the applicability of the theoretical framework developed in the appropriate chapter. The study is built by drawing on four primary sources of qualitative and quantitative data to achieve triangulation:

- *Original policy papers* at the national and regional levels and official reports on policies that have been implemented are used in this research. The majority of the materials studied are available on government websites.
- *Press reports on essential data*. Primo AAU, an online database that provides diverse press sources, including specialised periodicals focusing on the agricultural sector, was extensively used for this research. The database may be accessed via the Aalborg University Library.
- *Semi-structured interviews* with policymakers, business people and other experts.
- *Statistical data* was gathered through the internet and archival research.

During the construction of this research, the objective is to construct the a priori framework using empirical knowledge and current data to support the reasoning behind markets reaction to different disruptions across the time. During the discussion, the researchers will build an a posteriori framework as well from empirical experience and knowledge from the interviews. These interviews have been purposely designed to gather information about the consequences and the current effects of the disruptive event not only at a local level, specifically in Ukraine, but its effects worldwide.

1.5 Contribution

Through 2020 and 2021, the pandemic spread globally, putting tremendous pressure on the current supply chain operations worldwide and questioning the readiness of the GVC to the future possible disruptions that will have a similar impact as a pandemic, given more simple and affordable globalisation (Alirol et al., 2011). Moreover, ongoing geopolitical tensions, climate changes and upcoming financial crises are already known challenges that increase the likelihood of future GVC disruptions (Pimentel et al., 2010; Huff et al., 2015; Politico, 2023). Thus, this research will contribute with an understanding what lessons can be learned from the disruption of the Ukrainian AGVC, and how can these inform future agricultural policies and practices in Ukraine and other countries facing similar challenges.

1.6 Structure

Our research paper is structured as follows: the introduction, problem formulation, which consists of the research questions, and the research objectives and goals are covered in the first chapter. The literature review and theoretical background are presented in the second chapter. The data collect and methodology chapter that follows discusses data collection methods, research designs, data analysis procedures, and the validity of our study. This is followed by data analysis, and the results are provided along with the conceptual framework we developed using the findings. The results are reflected upon, compared to previous studies, and contributions are presented in the discussion chapter. The research paper's conclusions and limitations are discussed in the last chapter.

2. LITERATURE REVIEW

Several significant components of this study may be found in the academic literature. This study's literature evaluation and research questions are framed by multiple disciplines, including GVC, its risks and disruptions, the implications of supply chain disruptions, and agri-food product supply chain disruptions. Following that, the gaps in the literature are identified, particularly the fact that there is limited to no study focused on the influence of the following:

1) Impact of the Global Financial Crises on the GVC
2) Impact of COVID-19
3) Impact of the sanctions on the agri-food supply chains
4) Impact of the geopolitical conflict on the global food supply chain.

2.1 Global Value Chain

Things began to evolve in the 1970s and 1980s when pioneering retailers began to global source their products. China's movement toward market capitalism, and India's decision to undertake market reforms and enter the global trading system, the global economy encompassed roughly half of the world's population in the advanced OECD countries, Latin America and the Caribbean, Africa, and some parts of Asia. Then, in the 1990s, after the Soviet Union collapsed, China, India, and the ex-Soviet bloc almost all at once joined the global economy. The entire world came together in a single economic world based on capitalism and markets. Global trade has increased, and the global economy has welcomed many new exporting nations (Freeman, 2014).

Along with this increase, two significant structural changes have occurred. The growth of supply-chain trade is the first. At the end of the 20th and the beginning of the 21st centuries, production became more fragmented, and while international trade in finished goods decreased, the movement of parts grew. Second, there has been an increase in outsourcing because of the migration of production to developing economies (Humphrey et al., 2019).

While these changes have made it increasingly regular for value to be added in two or more companies across national borders before being used in products and services-producing industries, the global economy was undergoing more profound shifts. The revolution in information and communication technology has raised productivity dramatically and redefined the role of time and space. With "one click," billions of operations are linked, and new requests are met with "just-in-time" delivery. The globe became increasingly linked (Gereffi, G. and Luo, X., 2015). Digitalising different

operational processes, such as design, manufacturing and management of information flow and low-cost data communications, enabled high levels of monitoring and control. It has also enabled more precise logistics coordination and the transfer of highly complex design parameters, requirements, and instructions within this new, spatially and organizationally fragmented system. As a result, distance is no longer an impediment to segmenting and relocating corporate processes, and the trading system has become globalised, more dynamic, adaptable, responsive, and complicated (Sturgeon, 2013).

Globalisation can be defined as "the functional integration of internationally dispersed activities". *Economic globalisation* combines the traditional drivers of internationalisation (arms-length trade and intra-firm trade related to FDI) with international or global sourcing that requires high levels of explicit coordination that differentiate it from arms-length trade (Gereffi et al., 2005; Sturgeon, 2013). Globalisation itself also motivates companies to restructure their operations abroad through outsourcing and offshore activities. In a globalised world with decreased transportation and transaction costs, connectivity among enterprises or sectors linked by supply networks or financial links multiplies and intensifies, creating a global value chain (GVC) (Gereffi, G. and Luo, X., 2015). While various manufacturing process phases are spread over multiple countries, GVC significantly pushes international production, commerce, and investment.

The concept of GVC emerged from its closest "ancestor" – the "global commodity chain" concept, which was established by Hopkins and Wallerstein (1977, 1986). The scholars discussed the state's role in influencing global production systems, primarily through tariffs and local requirements applied when items cross international boundaries (Sturgeon, 2008). In 1994 this concept was reviewed by Gereffi. In part due to the states' limited authority to set tariffs and laws in the context of international trade, he refocused it on the plans and actions of businesses. The expansion of international trade has been made possible by liberalisation. However, if it were not for the push from advanced economy companies looking to access the markets and capabilities of developing nations, the international flow of goods and services would undoubtedly be less significant than they are now. Companies from developed countries continue to influence many essential resources in the global market, even those they do not own, due to their extensive efforts to develop capabilities in developing nations (Sturgeon, 2008). Gereffi's idea encapsulated the diversity in how businesses set up their inter-border manufacturing relationships. In particular, the revived GCC concept significantly differentiated amongst global chains "led" by buyers and producers, two different types of lead firms. Researchers and practitioners alike quickly embraced the change in emphasis from the government to the players in the chain and their interactions since it mirrored and provided an explanation for some of the most

innovative aspects of the international economy (Sturgeon, 2008). As researchers continued their analysis, they noticed that the global manufacturing structure shifted in favour of external networks. Producer-driven networks were being hit by an outsourcing wave, which caused "manufacturers" to act more like buyers. The goal of de-verticalization was to maximise shareholder value by moving risk and fixed assets (like production facilities) to suppliers (Gereffi, 1999). Further, scholars decided to use the term "value" instead of "commodity" because it better encapsulated the idea of "value added', forming the new concept of a "Global value chain" (Sturgeon, 2008).

The emergence of GVCs is acknowledged as one of the world economy's significant development trends (Abramova and Garanina, 2018). According to OECD (2013), the global economy was growing increasingly complicated as it primarily comprised GVCs. According to Antras (2020), GVCs are networks of businesses that share similar objectives, like lowering production costs or increasing revenues related to the supply chain. The manufacturing of a particular good began to be distributed throughout a network of interconnected geographical areas (OECD, 2013). Sturgeon (2001) defines GVC as a method for adding value when creating a final product, which may include multiple technological stages of manufacturing, design, and marketing. Antras (2020) also highlights that while using GVCs, companies can move resources between sectors and nations and between different production stages within a single sector.

Koopman et al. (2010) defined GVC participation as the source of value-added included in exports, looking both backwards and forward from the perspective of a reference nation (Le and Bach, 2022). Gereffi (2014) stated that GVCs were labelled "the world economy's backbone and central nervous system". The author stated that GVC grew more consolidated organizationally and geographically as lead firms reduced their supply chains to include a significantly smaller number of larger and more capable suppliers in several key emerging economies. This statement consolidates with the internalisation theory, according to which economic players choose and keep the most effective governance structures to conduct an economic transaction (Verbeke, 2013; Kano, 2018). In the context of a GVC, this implies that, over time, lead company management and their strategic partners will make strategic decisions that result in the most efficient, cost-effective combination of internal and external contracts and locations. The alignment of governance choices with transaction attributes results in efficiency (Kano, 2018), such as micro-level attributes, including individual characteristics of decision makers involved, as well as macro-level attributes, including technological, institutional, geographic, and cultural characteristics of relevant environments and industry features (Kano et al., 2022).

While these changes have made adding value in two or more nations increasingly regular before being used in products and services-producing industries, the global economy is undergoing more profound shifts. The computerisation of design and manufacturing processes, low-cost data communications, and improved software to manage the flow of information both within and between firms enable high levels of monitoring and control, more precise logistics coordination, and the transfer of highly complex design parameters, requirements, and instructions within this new, spatially and organizationally fragmented system. As a result, distance is no longer an impediment to segmenting and relocating corporate processes, and the global trading system has become more dynamic, adaptable, responsive, and complicated (Sturgeon, 2013).

According to Gereffi and Sturgeon (2013), GVCs are usually comprised of two types of firms: 1) "lead firms" (regularly represented by TNCs) located in advanced industrial countries control and define the main activities in terms of price, delivery, and performance in both producer-driven and buyer-driven GVCs and 2) supplier companies, generally located in developing countries and produces goods and services. As a result, the GVC connects both developed and developing countries (Gereffi and Luo, 2015).

Unlike traditional MNEs with equity relationships between headquarters and international affiliates, global buyers have non-equity ties with their suppliers, which are considerably harder to discern in official statistics. Intermediaries (e.g., trading companies) are frequently used to connect buyers with producers in multiple countries, further complicating and expanding production networks. Non-equity ties, on the other hand, are frequently accompanied by design specifications and standards for quality, input sourcing, and logistics that are as thorough and demanding, if not more so, than those imposed by MNEs on their foreign affiliates (Sturgeon, 2013).

Although the efficiency gained from GVCs is widely documented, concerns have been raised regarding whether the benefits of deepening and increasing international specialisation in GVCs exceed the risks and instability that come with it. The dangers linked to GVCs were recently re-apparent in the early stages of the pandemic when the public health crisis in China resulted in lockdowns. Most global manufacturers are present in China, and many businesses have experienced production and trade interruptions due to this significant GVC disruption.

2.1.1 Risks affecting GVC

Massive restructuring and reconfiguration of the global economic system took place in recent years (Petricevic and Teece, 2019), with various interconnected macro-level dynamics influencing

GVC governance. Scholars in their recent GVC studies have identified these forces as geopolitical tensions, renewed protectionism, rising costs of doing business in emerging markets (i.e., rising labour and transportation costs, compliance costs), increased pressure for social and environmental regulation compliance, digitalisation and automation (Kano, 2018; Kano et al., 2020). These changes, taken together, have generated significant dangers for GVCs, whose very existence has been permitted by the liberalisation and deregulation of international commerce (Kano et al., 2022).

The roots of studying the risks affecting the international supply and value chains are deep. Back in 1987, Ghoshal described the main categories of risks that MNEs might face:

- *Macroeconomic risk.* This category includes certain risks beyond the MNE's control, for example, cataclysmic events such as wars, natural disasters or changes in wage rates, interest rates, currency rates, and commodity prices.
- *Political or policy risks.* This category of risks arises from national governments' policy decisions. Sometimes policy risks can be compared with macroeconomic risks due to similar outcomes like increased wages or interest rates. Still, policy risks can be foreseen and thus can be controlled.
- *Competitive risk.* This category of risks is associated with uncertainties regarding competitor activities. This category also includes new technology risk, as new technology can only be risky to a company if a competitor adopts it.
- *Resource risks.* This category relates to the possible difference in available resources and resources needed for the adopted business strategy.

Furthermore, Manuj et al. (2008) have identified four additional risk categories:

- *Supply risk.* The distribution of outcomes connected to wicked occurrences in incoming supply impairs the focal firm's capacity to satisfy customer demand (in quantity and quality) within projected prices and time or poses hazards to customer life and safety, referred to as supply risk.
- *Demand risk.* The distribution of outcomes connected to wicked occurrences in outward flows that impact the chance of consumers placing orders with the focal company and variance in the volume and assortment required by the client is referred to as demand risk.
- *Operational risk.* The distribution of outcomes connected to unfavourable occurrences within the business that influence a firm's internal ability to provide goods and services, quality and timeliness of production, and profitability is called operations risk.

- *Security risk.* Distribution of outcomes associated with wicked occurrences that endanger human resources, operational integrity, and information systems and can result in freight breaches, stolen data or proprietary knowledge, vandalism, criminality, and sabotage is called security risk.

GVC risks can take numerous forms (for example, trade or productivity shocks), arise in various geographic regions, and be either particular to certain value chains or general. They can either be independent of one another (in the case of natural disasters like earthquakes or floods) or associated with one another (as can be the case with, e.g., infectious disease pandemics). Supply shocks can either be negative or positive. In the case of adverse shocks, access to intermediate inputs is limited or disrupted. In contrast, positive shocks can be caused by improvements in trade costs, favourable productivity or harvest shocks, or industrial inventions (Gereffi and Luo 2015). Businesses and countries engaging in GVCs may be vulnerable to adverse shocks at any time, but they are also prepared to profit from the emergence of positive shocks. (OECD, 2020) Shocks in one area can quickly move throughout the network, causing cascade consequences. One industry's low productivity might harm the entire economy if the supply network is firmly integrated, as downstream industries would suffer (Acemoglu et al., 2010).

In recent decades, especially after the latest development of globalisation, businesses have adapted to different risks. However, recent critical events have created for economic society new challenges. The next section of the study will assess the most challenging critical events (crises) that occurred during the last 15 years and their impact on the GVC.

2.1.2 Past disruptions in GVC

Earthquakes, tsunamis, nuclear disasters, and global financial meltdowns are examples of common global crises and disruptions. Growth in foreign trade and GVCs has slowed down dramatically since the global financial crisis (Antras, 2020). After years of recovery and slow development, the recent political pushback against globalisation, culminating in Brexit and the US-China trade war, has exacerbated this retreat from global economic integration, dubbed 'slowbalisation' (The Economist, 2019; Irwin, 2020). In addition, Covid-19 hit the global economy at a critical juncture. The pandemic gave a bigger, more powerful, and extended shock to the current GVC economy and heightened knowledge that future crises are unpredictable yet unavoidable (Eppinger, 2021; Kano et

al., 2022). Thus, it took not long from one significant critical event to another: at the end of February 2022, the Russian Federation invaded Ukraine, putting GVC in different economic sectors at stake.

The following parts of this chapter will review the most significant critical events in a globalised economic world and their effects on a GVC.

Sanctions

Sanctions were a powerful tool of coercive international diplomacy to disrupt military plans or actions, especially in the pre-World War II era. After World War II, sanctions were increasingly used for diplomatic pressure and coercion (Doornich and Raspotnik, 2020). Sanctions can be defined as "actions or threats made by sanctioning nations or international organisations (the senders) to penalise, restrain, or, more broadly, affect the conduct of sanctioned governments, private entities, and strong elites (the targets)" according to Felbermayr et al. (2020). Sanctions are actions or specific intervention techniques based on coercive measures (threats) imposed by one country, also known as a sanctioning state (e.g., the United States), a coalition of countries (e.g., the European Union), or international organisations (e.g., the United Nations) (the sender) to punish, constrain, or change a specific policy or behaviour of the sanctioned party (the target) (Folch, 2010). Sanctions are often used as an extreme tactic of foreign economic policy to achieve particular political objectives (Filipenko et al., 2020). The reasons for imposing sanctions can be internal activities of the targeted country (violation of human rights, weakening of democracy or other) and external activities (military campaigns and illegal annexations of foreign lands) (Doornich and Raspotnik, 2020). Sanctions have tackled many policy challenges since their beginnings, including nuclear proliferation, extremism, democracy promotion and others. At the same time, restrictions included multiple areas, such as aid withdrawal (both military and economic), suspension of diplomatic relations, travel restrictions, trade and finance limitations, and others (Le and Bach, 2022). According to Drezner (2011), traditional sanctions have a substantial humanitarian impact as they were believed to be causing economic harm to innocent persons.

With further world economic growth, the highly linked international environment is fuelled by increased interdependence among nations on different matters, including financial reserves, FDI and trade inflows (IMF, 2009; Filipenko et al., 2020). As a result, domestic economies became more vulnerable to unfavourable macroeconomic policies, such as an FDI reduction or aid decrease. Consequently, countries, particularly those in the developing world, become more susceptible to an increasingly interconnected economy (OECD, 2013). In the 1990s, caused by globalisation development, the UN instituted targeted or smart sanctions, which have mainly been employed to

punish the targeted regime's elite supporters or a particular sector of the economy while reducing the economic impact on the general populace or overall economy (Biersteker et al., 2016; Sun et al., 2022).

As a part of targeted sanctions, economic sanctions were described by Doornich and Raspotnik (2020) as coercive tools used to influence another country's policies and regimes by limiting international trade. Filipenko et al. (2020) state that economic sanctions are essential to international economic policy. Economic sanctions usually take the form of assistance withdrawal; trade restrictions (i.e., partial or total embargoes); financial or economic blockades (i.e., asset freezes, capital flow decrease); travel bans (visa restrictions) and others (Gordon, 2011). The international sanctions system also includes transportation restrictions (i.e., restrictions on aircraft landing and transit flights; the limitation or suspension of rail, sea or other transit), which also significantly impact the targeted country's economy (Filipenko et al., 2020). Though economic sanctions forms vary, they always aim to impose economic constraints on the targeted country, with trade and investment or financial charges being two significant choices. (Le and Bach, 2022)

Economic sanctions effect on GVC

Some scholars argue that targeted and economic sanctions do not consistently achieve their initial goal of improving conditions inside the sanctioned country (Pape, 1997; Biersteker et al., 2016, Pala, 2021). At the same time, economic sanctions can significantly impact the country's economic development and its involvement in GVC (Filipenko et al., 2020). The sophistication of international contracting for specialised products and investment distinguishes GVC from regular trade (Fernandes et al., 2020). In contractual agreements, poor institutions would pose concerns of knowledge asymmetry, resulting in behavioural and environmental uncertainty. As a result, transaction costs will rise, discouraging trade and inward FDI flows in the target country (Blyde, 2014; Dollar et al., 2016). The target country's adverse economic, political, and institutional climate may negatively influence GVC involvement when combined with the existing economic sanctions. In the face of global sanctions, such a market can be seen by sender traders and investors as neither profitable nor appealing enough to take risks and incur expenditures to retain business contacts with the target market. In other words, the target country's institutional restrictions may amplify the negative impact of global sanctions on the target's GVC values (Le and Bach, 2022).

Economic sanctions' effects on GVCs can be explained directly or indirectly by their effects on factor endowments and FDI flows. Economic sanctions seek to disrupt trade links between the sender and the target state by imposing commercial or financial sanctions on certain persons or companies

(Hufbauer et al., 2007). Therefore, economic sanctions raise the costs and risks of business with enterprises in the targeted country. Consequently, some economic actors can become driven away from conducting business there. As a result, removing the targeted state from some GVCs is unavoidable. Economic sanctions imposed on a company or industry may discourage its supply chain partners from entering overseas markets. Non-sanctioned enterprises that rely substantially on upstream or downstream partners in international activities may suffer a significant setback if their partners face economic penalties (Sun et al., 2022).

Furthermore, according to Sun et al. (2022), economic sanctions may inhibit the technical equipment import, reducing potential advantages such as lower production costs and efficiency improvements that may have benefited non-sanctioned supply chain participants. In the case of imposing economic sanctions on the whole sector of the economy, Ahn and Ludema (2020) argued that foreign businesses and investors can decide not to create additional problems for themselves with the sanctions compliance rules but rather avoid working with sanctioned economic sectors. This implies that the entire industry may be tainted by the implications of sanctions.

Sanctions and instabilities in targeted nations can also be seen as indicators that these nations are becoming isolated by the global economy. Foreign investors may lose trust in the target countries' performance. Increased uncertainty and investor scepticism can result in further withdrawal of FDI from sanctioned governments (Janeba, 2002; Le and Bach, 2022). Furthermore, as knowledge may be a crucial production input (Nonaka, 1994), travel restrictions may impede the movement of professionals and those seeking further education overseas; they will further limit knowledge integration and transfer, hence the contribution of human capital to GVC participation (Le et al., 2021). Other sanctions can restrict the role of factor endowments to GVC participation in different ways. As trade openness reflects a more linked economy, it also images possible high GVC involvement (Balié et al., 2019). Thus, to a certain extent, trading restrictions and embargoes will isolate the sanctioned country from the global economy and chains (Pala, 2021). Financial sanctions restrict the availability of financial services (e.g., trade finance) or access to financial markets, funds, and economic resources, reducing capital mobility and use. As a result, the economic sanctions affect international commercial transactions making them less appealing (Le et al., 2021).

However, as a result of the economic sanctions imposition, not only the targeted nation but also the imposer can be exposed to the economic consequences, which include external economic shock, banking crisis (Hatipoglu and Peksen, 2018), currency crisis (Peksen and Son 2015), increased uncertainty (Walentek et al., 2021) or business risks (McDowell, 2020). As a result, the businesses of

sending countries can lose competitive advantages and credibility in the target nations, making it harder to recover with new commercial and investment relationships after the limitations are eliminated (Farmer, 2000; Lektzian and Biglaiser, 2013). Sanctions have transformative repercussions (owing to changes in regulation and trade flow redirection) and increased transaction costs (due to the development of formal and informal trade barriers), mainly for the target nation but also for the sanction initiator and other countries (Filipenko et al., 2020). However, according to Barry and Kleinberg (2015), if the rewards from doing business with enterprises in the targeted nation are high, but the secondary risks and penalties are minimal, the business activities can continue directly, regardless of the sanctions, or indirectly, through relocation of trade and investments to third-party nations (indirect access provider to the sanctioned economy). In such circumstances, sanctions' application does not always imply a decline in economic activity, therefore, the level of GVC involvement (Le et al., 2021). To tackle these loopholes, another prominent modern penalty was established - secondary penalties, which target third-party acts (Le and Bach, 2022).

Establishing and expanding GVC connections is critical for the country's long-term economic growth. Given the complexities of GVC construction, international economic sanctions can have detrimental effects on GVC values that are hard to overcome in the future (Le et al., 2021|).

Examples of the imposed sanctions and their effect on the economies and GVC development

Case of Cuba

The USA imposed different sanctions on Cuba more than a half-century ago (Gordon, 2015). Over the years, these restrictions included:

- Logistics embargo (ships are not allowed to dock in the United States within six months after making a stop in Cuba), prevention of US MNEs' international subsidiaries from international activities, incl. trade with Cuba;
- Enforcement of bans and fines on other countries for conducting commerce with Cuba, even if no US corporation was engaged in it;
- Prohibition of conducting bank transactions in the USD;
- The embargo on the export of various products and services from Cuba;
- Constraints on third-country manufacturers who use Cuban raw materials in production;
- Blockage of access to financial institutions like IFC and World Bank.

After the collapse of the USSR, more than 3/4 of Cuba's foreign trade was lost, leading to a significant drop in its economy (Ritter, 2010). These measures have additionally substantially damaged Cuba's economic, infrastructural, and social spheres and created almost impossible conditions for cooperation between Cuban and international companies. MNEs like Bayer AG and Siemens, which were conducting M&A on the US market, were forced to stop trade with Cuba (Hidalgo and Martinez, 2000). In fear of a lawsuit from the US side, companies like Cemex and Redpath stepped out of the joint ventures in Cuba (Gordon, 2015). Restrictions from using USD and logistics limitations made shipments to Cuba commercially unprofitable for logistic companies and international businesses. There are pieces of evidence of companies cancelling their shipment of food products due to these restrictions (Hidalgo and Martinez, 2000).

Cuba's involvement in the GVC had been considerably influenced by the trade and political limitations placed on it by the USA. While one of the biggest nickel producers, Cuba is partially restricted from exporting its nickel for further stainless-steel production in other countries. In addition to being unable to export raw resources like coffee, tobacco, and seafood to the US, Cuba is also restricted in its capacity to sell sugar, one of the leading exporting raw products, to international businesses that can use it as an input for the production of other food products and ship them over the world, including the US (Gordon, 2015).

The effect of the embargo on the economy of Cuba is difficult to quantify since the country has severe issues apart from the embargo itself (Ritter, 2010). Being partially cut from the GVC, the country's economy is also exposed to weak diversification and low production efficiency (Gordon, 2015). Its primary exporting items are more financially expensive and challenging to find clients for. The situation is worsened by extraterritorial prohibitions that prevent international enterprises from exporting any items created with Cuban components to the US. Cuba essentially loses access not only to the US market. The country also loses the markets of operations of any other enterprises worldwide that export products to the USA.

Case of Iran

The United States led the international community in imposing economic sanctions on Iran to change that country's government's support for international terrorism, poor human rights record, weapons and missile development and acquisition, role in regional instability, and nuclear program development (Rennack, 2018). After the 1979 Iranian Revolution, the United States imposed many

sanctions on Iran. These sanctions have significantly impacted Iran's economy, leading to the national currency's depreciation and higher inflation (Katzman, 2014).

Overall, Iran has a great level of attention from the United States. As Iran holds a position as the world's top oil producer, it also influences global energy prices, impacting the Gulf region's political situation. In addition, Iran can control the Strait of Hormuz. Thus, it can cause the blockage of tanker traffic, possibly creating supply shortages of over a fourth part of the world's oil supply, which can lead to a global energy crisis. Under these circumstances, relations between US and Iran are a political and economic indicator in the region (Filipenko et al., 2020).

Based on World Bank (2020) and International Monetary Fund (2020a and b) figures, Filipenko et al. (2020) concluded that sanctions imposed on Iran caused an increase in the instability of the Iranian economy. Furthermore, it resulted in a decline of the following indicators: Iran's exports and imports number, FDI inflows, economic investment, and oil rent. In addition, sanctions imposition caused a rise in regional oil price volatility, which provoked turbulence in Middle Eastern oil exporting nations and changes in Iran's economic development rate.

Thus, it can be concluded that the imposed sanctions limited the access of Iranian resources to numerous international markets. Although the limitations in receiving international investments partially slowed down Iran's access to GVC, they did not completely stop the country's participation in them.

The case of Russia (before the critical events of 2022)

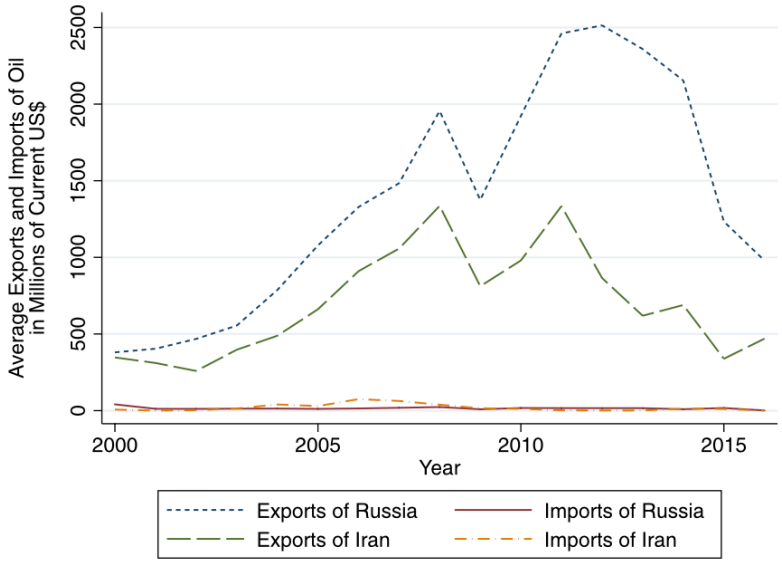
Following Crimea's illegal annexation and support of the destabilisation of the situation in the East of Ukraine, in 2014, the US and the EU imposed sanctions on Russia (Doornich and Raspotnik, 2020). These restrictions included diplomatic measures, visa bans, the freeze of assets for concrete individuals and businesses, limitations on economic ties with Crimea, financial markets access constraints and a prohibition on provision to Russian military and energy sectors companies of specific technologies (Abramova and Garanina, 2018).

As a result of the imposition of sanctions, scholars identified their economic impact on Russia. Net private investment withdrawals totalled 152 bln USD in 2014 (Li and Li, 2022). In 2015 IMF predicted that sanctions could cause less than 1,5% of Russia's short-term GDP to fall, which can be compounded to 9% in the medium term. Due to Western sanctions, Russia also lost 53 bln USD in foreign trade (Crozet and Hinz, 2020). Some experts considered such sanctions significant challenges for the further growth of Russia–EU economic ties (Romanova, 2016). However, the sanctions caused

considerable changes in the sector's value chains. Several Western firms have cancelled plans to collaborate with Russian MNEs on developing projects affected by technology restrictions.

In contrast, some other multinational corporations boosted their presence in Russia in business divisions unaffected by the sanctions (Abramova and Garanina, 2018). Despite sanctions limiting Russia's ability to import from other Western economies, exports from Israel and Switzerland to Russia also decreased (Le et al., 2022). According to the authors, the interdependence in GVCs resulted in losing Israel and Switzerland's trade values. Consequently, sanctions had spill over effects, which impaired the GVCs of both sanctioned and non-sanctioned items. One of the most notable effects of sanctions on the oil and gas industry has been Russia's diversification toward Asian markets, with the deal on gas supplies to China achieved in 2014. However, it refers to chain diversification instead of chain upgrading, which refers to moving up to another chain (Abramova and Garanina, 2018).

Figure 1. Russia's and Iran's oil imports and exports from 2000 to 2016



Source: Larch et al., 2022

Global financial crisis

Financial turmoil was firstly visible in 2007 when property values began to fall in the US. However, only a few analysts projected it would lead to a worldwide crash (Lin and Martin, 2010; Verick et al., 2022). Following the fall of Lehman Brothers in 2008 and the subsequent credit crunch, the United States' financial crisis took on global proportions, transferring to the real economy and sending shockwaves worldwide (Verick et al., 2022).

The global financial crisis of 2009 was the first time the world economy shrunk since World War II, a dramatic contrast to the boom years of 2002-2007. Global commerce declined by 11% that year (Baldwin, 2009), significantly outweighing the drop in output. During the crisis, goods output, commerce, and consumption, particularly industrial products, decreased more than services. The collapse of housing bubbles severely impacted the construction sector and the financial crisis, resulting in significant employment losses, particularly among low-skilled and young employees (Verick et al., 2022).

The global financial crisis was triggered by several issues, which include an increase in risk-taking (specifically, subprime crediting in the USA and its following packaging in collateralised debt obligations disguised as assets with low risk but high quality), inadequate financial regulation, monetary easing, and the breakdown of real estate markets in a variety of places worldwide (Chowdhury et al., 2018).

The response of the policymakers to the developing global financial meltdown was the introduction of various countercyclical macroeconomic tools. These tools included cuts in interest rates so that regular citizens and businesses were encouraged to borrow and invest; officials also injected money into the financial system and provided fiscal stimulus packages to boost demand (Verick and Islam, 2010). In 2009, stimulus in the G20 group of countries totalled around 692 bln USD, or approximately 1.4% of their combined GDP (Prasad and Sorkin, 2009).

Even though the crisis was called "global", it had varying effects on economies and labour markets worldwide. Even though worldwide unemployment fell gradually after the global financial crisis, it did not recover to 5,3% within a decade (Verick et al., 2022). In addition, the crisis had a higher impact on advanced economies in 2009, which saw a 3.3% fall in GDP compared to a 2.8% increase in emerging market economies and underdeveloped nations. Developing countries (as opposed to emerging market economies) experienced a growth slowdown in 2009 but maintained a relatively robust growth rate of 5.1% on average. This indicated that developing economies were not profoundly integrated into the global economy. Thus, they were less affected by trade and credit shocks. Emerging economies, particularly China and India, resumed robust economic development in 2010, generating strong demand for commodities worldwide, which helped exporters, particularly emerging nations, in the following years (Verick et al., 2022).

Effects on GVC

The crisis of 2008-09 exposed faulty lines in export oriented GVCs after their expansion from the mid-1960s to the mid-2000s (Gereffi, 2014). The global economic recession intensified the "rationalisation" that occurred intending to lower supply chains' size. As consumption fell in most advanced industrial nations, which were the primary consumers of GVCs, the scale of GVC supply chains shrank dramatically due to the crisis (Gereffi and Luo, 2015).

Production losses lingered after the crisis, while investment and total factor productivity in several economies remained below pre-crisis levels (Chen et al., 2019). In 2009, job losses were caused by a demand shock and subsequent drop in output, which was prompted by a financial crisis and subsequent credit constraints (Verick et al., 2022).

The 2008-2009 financial crisis revealed specific correlations between trade ties and economic cycle synchronisation between paired nations. According to the 2008-2009 financial crisis study, the business cycle during the economic downturn was remarkably coordinated and quickly spread all over Europe over a month (Levchenko et al., 2010; Chor et al., 2012; Bems et al., 2013). Similarly, Abiad et al. (2013) discovered that trade links had no significant association with the synchronisation of the economic slide during the 2008-2009 economic crisis. Meanwhile, Busl and Kappler (2013) observed that trade links shrank Business Cycle Synchronization.

The global financial crisis caused a global recession (-0.1% GDP growth rate in 2009) but did not result in negative economic growth in most low- and middle-income nations. Overall, GDP growth was negative in 92 countries in 2009, as at the beginning of the 21st century, the global economy was growing and developing, so not the whole world was. The world's countries were not fully immersed in the globalised world economy but only indirectly participated in the GVC (Verick et al., 2022).

In general, the global financial crisis caused a delay in the development of the global economy due to the lack of an adequate amount of unrestricted funds. Also, the lack of sufficient financing caused a partial shock in the supply of products, especially in countries with closer economic ties with developed countries.

COVID-19 pandemic

Because of the evolving nature of the pandemic, COVID-19 has created serious shock waves for the economy and the political and social spheres of our life (Verick et al., 2022). In contrast to previous epidemics or economic shocks, during the latest pandemic, labour supply, travel, transportation, and trade were all impacted in a new and unexpected way as governments of almost all

world countries installed restrictions aimed at slowing the spread of the virus. These limitations included: border closures, curfews, lockdowns, social distancing, and the closure of many retail and leisure businesses. Introduced measures had a significant impact on people's day-to-day life and drastically limited economic activity (Verick et al., 2022). Thus, the crisis has simultaneously struck many major global economic centres (Smietanka et al., 2020). According to the authors, introducing pandemic restrictions in China has led to a dramatic decrease in imports and exports. This, in turn, caused a drop in volumes of world foreign trade.

According to Kano et al. (2022), the pandemic has introduced new governance challenges that can be classified as follows: information asymmetries (continued ambiguity about the global health situation, uncertainty about trade and travel restrictions); commitment problems (supply limitations, restrictive government practices, increasing institutional frailty); and corresponding value - creating problems (reduced access to international resources, lack of labour, trade interruptions, problems with addressing changes in demand)(Kano et al., 2022). The economic components of the COVID-19 crisis were caused by a simultaneous demand and supply shock, which seriously affected economies and job markets (Verick et al., 2022). On the one side, travel and transit restrictions and business closures resulted in abrupt and severe supply bottlenecks. The COVID-19 pandemic has demonstrated that suppliers may be inertial and path-dependent in their response to the crisis, owing to a lack of technological capabilities and orchestration know-how required to deal with unforeseen interruptions (Kano et al., 2022). Conversely, global demand patterns evolved, partly amplifying supply-side shocks (Strange, 2020). Non-essential consumer items and services needing in-person interaction declined, but demand for necessities such as food and cleaning supplies increased considerably (Gereffi, 2020).

The lockdowns and other containment measures hit many economic sectors, especially the service sector, stronger than the global financial crisis. As it was known, the Global financial crisis led to more considerable losses in production industries and some losses in construction (Verick et al., 2022). The global COVID-19 pandemic has caused significant supply shortages and demand swings. From medical supplies to food products and transportation and service sectors to essential intermediate goods, these have impacted practically every industry worldwide.

The worldwide impact of the coronavirus outbreak has been disastrous. The virus caused several chain events, including increased unemployment, a drop in commodity prices, a collapse in stock markets and other consequences (Su et al., 2021). Still, the pandemic's effect on the global economy was previously unseen (Yu et al., 2022).

Effects of the COVID-19 pandemic

According to different researchers, three main channels of disruption were identified during the covid-19 pandemic: a demand shock caused by lockdowns and stalled economic activity, a supply shock emanating from temporary or permanent disruptions in supply networks, and a global value chain contagion simultaneously affecting multiple locations, marked by a high level of interconnectedness of the global economy that amplifies the impact, especially on global hubs (Baldwin and Freeman, 2020; Baldwin and Toimura, 2020).

Implementing restrictive measures and lockdowns resulted in a severe drop in both consumption and investment demand on the one side and supply of goods and services on the other. Supply shock caused by the lockdown stopped firms from functioning. Most damaged were industries that require people-to-people operations. As a result, demand for products and services produced by other industries decreased (through forwarding and backward linkages) (Verick et al., 2022). Global supply chain disruptions also impacted supply in a variety of industries. Restrictions on the demand side drastically reduced consumption of numerous products and services, particularly at restaurants, leisure, shops and others. Job and income losses exacerbated the demand shock, further dampening consumption. Finally, a substantial level of ambiguity was expected to have a severe effect on investments and consumption (Altig et al., 2020).

Although the efficiency gains from GVCs are widely documented, concerns have been raised regarding whether the benefits of deepening and increasing international specialisation in GVCs exceed the risks and instability that come with it (Buckley, 2009). The dangers linked to GVCs were first apparent in the early stages of the pandemic when the public health crisis in China resulted in lockdowns. Most global manufacturers have a presence in China, and many businesses have experienced production and trade interruptions as all manufacturing facilities except critical ones were closed by governmental restrictions (Kano et al., 2022). For instance, it led to dramatic shortages of medicines and personal protective equipment worldwide (Raza et al., 2021). Disruptions in the supply chains and shortages of crucial medical products emphasised the interconnectivity of countries through GVCs. On the other hand, the global scarcity of medical devices was caused by an exceptional demand shock (Kano et al., 2022).

Another prominent example was Bangladesh, where numerous clothing factories were shuttered upon further notification as retail companies (such as Gap, Zara, and Primark) terminated or stopped orders and ceased placing new ones to avoid further losses from the decline in sales. Labour

organisations and local institutions required corporations to preserve some of their investment in these production facilities and follow tight safety measures once the work was restored (Kano et al., 2022).

According to Kano et al. (2022), supply dependence and disruptions reignited the debate about the costs and advantages of globalisation. Recent debates have focused on the dangers and instability that come with the worldwide fragmentation of the industry. Scholars also foresee a systemic and fundamental transformation in how GVCs are constituted regarding ownership and location strategies chosen by leading MNEs. The study suggests that GVCs will have a smaller geographical footprint, reshore more operations, and rely less on outsourcing.

The pandemic is an undoubtedly significant and worldwide-spread shock. However, the critical advantage of a GVC over a vertically integrated firm is that the network involves various actors. It is thus designed with a certain resilience to overcome exogenous events, even when individual firms within the GVC (whether the lead firm or its suppliers) are not (Kano et al., 2022).

COVID-19's influence will undoubtedly be felt for many years to come. In the long run, response to the risks of the crisis and GVC disruptions will be an inherent element of standard operating procedure (Kano et al., 2022). The worldwide pandemic has challenged international society with several critical difficulties, but more severe global concerns will be faced in the following years (Hitt et al., 2021).

2.2 Agricultural GVC

The dispersion of the production process between nations has long been one of the factors affecting the agri-food business most. One obvious explanation is that the source of some agricultural raw resources is geographically remote from consumption owing to natural limitations. Foreign investors first focused on extractive sectors and agricultural production. Multinational corporations from the USA, Europe, and Japan began to invest in plantations abroad at the end of the 19th century and the beginning of the 20th century, motivated mainly by the demand for natural resources (Scoppola, 2021). Further development of agricultural GVCs, also known as AGVCs, expanded quickly since the middle of the 20th century. Before globalisation, agricultural businesses transitioned from small-size to larger-scale industries between the 1950s and the 1980s. Agricultural countries have upgraded their agricultural GVCs since the early 1990s (Lim, 2021). Globalisation, liberalisation of trade and elimination of trade restrictions, reduction of communication costs and China's rise as a significant player in global commerce led to further fragmentation of the AGVC (Lim, 2021; Scoppola, 2021).

According to scholars, between 1995 and 2008, global GVC involvement in agricultural and food and beverage products was roughly 30 to 35 per cent, with considerable regional differences (Nenci et al., 2022).

The global food system became more linked with the rise in agri-food trade between 2004 and 2014. The application of foreign value in exports (backward participation), the use of one's value added in exports to other countries (forward participation), the links in value-added streams between states, and changes in the locations of agri-food value-added production facilities compared with where the final good is consumed - these are just a few ways to investigate changes in GVC participation. Indications point to rising AGVC participation, yet this may frequently be done to continue serving domestic markets by using foreign supplies rather than satisfy international demand. Two of these metrics, backwards and forward participation, demonstrate a rise in agri-food GVC involvement across the board, with notable gains between 2004 and 2011 and slight declines between that year and 2014. The total increase throughout this period indicates that agri-food industries increased using foreign inputs in their production aimed for further export. Many agri-food exports were utilised to manufacture other exports (Greenville et al., 2019). Also, by connecting farmers upstream with customers downstream via fast vertical integration, top international agricultural companies, global food processors and retailers have become significant players in AGVCs (Lim, 2021). Around one-third of the value added in the global agriculture industry, as of 2015, is accounted for by AGVCs, based on a report released by the FAO (Lim and Kim, 2022).

The international production chains, driven by existing agri-food processors and retailers, became increasingly vertically organised. While going through these chains, products now cross international borders many times. Meanwhile, agri-food trade has increased dramatically over the previous three decades, from 230 bln USD in 1980 to about 1,100 bln USD in 2010 and 1,675 bln USD in 2020, a rise attributed to several causes, including GVC expansion. According to Balié et al. (2018), half of this entire agri-food trade is used in some capacity for international production.

The original unbundling of the agri-food industries was primarily characterised by trade in commodities and facilitated by the creation of specifications. These innovations made combining goods from many suppliers in large-volume shipments possible, making it easier to transport and use them by end consumers or other production processes. The second stage was characterised by a de-commodification process, focusing on the importance of knowing how food was produced and several advancements in procurement and marketing procedures that contributed to creating trust across value chain actors. As a result, numerous agri-food chains were integrated with marketing channels,

increasing the significance of services equally in the upstream and downstream stages of the chain. Improvements in trade logistics and agricultural and food sector developments further catalysed this second unbundling (Greenville et al., 2019).

There are two potential value-adding pathways associated with trade and GVC engagement, according to Greenville et al. (2019). The first is a processing channel through which domestic added value in agri-food products develops through downstream processing industries, and ties to trade and GVCs emerge. The second is a leading channel where the raw product receives domestic value addition. The agriculture sector participates directly in trade and GVCs by exporting these raw goods for either further international processing or final international customer (Montalbano and Nenci, 2020).

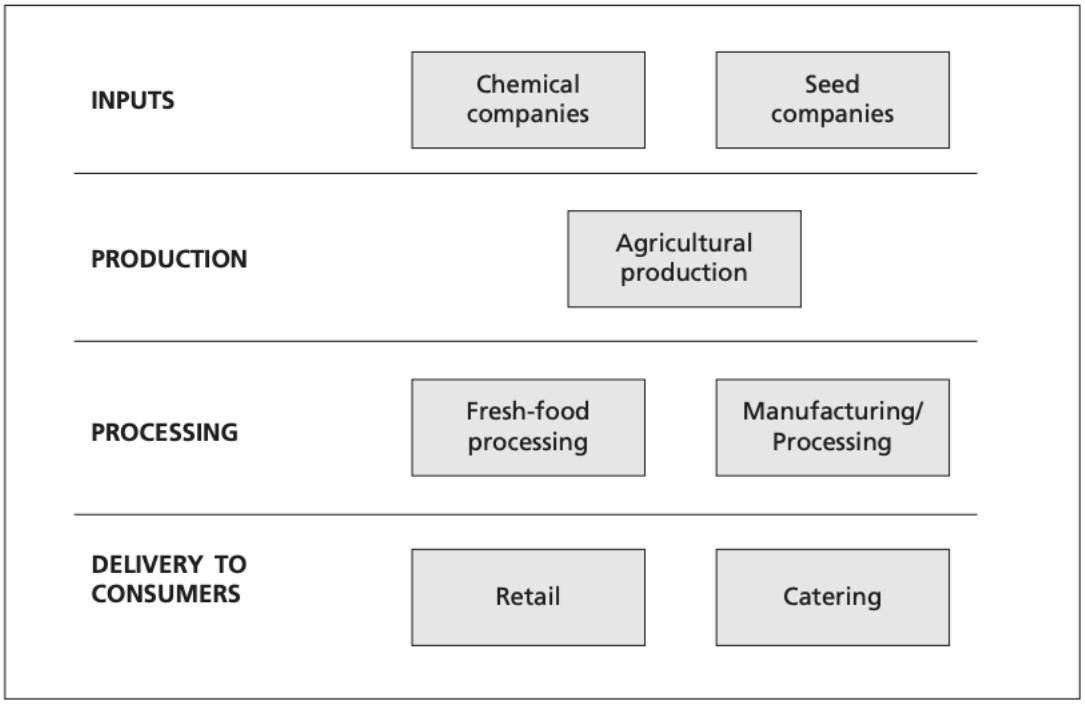
Greenville et al. (2019) and Lim and Kim (2022) state that, in GVC, forward and backward links can be distinguished. Forward linkages are when raw materials are exported, used in another nation, and shipped overseas to a third nation. Backward linkages are when intermediate inputs from abroad produce exported goods.

GVC links in agriculture are primarily forward connected given that agricultural goods are essential building blocks in other manufacturing. Argo-food and beverage production involves the processing of agricultural inputs and is significantly more at the middle and the end of a value chain. The imports of food and beverages from agri commodities account for most of the backward linkages. In contrast, agriculture's backward connections correspond to imports of agricultural supplies and are associated with growing economic servitisation and global trade in fertiliser and seeds (Nenci et al., 2022). According to the author, the sector's exports contribute to most of the forward links in food and beverages; agri commodities are minimally processed in one state and further exported for additional processing and distribution. Nevertheless, other downstream industries include value-added products in the food and beverage sector, for instance, sugar in cosmetics and pharmaceuticals.

Nenci et al. (2022) argue that chemicals and raw products comprise a large part of international inputs in agriculture. Agricultural commodities comprise the food and beverage sector's second-largest share of forward value-added inputs. According to the authors, this share can be up to 20%.

Value chain coordination can be started by upstream suppliers like producers (farmers) or agri-cooperatives or downstream buyers like retailers and processors. According to Scoppola (2022), strong coordination amongst farmers, producers/processors or traders, and between producers/processors and retailers, is a characteristic of AGVC. For better illustration, Humphrey and Memedovic (2006), in their work, formed a simplified model of the value chain in agriculture.

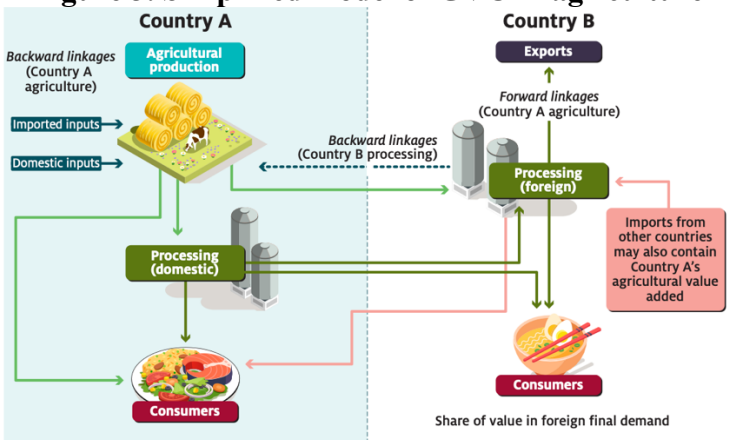
Figure 2. Simplified model of value chain and agriculture



Source: Humphrey and Memedovic (2006)

Additionally, Greenville (2019) also developed a simplified model of GVC in the agricultural sector, taking into account the ability of companies to provide products with added value in different countries.

Figure 3. Simplified model of GVC in agriculture

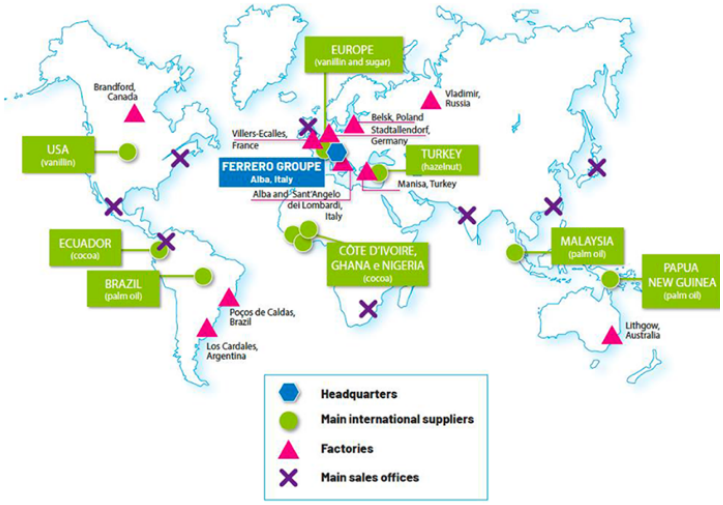


Source: Greenville (2019)

Case studies are often used to describe the complexity of contemporary agri-food value chains. One great example explained by Scoppola (2021) is Nutella's production process. According to the author, it effectively demonstrates how global agri-food production is fragmented and can be compared

to the value chain of electronic gadgets. Sugar, cocoa powder, hazelnuts and other ingredients make Nutella. These products are considered intermediate since they result from processing agricultural raw resources upstream. The chain may comprise two or more production phases upstream and production for each component in Nutella. The finished product is made at many manufacturing facilities worldwide (Europe, North America, and South America). Additional attention the author pays to acquire the intermediate inputs conducted by the company. Scoppola (2021) states that several world regions produce intermediate products for Nutella production. The company frequently buys ingredients from other businesses, which applies to sugar, vanilla, and other products. A network of worldwide manufacturers provides all these products. According to Scoppola (2021), this process refers to outsourcing: supplies are acquired from a different, unaffiliated upstream firm through arm's length international transactions. The company has incorporated upstream for additional inputs. These global exchanges of products along the production value chain are not between independent parties but between companies that fall under the same umbrella organisation, namely Ferrero.

Figure 4. Global Nutella production



Source: Scoppola (2021)

By considering business heterogeneity, recent new-new trade theories, building on Melitz's foundational work from 2003, improve the study of MNEs (Scoppola, 2021). While new-new trade theories describe the geographic distribution of global production, yet do not address the factors that influence how firms decide who controls which production stages (the internalisation choice). Scoppola (2021) also suggested that resource endowments can influence the position of countries in the GVC. For illustration, states with a wealth of resources are anticipated to demonstrate a high level

of participation in forward GVC as these countries are probably specialised in primary goods utilised by different downstream sectors. Trade costs, which raise the price of intermediate inputs and exported outputs and deter GVC involvement, substantially negatively affect participation. These include transportation costs, trade regulations, and the remoteness of states and trade barriers. Hence, according to the author, engagement in GVC grows with membership in regional trade associations or unions. Trade expenses also impact the positioning of nations within the GVC.

Moreover, downstream phases (i.e., the lower gross value phases) are more affected by trade costs if they are proportionate to the gross value of the item; this causes distant states to specialise in the upstream phase and central states to specialise in downstream phases of production (Scoppola, 2021). Furthermore, GVC is not easy to access, get involved in, or participate in, according to Montalbano and Nenci (2020). According to the authors, increasing standards in the global market could keep small farmers out of value chains. Small farms may not have the technical and financial resources necessary to meet strict criteria (Reardon et al., 2001). It might lead dealers and processors to use fewer small suppliers. Moreover, sourcing from small farmers may come with very high transaction costs for ensuring standard compliance (Montalbano and Nenci, 2020).

Agriculture and agri-food sectors have globalised during the last thirty years, evolving from a weakly coordinated local producer-consumer interaction to a globalised network of formally organised trade that connects socially and geographically dispersed locations of manufacturing and consumption. Globalisation is bringing agriculture closer to manufacturing in one crucial way: despite being geographically and production-wise disseminated, it is embedded and orchestrated by a small number of agri-food MNEs, likewise in any other sector (Yang and Liu, 2022). Furthermore, AGVCs have grown in a manner akin to that of manufacturing industries. In other words, there is a significant regional component; value chain ends are centred around specific hubs, and significant actors at the middle of the chain as agri-food inputs suppliers are often developing countries. It has implications for the value chain's resilience, and supply and demand shocks in the economies of the leading agri-food GVC suppliers could impact satellite nations (Greenville et al., 2019).

Supply chain in agriculture. The agricultural supply chain comprises all the input supply, production, postharvest, storage, processing, marketing and distribution, food service and consumption functions along the farm-to-fork continuum for a given product, including the external enabling environment. These tasks frequently involve a wide range of institutions and businesses from both the public and private sectors. They frequently cut across other supply chains and geographical and

political borders (Jaffe et al., 2010). Since the supply chain is an integral part of GVC, it is worth examining it in more detail.

The agri supply chain participants can be located within or outside national borders. Some participants can be involved in different supply chains, while others provide specialised services. In our current global economy, technical support, including R&D, and technical and financial assistance can easily be located across borders (Jaffe et al., 2010).

The agri-food system also includes farmers and a diverse range of firms, including backwards-linked input suppliers and forward-linked intermediaries, processors, exporters, wholesalers, and retailers (Jaffe et al., 2010).

The main activities of a direct supply chain are:

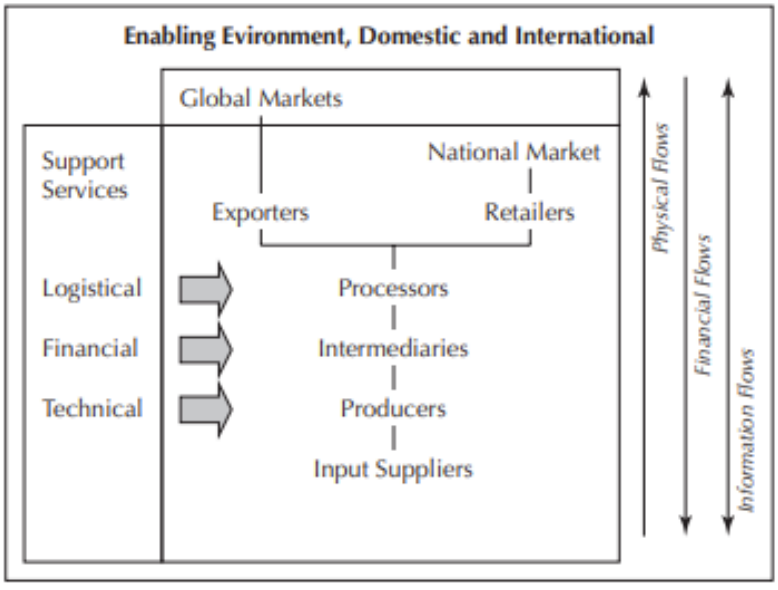
a) Input supply: this relates to the production and distribution of material inputs - fertilisers, seeds packaging - utilised in the start of the production, processing and trade of the focal commodity;

b) Farm production, relating to the primary agri production through the sale of a raw commodity at the farm gate or to the following supply chain participant;

c) Processing involving the transformation of agricultural raw materials into finished goods; activities in this sector include drying, canning, and freezing, among others;

d) Domestic and international logistics comprising the delivery of marketed commodities to the final market (Jaffe et al., 2010).

Figure 5. Agri-food supply chain framework



Source: Jaffe et al. (2010)

In supply chain analyses, success is measured in terms of the supply chain's performance, meaning the ability to deliver a product to the final market. This success is a multifactorial dependency, and some risks can hinder it. The risks agricultural supply chain may be subjected to different natures and coming from different sources. The impact of those risks can be on reliability, costs, and efficiency of production, processing and marketing activities (Jaffe et al., 2010).

2.2.1 Risks in AGVC

The agriculture industry has witnessed notable changes recently, primarily attributable to rising globalisation, the growth of complex network structures, and commodity flows. There are several big multinational food producers, retailers, and agricultural technology companies now. Large multinational corporations have enormous power and can design and manage dynamic and complex economic ecosystems formed of relationships between firms and inside firms. Agricultural methods, transportation, processing, and consumption of agricultural goods all contribute to the global spread of the dangers of agriculture and agricultural products. These adjustments cause novel difficulties and threats, such as managing the networks of agricultural production worldwide and enhancing the sustainability of agricultural output and the supply of agricultural goods (Yand and Liu, 2022).

According to Grunder et al. (2021), each step and activity in the agricultural value chain (AVC) is subject to risk because it incorporates unpredictable aspects. Several actors in the AVC might be impacted by risks to varying degrees. The authors distinguish two main categories of risks: *idiosyncratic risks and covariate or systemic risks*. The first type relates to hazard occurrences that often only affect one agricultural production at a time. Examples of idiosyncratic risks include illness or the death of workers or animals, equipment failure, and plant diseases and insects (Jaffee et al., 2010). The second type, systemic risks, like a drought, a price reduction, pests and diseases, or abrupt regulatory changes, affect numerous firms at once and can consequently significantly affect the entire AVC (Grunder et al., 2021).

The authors also distinguish the following risk categories:

- Production risk includes extreme rainfall, natural disasters (floods, wildfires, droughts, storms, earthquakes, volcanoes and others), pests affecting crops, animal diseases, and contaminants.
- Price and financial risk: this risk includes market volatility (volatility in demand/supply), changes in manufacturing standards, fluctuation in interest rates, exchange rates, price of inputs and their quality and availability.

- Logistical risk: this hazard includes the possibility of a physical breakdown of facilities and infrastructure, a disruption in the energy supply, and a breakdown in communications infrastructure.
- Institutional and policy risk includes instability in political, regulatory and trade fields.

Still, as the supply chain plays a crucial role in agricultural GVC development, the supply chain's risks may significantly impact the whole added value chain both internally and internationally. Therefore, we have examined the risks of the agricultural supply chain defined by Jaffe et al. (2010) in their research. According to the authors, there can be the following types of risks in the agri supply chain:

- Weather-related: Too much/too little rainfall, low/high temperatures. Weather-related risks can reduce yield. They can also affect the quality and disrupt the flow of goods and services, such as transportation. Some specific areas might be affected more than others affecting only small parts of the supply chain.
- Natural Disasters can affect multiple growing seasons and production cycles. The risks are mainly related to production and postharvest reductions in quantity and quality losses. The impact can be over single or multiple suppliers, the logistics causing disruptions in the communications, transportation and energy services. Upstream and downstream, participants in the supply chain have a ripple effect.
- Biological and environmental: They are ubiquitous and vary. They affect the decision-making process, productivity and market options. They are related to production and postharvest reductions in quantity and quality losses as they affect the supply chain, either seasonal or the production cycle disrupting the flow of goods and services. Financially, they can affect producers' ability to repay loans; examples are plant pests, livestock diseases, or general environmental degradation.
- Market-related: They are related to inputs and outputs and the critical services supporting supply chains, including finance and logistics. Issues affect price, quality, availability, and access to imperative products and services. Affections can be on a single growing season and production cycle or for more extended periods. Price risks are directly associated with quality as it is influenced by the availability of affordable inputs, delivered and applied in time, impacting decisions linked to production, postharvest and processing. Upgrading the quality often comes with institutional risks as financing might be needed; however, those instruments are not always accessible and affordable; premium markets should be assured; otherwise, is not

viable for producers as the ability to repay loans might not be possible. These risks vary constantly and are rarely associated with a unique geographic location.

- Logistical and infrastructural: These risks affect the availability and timing of goods and services, energy and information. Logistical failures impact the supply chain in terms of product quality and traceability. Access to the reliable and affordable transport, communications, energy and information technology is decisive for productivity and decision-making tasks, enterprise selection, and designated input and output markets. These risks are interconnected with price and market-related risks. Conditions related to logistics can impact demand for inputs and the range of support services, the ability to repay loans and cooperation with buyers and processors upstream in the supply chain.
- Managerial and operational: These risks are closely related to human judgement and response, defined as errors in action or inaction of commission and omission. They often affect a single chain participant but can be passed to parts of the supply chain. Examples are related to reductions in productivity, poor quality and unreliable delivery of inputs and outputs or support services. Single supply chain actors, producers and producer groups in a community are directly impacted.
- Public policy and institutional: They have significant direct and indirect impacts on designing incentives, the decision-making process, the structure, the relationship among singular actors, the distribution rewards and those linked to support services and government across the agricultural supply chains. These risks can translate into the movement of goods, services, information, and cash flow. Uncertainty in the "game" - whether the rules will be enforced efficiently, equitably and transparent- significantly impacts business conduct. Market options are part of it.
- Political (Order of risk magnitudes): The incidence and severity of the different risks vary among countries and locales within countries, thus depending on defined climatic conditions, location and topography, demographics, and the agrarian and industry structures; thus, its importance will differ.

The different risks can affect individual participants. However, those risks and their response are differently transmitted throughout the agri-food supply chain. Examples of the transmission of risks across the supply chain can be found in the following table:

Table 1: Risks impacting agri-food producers and transmission of impacts to actors in the value chain

Table 3: Risks Impacting Farmers and the Transmission of Impacts to Agro-enterprises						
Risk	**Input Suppliers**	**Farmers**	**Buyers**	**Processors**	**Traders**	**Distributors**
Weather-related risks	Demand for inputs Repayment for inputs on credit	Planting decisions Yield and quality Income decline	Availability, price, quality of products Logistic costs	Availability, price, quality of products Logistic costs	Availability, price, quality of products Logistic costs	Availability, price, quality of products Logistic costs
Natural disasters	Demand for inputs in this and subsequent year Repayment for inputs on credit	Yield and quality Farm asset loss Longer-term output and income decline	Availability, price, quality of products Logistic costs	Availability, price, quality of products Logistic costs Costs to develop alternative supply sources	Availability, price, quality of products Logistic costs Loss of market contracts	Availability, price, quality of products Logistic costs Costs to develop new supply sources
Biological and environmental risks	Demand for inputs Repayment for inputs on credit	Input use Yield and quality Production costs Income decline	Availability, price, quality of products Need to screen or test supplies	Availability, price, quality and safety of products Brand reputation Market access	Availability, price, quality of products Brand reputation Market access	Availability, price, quality of products; Brand reputation; Product liability Need to procure from alternative sources
Market-related risks	Demand for inputs Repayment for inputs on credit	Planting decisions Input use Yield and quality Income decline	Availability, price, quality of products	Availability, price, quality of products	Availability, price, quality of products	Availability, price, quality of products
Policy and institutional risks	Demand for inputs Repayment for inputs on credit	Planting decisions Input use Yield and quality Ability to sell	Availability, price, quality of products Operating costs Ability to intermediate	Availability, price, quality of products Availability, price other products Need to procure from alternative sources Operating costs	Availability, price, quality of products Need to procure from alternative sources Operating costs Ability to sell	Availability, price, quality of products Need to procure from alternative sources Operating costs
Logistics-related risks	Demand for inputs in current and subsequent year (or season)	Input access and use Yield and quality Postharvest losses Income decline	Availability, price, quality of products Availability and price of other products Operating costs	Availability, price, quality of products Availability and price of other products Operating costs	Availability, price, quality of products Availability and price of other products Operating costs	Availability, price, quality of products Availability and price of other products Operating costs
Management and operational risks	Demand for inputs in current and future years	Inappropriate planting decisions and input use Reduced yield and quality	Availability, price, quality of products Operating costs	Availability, price, quality, and safety of products Product liability Operating costs	Availability, price, quality of products Operating costs Product rejections and market access	Availability, price, quality of products Operating costs Loss of brand reputation; market or regulatory sanctions

Source: Jaffee et al. (2010)

Earlier in this work, we analysed how the critical events of the last 15 years, namely the global financial crisis, the introduction of sanctions on global market participants and the relatively recent global COVID-19 pandemic, affected global value chains. Further, in work, we will study how these challenges affected the functioning of AGVC.

2.2.2 Past disruptions in AGVC

Sanctions

The available scientific literature does not provide enough information to fully assess the impact of previously imposed economic sanctions on GVC in the agricultural and food sectors. One of the possible reasons is the absence of assessed case studies and evaluation of the impact of past economic sanctions on the entire world supply chain of agricultural products.

Doornich and Raspotnik (2020) characterise economic sanctions as forceful instruments used to influence the policies and regimes of other countries by restricting international trade. Thus, it can be concluded that specific trade restrictions and policies (implemented for one specific country or region) could significantly affect the existing international trade, including participation in GVC. The relationship between trade policies within local and GVCs has recently been the subject of studies in international business literature. Although removing trade restrictions has been noted as one of the factors influencing the dispersion and spreading of GVCs (Nenci et al., 2022), the instalment of new trade restrictions could have the opposite effect on the GVC.

One of the most used examples of the influence of economic sanctions on agricultural GVC is the case of Cuba. Trade and political restrictions that were exposed on Cuba by the USA influenced Cuba's participation in the GVC. Apart from the inability to export raw materials such as coffee, tobacco, and sea products to the USA, Cuba is also limited in selling its top raw materials to the international companies that reprocess them and export finished products worldwide, incl. to the US. While one of the most exported raw materials, under the terms of restrictions, Cuba's sugar cannot be used in third-country products that aim to be exported to the USA. For example, for European producers who also export to the US, it becomes more sophisticated and problematic to use Cuban sugar in the production processes (Gordon, 2015). Thus, the participation of Cuba's agricultural producers in the food GVC has been reduced.

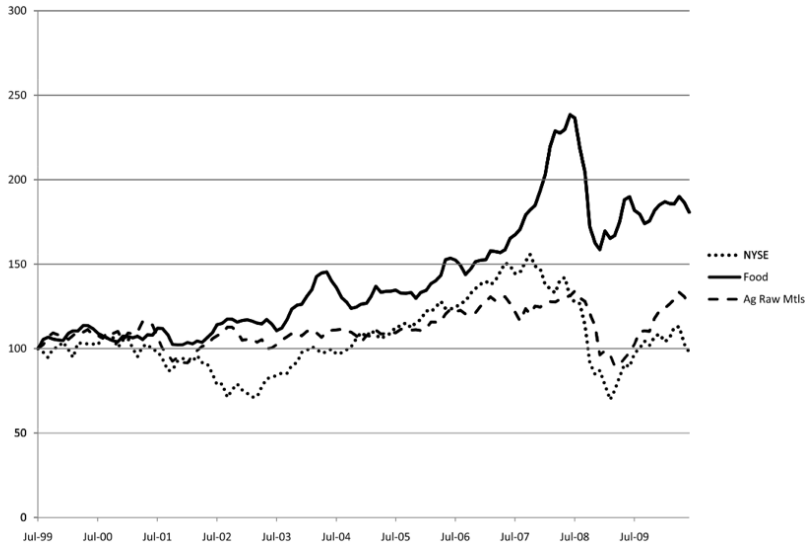
Global financial crisis

The Global financial crisis had several effects on the global economy, including falls in commodity prices, notably asset investment. Another effect was a drop in people relocation (migration) and money flows. Increases in production or commerce finance costs had adverse direct and indirect effects on developing-country producers and consumers and have been linked to a rapid decline in lending to developing nations (World Bank, 2009). Lower reduced labour demand directly impacted

jobs and salaries for unskilled workers in many underdeveloped nations. Finally, rising interest rates, particularly for trade credit (World Bank, 2009), have increased production and trade costs (Lin and Martin, 2010).

According to Lin and Martin (2010), the link between agricultural prices and stock market indices is a primary indication of the connection between agricultural commodity prices and financial sector shocks. The link between the New York Stock Exchange Composite index and the IMF composite indexes for food and agricultural raw commodities is seen in the Figure 6. Over much of the time studied, the three price indexes appear to have responded to similar factors, with raw material prices being far more strongly connected with the stock market index than food prices (Lin and Martin, 2010).

Figure 6. Stock market and index of agricultural prices from July 1999 to May 2009; USD index



Source: Lin and Martin (2010)

Evaluating the increases in costs in production and trade caused by the financial crisis is a challenging and unverifiable task, mainly due to the rise of the capital cost caused by credit rationing when banks withdrew from lending to specific businesses. Some rough estimates of the implications of such cost increases may be produced by making reasonable assumptions about the quantity of working capital involved in production and commerce and calculating the effects on developing-country agriculture (Lin and Martin, 2010). Because subsistence farmers employ relatively little working capital, the direct effects on agricultural production costs in developing countries appear minor. Given the increased working capital requirements of trade and the substantial seeming rise in

interest charges on trade finance, the effects on agricultural commerce appear to be more severe (World Bank, 2009).

Some consider the rise in commodity prices between 2007 and 2008 a fundamental component of the crisis (Caballero et al., 2008). According to this interpretation, the 2006 housing bubble burst drove investors to reallocate their portfolios to commodities, resulting in a doubling of the price of oil and steep rises in other commodities between June 2007 and June 2008 (Lin and Martin, 2010).

The global boom in food costs was first noticed in 2006, and after, it grew to 27% in 2007 as financial troubles loomed. The international economy has been pressured by deteriorating financial conditions and global macroeconomic pressures, exacerbating the negative impact of fluctuating and above-average food costs, particularly in developing countries (FAO, 2009). Cudjoe et al. (2010) claim that the rise in oil prices, US dollar depreciation, biofuel regulations, financial speculation, and temporarily enforced trade restrictions jointly contributed to the fast rise of food costs during the 2008 financial crisis surge years (Riveros et al., 2021).

In 2008, the subsequent spike in oil costs and the overall development of biofuel production was linked to increased food prices. Oil and food costs are inextricably related since food production and logistics need significant energy (Riveros et al., 2021). Lin and Martin (2010) also state that possible income growth in several large emerging countries appears to have increased energy prices.

Imports and exports of nations directly affected by the crisis have dropped during the crisis since trade began to fall severely in late 2008. This pattern is most likely explained by the fact that the crisis is genuinely global, induced by increases in risk premia on private sector capital even in nations that were not directly suffering financial problems. This argument corresponds to the significant rise in interest rates imposed on developing nations in late 2008, which became a significant problem for these countries (World Bank, 2009; Lin and Martin, 2010)

Both the food and beverage industries are feeling the effects of the 2008 financial crisis. These effects were also broad geographically; up until 2008, GVC involvement had decreased in around 7% of the states in the database. Only 8% of economies, comprised of a diverse mix of predominantly small states, continued their integration into the world economy after 2008 (Nenci et al., 2022).

COVID-19 pandemic

The COVID-19 outbreak has undoubtedly impacted GVCs through various channels, and lockdown measures have directly reduced production. On the supply side, a significant obstacle influencing the whole value chain is the unavailability or scarcity of international suppliers due to

disruptions in foreign manufacturing and transit networks. As for demand, the economic crisis provoked by the pandemic has caused a dramatic decline in demand for most items, while consumer market shocks have impacted all overseas upstream suppliers. According to academic research, the economic implications of the pandemic vary among industries, regions, and nations (Nenci et al., 2020).

Since the COVID-19 outbreak, there have been numerous reports of disruptions in the global agri-food supply chain, specifically regarding GVCs in the agri-food sector (Mutale and Xianbao, 2021). The pandemic has concurrently affected production, processing, logistics, and final demand for food products, imposing shocks on all links in this supply chain (Laborde et al., 2021). The local food system was undermined due to non-pharmaceutical actions undertaken by local and international officials to smooth the virus' spread, posing a severe threat to food security (Nenci et al., 2022). Nevertheless, not all industries and goods have been equally impacted, and various products have encountered disruptions throughout the supply chain (OECD, 2020). The implications on agricultural and food products supply chains are also anticipated to be widespread but uneven in the developing world, even though they have shown extraordinary durability and adaptation to the effects of COVID-19 in the developed world (Nenci et al., 2022).

Import, export, producer, and consumer price volatility has grown due to demand shocks and supply chain issues caused by global trade barriers, travel limitations, and significant shifts in consumption habits. Whereas most companies were forced to close due to the government's preventative initiatives, food suppliers and merchants stayed open (CISA, 2020). While reacting to supply chain disruptions, satisfying significant market demand, protecting its workers, and maintaining quality and safety requirements to preserve people's lives, the COVID-19 pandemic has had long-term repercussions on the food industry chain (Riveros et al., 2021).

COVID-19-induced disruptions in the food supply chain resulted in a harmful influence on food security. Disease outbreaks have had a relatively minor impact on staple food production in developed nations, although labour-intensive operations in some markets and processing sectors have been severely impacted. Another critical point of failure has been in processing various agricultural goods, notably meat manufacturing, where low temperatures and closeness of employees can result in extremely high rates of disease transmission. Other interruptions to food supply chains have resulted from restrictions on labour migration, a significant decrease in international air traffic, and delays in administrative licenses for food trading (Laborde et al., 2021).

Harvests were sold at a lower price by farmers in order to avoid dumping. The shutdown ripple effect across the food supply system, driving up and disrupting food prices (Lufkin, 2020). According to FAO (2020), global food prices have risen for three months since August 2020, owing to solid demand, weak currencies, and trade-restrictive policies implemented by some nations to build up food stocks. According to Yu et al. (2020), the influence of COVID-19 on food costs varied by area and product, with only a minimal impact on the total. The most severe food production and price interruptions occur in less-developed countries, especially heavily dependent on food imports (Fan et al., 2017). According to Coluccia et al. (2020), Italian agri-food exports declined directly due to the pandemic. Some nations still have ample food stocks for the near future, but if the pandemic continues, food insecurity will become an increasingly severe concern (Deaton and Deaton, 2020).

Agricultural and food sectors were designated as critical across most nations. Thus, supply disruptions were also expected due to lower labour mobility (e.g., seasonal migrant labour) and that perishable farm goods incur higher postharvest losses due to transportation issues and demand repercussions. There is a five-point rise in postharvest losses of perishable items (fruits, vegetables, meat, and dairy). Although this estimate is speculative, evidence shows that losses have been prominent in some circumstances and modest in others, making a 5% loss seem realistic (Laborde et al., 2021).

Commodity market. The COVID-19 epidemic has also harmed the commodity market. The oil market, among others, has been the most severely hit. Natural resource commodities markets are thought to be more efficient in delivering shocks to other economic sectors. As a result, commodities markets for natural resources are more closely linked to financial, stock, and equity markets. Furthermore, it is acknowledged that natural resource commodities have particularly volatile behaviour during crisis times (Yu, Guo, Chang, 2022). According to the authors, the natural resource commodity prices overflow to other markets is expected to be more resistant during the crisis, owing to the farmer's close links to the latter. Scholars also state that it is well acknowledged that uncertainty harms all stakeholders, like consumers, investors, and the economy itself.

2.3 Applicable theories

The relevance of supply chain management has grown as more businesses enter new markets in search of greater sourcing and production economies. As a result of globalisation, quickly advancing technologies, and improved customer responsiveness, supply chains now operate in more dynamic contexts that call for greater integration and collaboration (Soosay and Hyland, 2015). Due to the fierce

competition, supply chain managers have also had to consider other competencies and value-generation methods for their clients. Organisational and management theories can be used to describe the structure, operations, and behaviour of businesses.

There have been many theoretical attempts to explain the shifts in the global economy in perspective of what they mean for enterprises and nations. The GVC literature was created to comprehend these issues and determine their impacts. However, several areas of the literature on business and management have also addressed similar challenges, including studying international business, networks and strategy (Humphrey et al., 2019).

The development of new international approaches (Aximm and Matthyssens, 2002) and essential reconsideration towards past research (Hamill, 1997) became unavoidable in changing business environment and increasing number of companies expanding to the foreign market. Since the 1980s international business environment has significantly changed, and lots of time and resources have been invested in explaining the internationalisation process of companies. However, finding a theory explaining a particular company's actions is still challenging. Managers have different experiences and use various approaches to enter a new foreign market or cooperate with a company from another country. The subjective methodological perspective will investigate the intensity of applying the theories and their comparison. Analysis of the chosen theories, namely Transaction Cost Theory (TCT) and New Trade Theory (NTT), will be helpful when creating qualitative research questions.

The reasons for choosing the TCT and NTT are:

- Both theories describe entry modes in foreign markets;
- Theories are undiscovered in the changing business environment;
- Both theories consider minimising costs and profit maximisation when internationalising to foreign markets.

To sum up, chosen theories have common elements and would be most relevant among all internationalisation theories for the research, as they emphasise decisions to develop the international value chain.

2.3.1 Transaction Cost Theory

Transaction cost theory was developed in 1937 by Coase. Further, the concept underwent several revisions conducted by several researchers as the business environment was evolving. In 1975 Williamson concluded that the transfer of goods and services and methods to make these transactions more efficient are the academic units of analysis. As firms engage in supply chain collaborations to seek economic and social benefits, companies have deliberately acknowledged the benefits of supply chain collaboration to seek higher efficiencies primarily in sourcing, planning, producing and distributing (Soosay and Hyland, 2015; Um and Kim, 2019). Successfully fulfilling this collaboration is predicted to reduce transaction costs while strengthening the firm's buying performance. Supply chain collaboration allows firms to share gains and losses, considerably extend their resources and capabilities, and cross boundaries, exchanging crucial information, thus eventually enhancing performance and, as a result, an overall cost reduction (Um and Kim, 2019).

Analyses on intermediate products between nations show how GVCs are rather omnipresent. Companies' business operations strategies often incorporate offshoring and offshore outsourcing. According to the UNCTAD (2013), about 60 per cent of overall trade flows in goods and services are intermediate inputs primarily produced in offshore locations with favourable factor conditions (Mudambi and Puck, 2016). GVC involvement is frequently linked to transactions fundamentally distinct from the anonymous transactions that characterise traditional trade theory. Highly specialised data and inputs are frequently exchanged repeatedly between the many companies and production facilities participating in a GVC. Additionally, businesses invest a lot of effort and money in organising the structure of production chains (i.e., transactions occur within or across the firm's boundaries) (Antras, 2020).

According to Williamson (2008), TCT can be utilised to explain the supply chain collaboration connected with the partners' uncertainties, risks, and opportunism. In 2010 in his research, Yigitbasioglu applied TCT and demonstrated that supply chain cooperation between companies could be affected by dependency and uncertainties in demand and environment through the level of shared information across the chain. Similarly, Richey et al. (2012) add that this theory explains the controlling mechanisms businesses use to eliminate the influence of uncertainty or opportunistic behaviour.

Transaction costs are expenses incurred in transactional processes, from searching partners, negotiations and enforcing contracts to monitoring performance and adjusting to situational conditions. Transaction costs play a significant role in managing the supply chain. They also refer to the efforts and costs to coordinate and reconnect all links in the production chain (Williamson, 2008; Berghuis

and Butter, 2017; Um and Kim, 2018). Transactions or "units of exchange" are the focal point of this theory, while firms are viewed as a governance structure instead of a production function. TCT's premise relays on the cost of doing transactions (i.e., the cost of economic exchange), which could be too high under certain conditions. Transaction costs can be divided into ex-ante and ex-post according to the start of the relationship. Ex ante results from searching for a suitable supplier and writing up the contractual liaisons to begin a relationship; ex-post relates to those that monitor and reinforce the current relationship.

According to Clemons et a. (1993), transaction costs can be seen as a sum of the coordination costs and transaction risks. *Coordination costs* can be described as those related to the exchange of information and the later incorporation into the decision process. Regarding a manufacturer-supplier dyad, those cost examples are related to exchanging information on products, demand, availability, and product design costs, among others. *Transaction risks* include those risks related to parties involved in the transaction potentially avoiding or neglecting the previously agreed responsibilities. It may also include asset-specific investments made by one party in the relationship. This risk increases when information asymmetry is present. Other elements linked to transaction risks described by Clemons et al. (1993) is called "small numbers bargaining", where there are only a few suppliers able to supply the product and the company decides to procure from the market, it exposes itself to opportunistic behaviour since there is a small number of competitors. Additionally, "loss of resource control" relates to outsourcing a potentially proprietary product (manufactured by a private person) and again faces the risk of opportunistic behaviour. As an illustrative case example cited in the literature, a supplier might deliver an inferior product in the dyad above if it knows the manufacturer cannot prove the violation (Roeck et al., 2020).

Among the main vital assumptions that characterise TCT are bounded rationality and opportunism. In the theory context, *bounded rationality* is the primary restrictor in selecting qualified suppliers and composing contracts that should cover all the potential future contingencies and conflicts. TCT views bounded rationality as a problem under uncertain conditions. It means, despite the will and desire to act rationally within the firm, decision-makers are limited in their ability to receive, store, retrieve and communicate information without error. Uncertainty often makes it difficult to specify the conditions regarding an exchange fully; therefore, players involved have to incur ongoing renegotiation costs causing an economic problem. In a scenario where rationality constraint is binding, costs related to transactions rise, and the need to minimise them throughout a correct choice of governance arises (Grover and Malhotra, 2003). *Opportunism* is the term used to describe an actor's self-centred actions

when the situation is unfavourable. The most common behaviours linked to it are lying, cheating and subtle forms of agreement violations. Costs associated with these conducts are behaviour monitoring, asset safeguarding and controls over the other party to avoid engaging in opportunistic behaviours, all linked to transaction costs (Grover and Malhotra, 2003). Transaction expenses related to detecting and observing potential opportunists and creating protections are unavoidable for purchasers because suppliers may engage in opportunistic actions. Maladaptation can happen in the supply chain when a supplier cannot or does not want to fulfil demands. In an endeavour to safeguard its relation-specific assets, a buying business experiences transaction costs due to maladaptation. When a connection ends, a buying company is compelled to find a suitable supplier and create new contracts, which results in maladaptation expenses. It is important to note that TCT does not claim that every economic plater is always opportunistic, but only a few economic actors exhibit opportunistic tactics (Williamson, 1996; Kanwal and Rajput, 2016).

Both facets, despite their differences, will give rise to transaction costs, while governance mechanisms like the company and the market provide ways to sort these transactions (Grover and Malhotra, 2003).

The logic behind TCT can be compacted into the following propositions:

- *Bounded rationality and opportunism give rise to transaction costs.* In some cases, the bounded rationality of individuals restricts the ability to specify all conditions beforehand in the decision tree, raising the need to manage an incomplete contract with an economical cost. Where some parties require monitoring due to the open window to engage in opportunistic behaviour, the transaction costs also increase.
- *Transaction costs are higher under conditions of high asset specificity and high uncertainty.* Relationship-specific investments (RSI) or assets refer to the extent to which an asset can be put to different purposes by different users without losing its usefulness (Williamson, 1989; Kanwal and Rajput, 2016). RSI or specific assets are designed for a particular partner and transaction, and their value decreases outside of that special relationship. It can include human asset specificity, dedicated assets, site specificity and physical asset specificity. Both businesses invest in RSI, including amendments in products and processes. However, it can also take the shape of facilities, R&D, testing, and making changes to products and processes. These RSI's diminished worth outside of a particular connection is crucial (Kanwal and Rajput, 2016). RSI are precursors to opportunism.

- *The most efficient governance mechanism (markets or hierarchy) must be chosen to organise economic activity.* Lower transaction costs favour markets, while higher transaction costs favour hierarchies. Governance outlines how a supplier and a buying company must carry out certain activities to achieve a shared goal. It deals with operational and structural aspects of collaboration between involved parties, divided into contractual and relational governance. The first refers to how the collaborative relationship is governed by a formal contract specifying rules, obligations and duties. In contrast, the latter refers to an inter-organisational relationship ruled by shared norms and social relations (Um and Kim, 2019).

2.3.2 New Trade Theory

The New Trade Theory, composed and later generalised by Helpman and Krugman in the 80s, shook the foundations of international trade initially compelled by David Ricardo. This New Trade Theory considered technology paired with increasing returns of scale underpinning the analytical frameworks of international trade under imperfect conditions. The models gave a convincing justification for the frequent intra-industrial commerce between nations with comparable technological and resource endowments—a fact that cannot be explained by the conventional idea of comparative advantage (Inomata, 2017). According to New Trade Theory (NTT), significant economies of scale and network effects that might develop in important industries play a crucial role in establishing global trade patterns.

The "New Trade Theory" (NTT) is a contemporary economic theory that uses first-mover advantage, network effects, and economies of scale to explain international commerce. It aids in understanding the primary driver of globalisation and heavy trade between economies with similar characteristics. A nation specialising in a specific sector may profit from economies of scale and other network advantages (Pettinger, 2017). Additionally, it opens the door for government involvement in a nation's industrialisation. The theory also explores where transport costs cause international differences in goods prices (Neary, 2009).

The theory rejects the traditional view of trade that advocates fixed technology, consistent returns of scale, and the existence of perfect competition. Instead, it claims that the advantage of dominance and monopoly goes to the first person to create a company in a particular industry. As a

result, a poorer country may struggle in particular industries because their businesses lack economies of scale (Vaidya, 2023).

Monopolistic competition is another element of NTT which contends that firms frequently compete on factors other than mere price, such as branding and quality. The real benefit of this idea is the globalisation of trade. However, its main drawback is the emergence of monopolistic tendencies among massive organisations on a global scale (Vaidya, 2023). Being the first firm to reach industrial maturity provides a substantial competitive advantage (Pettinger, 2017).

New trade theory also pays attention to a company's costs during its internationalisation process. According to Ciuriak et al. (2014), the regular market access agenda is altered by the presence of sizable fixed and sunk costs associated with foreign trade activities of the firm, which include outsourcing, importing, exporting and FDI. The risks associated with the global market loom big if businesses invest considerable resources to enter and maintain a presence in other markets. Companies that compete in global marketplaces suffer more uncertainty about their chances of success abroad than in the domestic market. Companies might not be as familiar with overseas markets as domestic companies are, and they run additional risks from changes in currency rates. Market entrance barriers harm a firm's choice of technology, productivity, and dynamism if they prevent companies from joining export and import markets (Ciuriak et al., 2014).

In the words of Krugman, "the argument that countries will tend to export those kinds of products for which they have relatively large domestic demand is wholly dependent on increasing returns; in a world of diminishing returns, strong domestic demand for a good will tend to make it an import rather than an export" (Neary, 2009).

Assumptions:

- Businesses can increase their economies of scale by specialising
- The productivity benefits of experiential learning are excellent
- First-mover advantage enables new rivals
- The function of the government in industrialisation becomes essential
- Economies of scale become crucial in preventing new competitors and transforming businesses into monopolies.

As a company grows, product differentiation and product specialisation become crucial.

Other essential factors of this theory are understanding that no country has total employment rates and resources are not homogeneous and constant the same with the technology used as it is dynamic when producing goods. Regarding trade, it takes place within countries with similar growth

and technological progress levels. Government plays an essential role as its intervention promotes trade and sets the grounds for new industries to grow and secure continuous industrialisation in the country.

The advantages and disadvantages can be explained below (Neary, 2009):

Advantages

- An early adopter of trade develops into the most advanced and potent business in a sector.
- With proper government support, industrialisation can take place in a nation.
- Government subsidies enable regional businesses to compete with
- global ones. It encourages like nations to engage in considerable trade among themselves.
- It promotes the globalisation of production.
- After a certain amount of time, local industries would cease to need government assistance and become competitive without state involvement.
- Entry barriers created by established and large corporations are so rigid that monopoly begins to impede the expansion of smaller businesses.
- Early adopters in the industry have complete control and can erect obstacles to entry for newcomers.

Disadvantages

- Government backing may potentially result in the growth of a vast, powerful business conglomerate, which could then generally become ineffective and harm the economy.
- Government support may backfire on trade growth of its lack of information on such issues.
- It encourages economies of scale, allowing businesses to expand and develop monopolistic tendencies.
- Because they lack economies of scale, less developed nations could struggle to compete.

3. METHODOLOGY

This chapter aims to supply the reader with the approach used during the thesis work to address the research problem and tackle the propositions and research questions previously introduced during the construction of the topic. It includes a system of beliefs and philosophical assumptions that shape the understanding of the research questions and underpin the choice of research methods (Melnikovas et al., 2018). Its purpose is to detail how the data was chosen to be collected by the researchers for further analysis. The series of steps to compel with the methodology is related to the knowledge-extracting strategy underlying how and in which context the data will be procured and investigated. It is also defined as the extraction of easily interpretable knowledge from a large amount of data, mainly described in texts related to Machine Learning (Finn et al., 2014).

During the research process, some types of assumptions will be made. This includes but is not limited to an assumption about the realities the researcher encounters (ontological assumptions), about human knowledge (epistemological assumptions) and about the extent and ways the researchers' values influence the research process (axiological assumptions).

A robust research methodology is required to answer the research questions. One robust framework for creating a sturdy research technique is the "research onion", which enables you to make a series of choices that allows methodical study. Our research philosophy was based on ontological, epistemological, and axiological assumptions. Ontology examines the nature of reality, while epistemology examines how we can examine reality. Ontological assumptions shape how researchers see and study the research object/subject. At the same time, epistemology refers to an assumption about acceptable, valid, and legitimate knowledge and how to communicate this knowledge to others. On the other hand, axiology refers to the role of values and ethics (Bjerregaard, 2021). Once the particular philosophy has been chosen, the research issue and philosophy can determine the best research strategy.

The philosophy of this research paper is based on interpretivism or constructivism and critical realism. Interpretivism refers to how humans strive to be intelligible or make sense of the world around us; concerns during this research process are linked to how it fails due to unforeseen reasons. It is common to take researchers to interpret politics and how power is undertaken and used. The nature of reality includes practices, and the same action can have different meanings contributed by different worldviews as a contribution (Saunders et al., 2019). Critical realism will be described further.

Reasoning from the general to the particular (Dudovskiy, 2022). This research paper merges with the principal points regarding a deductive search method process, a deductive insight concerning

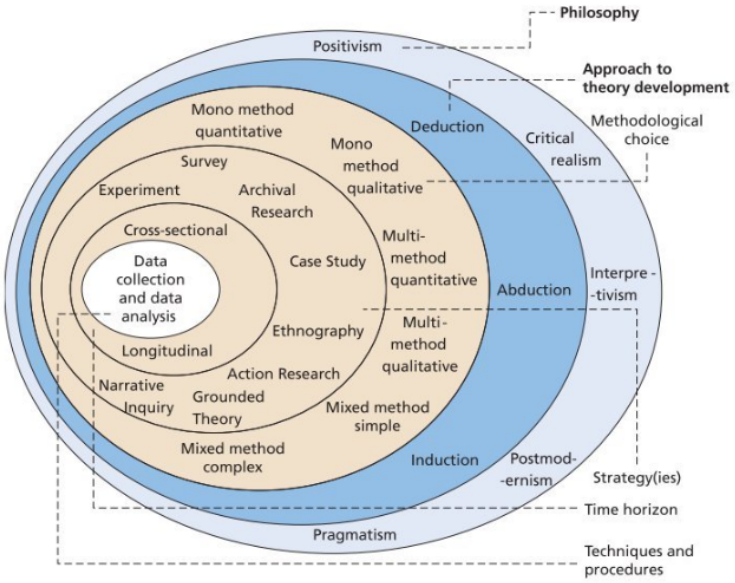
concluding from premises or, in this case, propositions. Experts will analyse the formulated propositions to confirm, reject, or modify the existing theory.

In this study, the researchers did not construct their propositions in isolation but against previous shocks' evaluations and government institutions' standard practices.

The Qualitative exploratory research design was selected as it aims to gain insights on how external shocks can affect and reshape the GVC, focused primarily on the agricultural sector as well as gaining insight on how different enterprises react to those changes, including the impact on specific characteristics of the product, i.e., the price. An exploratory study was promoted due to the researchers' inside connections with the Ukrainian agricultural market, thus limiting our limitations and enhancing the potential answers to our research propositions.

The construction of this chapter has its basis in the Research Onion proposed by Saunders et al. (2016).

Figure 7. Research Onion



Source: Saunders et al. (2016, p. 130)

The research onion consists of six main layers: 1) Research philosophy, 2) Approach to theory development, 3) Methodological choice, 4) Strategy, 5) Time horizons, and 6) Techniques and procedures.

1) Research Philosophy

We departed from the idea that for conducting the proper research, we had to engage and think critically about the current environment regarding GVCs and our social conditions in general. The research philosophy is the foundation of any study as it describes researchers' beliefs (Phair et al., 2021). It forms the basis of the research by delineating ontology – nature of reality, epistemology – nature, sources of knowledge or facts and axiology – values, beliefs and ethics of the research (Melnikovas et al., 2018).

Saunders et al. (2009) argued that the main philosophies in business and management research are positivism, critical realism, interpretivism, postmodernism and pragmatism. Critical realism is the one that the thesis has found most optimal to answer the different propositions. The remaining philosophies will not be discussed or described.

According to Bhaskar (2008), critical realism claims that the existence of present, past and future does not depend on our knowledge or experience of it – real entities exist independently of events, and events occur independently of experience (Adler et al., 2014). In the case of this research, there was no way to predict the extent of the COVID-19 pandemic and now the ongoing military conflict between Ukraine and Russia. Critical realism, for future studies, on the other hand, assumes the possibility of different futures which can be influenced by the present, at least to some extent; thus, it can be employed as an ontological position for scenario construction and analysis in areas such as institutions, culture, politics. The flexibility of the future is assumed and departs from the idea that the future is accurate; although not manifested yet, it consists of multiple possibilities and is actualised through transformative events. Therefore, participating actors can influence the future (at least to some extent) (Melnikovas et al., 2018).

Critical realism philosophy supports the use of mixed methods. The authors aim to start with qualitative research methods to explore different entities' perceptions and actions throughout the events that affected GVCs, followed by a quantitative analysis of officially published data.

2) Approach to the theory development

The primary data collection came from formal and academic documents regarding previous shocks as well as different interviews targeted at the people who have to take decisions in case of any and have the ability to foresee different scenarios and act accordingly.

According to Saunders et al. (2016), this part distinguishes three principal approaches to theory development: deductive, inductive and abductive and the best way to utilise the theory at the beginning of the research.

The deductive approach was utilised for this thesis to depart from general ideas to a specific application. Our propositions will be based on the information gathered and the writers' knowledge about the topic. The propositions' conclusion can either be sound (true) or unsound (false) depending on the truth of the original premises. Assuming the propositions are sound, certain conclusions can be drawn, but it is not allowed to make predictions about future or otherwise non-observed phenomena (Butte College, 2019).

Different theoretical frameworks are also used during the construction of the different propositions. Another reason to use the deductive approach is linked to the interviews with different experts.

3) Methodological approach

This part of the research onion model refers to the design or method used to acquire knowledge. There are two main types - quantitative and qualitative, and a third, primarily mixed methods.

We chose a multi-method (mixed methods) to gain data for this specific research project. Mixed methods research design forms part of multiple-method research integrating quantitative and qualitative data collection techniques and analytical procedures within the same research project. As the literature states, researchers using mixed methods have a pluralist view of research methodology; in other words, flexibility when using combined qualitative and quantitative research methods is accepted (Saunders et al., 2019). For this project, we focused primarily on analysing qualitative data from both primary and secondary sources, helped by data in a quantitative form due to the nature of the research project, also from primary and secondary sources. One of the partners of this thesis helped with the creation of quantitative data used as a reference. Mixed methods design allows for flexibility during theory development example, using quantitative or qualitative research to test the different propositions followed by qualitative or quantitative research to develop an enhanced theoretical understanding, also providing a more precise, clearer research direction (Saunders et al., 2016).

Some of the characteristics of mixed methods include qualitative and quantitative techniques combined in various ways ranging from simple to complex. Those combinations also have a name in the literature reviewed. Referring to this research project, the quantitative part comes from analysing graphs and statistics that use numerical data. In contrast, the qualitative side comes from interviews

and secondary data categorised without numerical information as a little explanation. Some qualitative data is analysed quantitatively. The benefit of the qualitative approach in this study is that the research focuses on historical events and the different processes and significant events resulting from those shocks.

4) Research Strategy

This layer refers to the strategy the researcher has employed to answer the propositions or research questions, in other words, how the researcher aims to carry out the work. It involves using experiments, surveys, archival research, case study, narrative inquiry, grounded theory, action research and ethnography.

To collect primary data on possible scenarios regarding global supply chains of wheat and other cereals, this thesis collected data from surveys to the authorities in charge of producing quantitative information about a specific country involved in the process: Ukraine. The data collection was broadened by using archival and documentary research primarily produced by the governments of Ukraine and Russia. Some documents have been translated from the original languages into English, including national reports, publications and statistics produced by other governments involved who have also been hit by the current shock. The information produced by the government was compared to the national numbers produced by the local authorities.

Although the surveys and interviews require longer preparation times and are more resource-oriented, they played a significant role when the information had to be validated against theory and archival research - history.

5) Time horizon

The two main categories of this layer are cross-sectional and longitudinal, also known as successive independent samples, all referred to as timeframes. The longitudinal refers to studying a phenomenon over time, while the cross-sectional is similar to a snap-shot study (AESA, 2020).

The shocks involving the GVC are explained throughout the years; therefore, the timeframe that best approaches this study is longitudinal. Different shocks have affected the world at different time frames, with consequences visible over an extended time, with history repeating itself.

6) Data Collection and Analysis

The inner or final layer of the research onion references tactics linked to aspects of the finer entails data collection and analysis. Critical decisions at this stage include target population, sample size, sampling method, data collection method (interviews, questionnaires), data analysis techniques, ethical issues, and research methodology limitations. A more extended description of the aspects belonging to this section is described as follows (Clifford et al., 2014):

A. Data collection tools and procedures include scale, questionnaire, and mail survey, among others, where procedures can include scale construction, interviews, focused group discussion and more.

B. Study Area compels a brief description of the study area and the reasons behind the researchers' decision.

C. Research population and sampling procedures involve the description of the following: a) Inclusion/exclusion criteria; b) Sample size; c) Sampling method; d) Sampling plan characterised by flow chart with a table indicating sample details; e) Sourcing samples which describe the source of the study samples; f) Sample limitations.

D. Study phases. The aim was to illustrate the research's multiple phases of this research, including some time off due to personal situations for both researchers.

E. Statistical analysis mentions all the statistics tools and software(s) used to analyse the research data in the thesis.

F. Ethical considerations involve all ethical aspects considered in the study that needed to be planned and mentioned, including respondent consent and how sensitive information (in the synopsis) was elicited, if any.

The interviewees will have an anonymous role and be coded with the letter "R", followed by a number. A total number of five interviews were conducted to enhance the validity of the research project. All the interviews conducted were consented to together with the responses. The interviews were sent digitally to the interviewee for approval before publication.

An essential step in the analytical process of evaluating qualitative research is coding qualitative data. This process will be done after the transcript production. Qualitative coding enables the reader to understand, arrange, and structure the researcher's observations and interpretations into valid theories when producing data using qualitative methods like semi-structured interviews. In this regard, it is easier to be reflective, critical, and rigorous when analysing the results of a qualitative study by using coding (Rabinovich and Kacen, 2013).

The transcription of the interviews will follow the intelligent method, meaning pauses, filler and stutter words will be filtered, cleaning the grammar.

Interview Protocol. A series of interviews have been designed to contribute with the data collection process. The people selected for the interviews were assessed depending on the expertise in the Ukrainian agricultural sector. Six people were selected and four accepted to give interviews. Firstly, data was collected and analysed to give an understanding of the overall situation prior and during the disrupting event. The first part of the interview aimed to provide an understanding of how things were working and how previous observed disruptions affected their Value Chain (VC). The rest of the interviews was designed to understand the current disruption, the effects and the possible solutions experts in the matter are trying to come up with. Since the disruption is an ongoing process during the creation of this research project, a post disruption assessment can't be done but instead the experts have made a series of recommendations to ameliorate the consequences of the situation.

Data Analysis. On completion of overall four hours interviews in the form of voice recordings and after transcription of the data was done to interpret the results of the interviews, the authors used a hybrid method involving deductive and inductive coding to analyse the data and create the initial names of the coding. The mixed method was used since we knew in advance the topics were relevant for this interview and the questions were tailored to cover the topics to be explored however, during the interview new information was found needing the inductive method as the findings suggested topics for further development and further research.

The analysis of the data involves both seeking both commonality and variability across all the interviews. All the responses will be compared with each other in the Discussion chapter allowing us to gain an overall image on the impacts of the ongoing full invasion to Ukraine in the supply chains not only in the country for its effect worldwide.

The propositions gathered as recommendations from specialists will be used to understand the further implications if the situation doesn't improve and the long-term effects.

Manual Coding. The coding used it is called structural coding, we have categorized the text in sections according to the research topic and subtopics we were trying to analyse. The literature recommends this type of coding when specific research questions and topics are essential of a semi-structured interview. During the coding process, three different rounds were made to code the data and then we proceeded with pattern coding for the last rounds. The authors were focused on specific information to contributed to the overall research project to later draw conclusions that sustain the previous research.

The steps we followed was first transcribing four hours of interviews. Later on, we created initial codes and continue adding codes as we saw fit using the inductive and deductive method. We then brought together all the information associated with the code and we gave it a colour. Since the information we are related to an ongoing process where changes are not still public and available, new knowledge and understand deeper the knowledge gathered throughout the interviews. Pattern coding is a useful second cycle approach to facilitate the process of refinement (Saldana, 2009).

The coding process was separated into two stages to contribute to the validity of our final narrative. Pattern coding helped us guiding us through the research process to draw the final narrative conclusions. The interviews were first described in the methodology and the coding reassures the reliability and validity of this research project.

7) Validity, reliability and generalizability

These concepts are used to evaluate the quality of the research. Validity explains the extent to which the results measure what they are supposed to measure. Reliability refers to the degree to which the findings may be repeated when the study is conducted under the same circumstances; however, validity cannot be guaranteed solely by reliability. A test may not precisely reflect the real world, even if it is reliable. It is always necessary to replicate a study in another context or context to establish such statistical generalisability (Saunders et al., 2019).

Reliability has two dimensions, internal and external. Internal reliability refers to consistency during the research. At the same time, its counterpart references the data collection techniques and the degree to which other independent research could replicate the same results using similar data collection techniques (Saunders et al., 2016).

Two authors write this thesis; one has some knowledge and previous experience within the agricultural sector, but the second has no previous knowledge. This difference in information enhances the natural internal reliability and decreases biases.

Regarding external reliability, the thesis has conducted most of its investigation based on government and institutional databases, well-known worldwide organisations and previous research papers from databases accessible to researchers and students. It ensures that another independent researcher could easily replicate this research and achieve the same conclusion using a translator for the information not produced in English.

Validity also possesses two different dimensions, internal and external. Internal validity refers to the accuracy of the data in answering the research questions linked to a topic under the research

process. In contrast, external validity is linked to whether the research can be generalised to other groups or settings (Saunders et al., 2016). To maintain the validity of this research, the question of whether the information gathered is sufficient to answer the research question has been raised throughout the entire research process. To maintain the goal of high validity government sources, well-known and worldwide organisations highly recognised and previously reviewed and published articles in academic and non-academic sources have been investigated. This is also complemented by a series of interviews with experts in the matter who are heads of departments linked to the topic of this investigation. The qualitative research project has also been coded to increase validity by providing structured data that was examined systemically and decreasing biases. Coding the transcripts also enables the researchers to evaluate the analysis and prevent the researcher from representing one person or a group of them, enhancing transparency and helping other researchers to review the analysis methodologically and systematically. Both participants agreed on the codes developed, increasing the project's validity.

As an example of external validity adapted to qualitative research, the literature suggests how findings from one qualitative research setting may lead to generalisations in other settings where characteristics of the research setting are similar or where learning from the research setting can be applied in other settings (Buchanan, 2012; Saunders et al., 2016). External validity has been achieved by comparing the similarities within historical events and the difference between the mechanisms that alleviate the issues within the value chains. Regarding the generalizability of this research, this thesis acknowledges that investing in the different disruptions is challenging because GVC is a relatively new phenomenon whether different shocks have previously hindered value chains at a domestic level. Information on COVID-19 and the recent outbreak of geopolitical events are events in the process; therefore, information is on the verge of being created and restricted in some contexts since politics are not always straightforward. Because of this, the generalizability of the results of this research can be debatable. This is not discouraging but a natural part when investigating a subjectively defined phenomenon.

Triangulation in research refers to the usage of multiple datasets, methods (previously described), theories and investigators (experts' interviews) (Bhandari, 2022). Since the authors chose mixed methods research, it is safe to conclude that methodological triangulation has contributed to the validity and credibility of the findings in a continuous effort to mitigate the presence of research biases for this project. The findings' reliability and validity rely on developing a solid study design, picking suitable techniques and samples, and carefully and consistently carrying out the research.

Reliability and validity should be considered in quantitative research while developing the study design, selecting the methodology, and summarising findings.

8) The researchers' role

Consideration of the researcher in deciding how to formulate a research design is related to the role of a researcher (Saunders et al., 2019). One of the researchers could be considered an internal researcher since she had internal access to some of the people within the organisation, and the trust led to access to them. The researcher is based outside Ukraine and does not participate in any organisations that collect data from the interviews. We tried to avoid any negative implications on how the research was conducted and aimed at reporting the entire content.

The ultimate goal of this exploratory inquiry was to gain information that could potentially lead to assumptions which explain, together with the data gathered, the reasons and potential effects of similar disruptions in the future. The latter is supported by Lincoln and Guba (1985), who state that in exploratory research, social phenomena are investigated with minimal a priori expectations to develop explanations of these phenomena. A military conflict is affecting the GSC, one of the leading worldwide producers and exporters of wheat and poultry meat.

The principle of an exploratory approach is to add to the existing knowledge base. In case of an ongoing military conflict, most of the information is in the original language (Ukrainian). This way, it will be available to non-Ukrainian speakers, academic databases, and government databases and understanding the perception of the current situation from the eyes of the experts who oversee the agricultural sector in specific countries like Ukraine. Leaning toward the impact of the current situation regarding lack of cereal due to the ongoing military conflict between two major cereal-producing nations, it is expected that the potential problems hindering food security can be addressed as the most vulnerable population is the one who suffers these disruptions the most.

The qualitative methodological approach allowed the researchers to elaborate propositions, describe and interpret the shocks and lay them throughout a timeline to analyse later the nature, impact and previous core of action shown historically.

9) Limitations

Since the military conflict in Ukraine is still ongoing, it is believed that the respondents could have potentially withheld some information that could compromise their position within the organisation, hinder the nation, or give away information that could be used against Ukraine.

4. DATA ANALYSES

The place of Ukraine in the world as a “breadbasket" has become more evident during the ongoing military conflict between Russia and Ukraine. Based on the literature, the country is a net cereal exporter worldwide. The use of secondary data and interviews shows the extent to which Ukrainian agricultural sector is part of global agricultural supply and its supply chain structure.

The following is a reflection on the data available, from the interviews with experts from the market and secondary sources of data that shed light on the agricultural sector of Ukraine and its involvement in the AGVC.

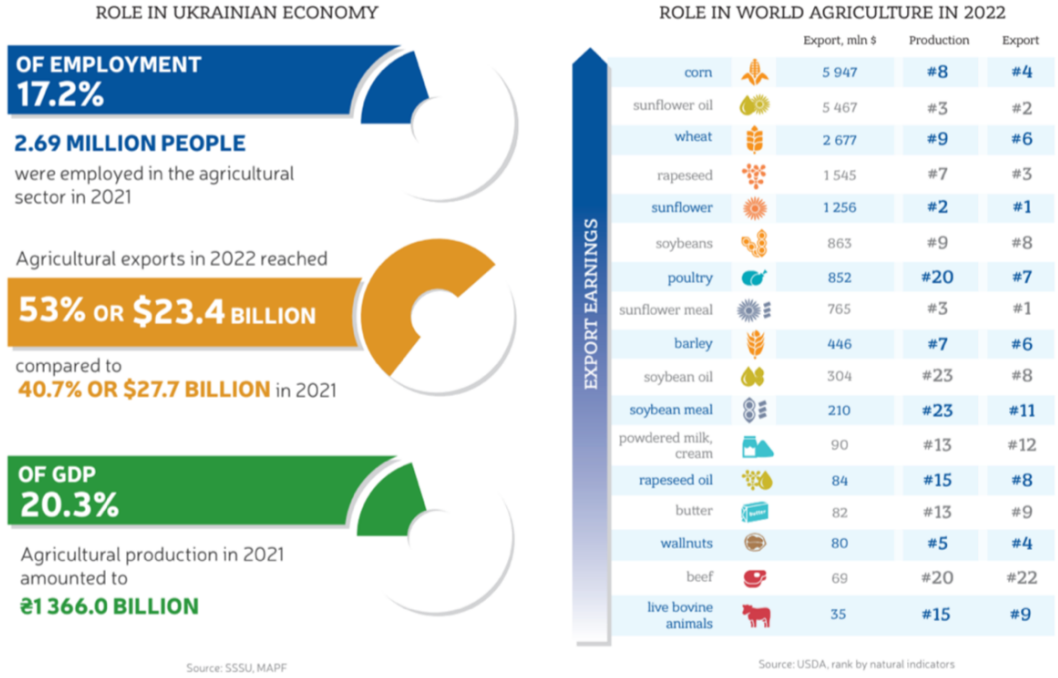
4.1 The agricultural sector of Ukraine and its involvement in AGVC

In terms of territory, Ukraine is the second-largest country in Europe after Russia. Around 42.2 mln ha, or 70% of the country's territory, is used for agriculture. With access to the Black Sea and direct routes to key markets in the EU, CIS, the Middle East, and North Africa, the agricultural sector is a significant part of the Ukrainian economy. The country has emerged as a major player on several agricultural markets (Nykolyuk et al., 2021).

Ukraine's soil, climate, and water are rich in natural resources and ideal for agricultural usage. Around 40 mln ha of the country's land is used for agriculture, of which roughly 33 mln ha (or 80%) is arable. More than half of this area comprises deep black soil called chernozem, extremely rich in nutrients. Agriculture can potentially be a significant “driving force” behind the growth of the Ukrainian economy. However, in the 1990s, the agricultural industry experienced a sharp collapse. After ten years of underperformance, the situation began slowly changing in 2000 (Nykolyuk et al., 2021).

For the Ukrainian economy, agriculture is a crucial sector. It generated 20,3% of the nation’s GDP in 2021 and accounted for 40,7% of Ukraine’s exported goods and products (in terms of value, 27.7 bln USD) and for about 17,2% of all jobs (UCAB, 2023).

Figure 8. Role of Ukrainian agricultural sector in economy and world agriculture in 2022



Source: UCAB, 2023

A respondent one (R1) commented:

The involvement of the Ukrainian agricultural sector in the AGVC is considered very important, referring to it as a global supplier. The country's relevance has become significant in the last fifteen years. The main products are commodities such as wheat, corn, barley, sunflower, and rapeseed, among other oil cultures. Ukraine's global market share is not as significant regarding processed products derived from raw materials such as flour, bread and other deep-processed products. In 2022, the value exported to the world for cereals and corn reached 18 bln USD, while its contribution to the global export of beef, pork and live animals severely decreased. (R1)

Structure of the Ukrainian agricultural sector

The output of crops has dominated Ukrainian agriculture for the past ten years and has increased relatively steadily. For instance, between 2000 and 2019, the production of cereals rose from 23.8 mln t to 74.1 mln t and oilseeds from 3.7 mln t to 22.2 mln t. Almost 79% of the total agricultural output in 2019 comprised crop production. Maise, winter wheat, winter barley, sunflower, soybeans, and rapeseed are the principal crops (SSSU, 2020b). Winter wheat, sunflower, and maise comprised most

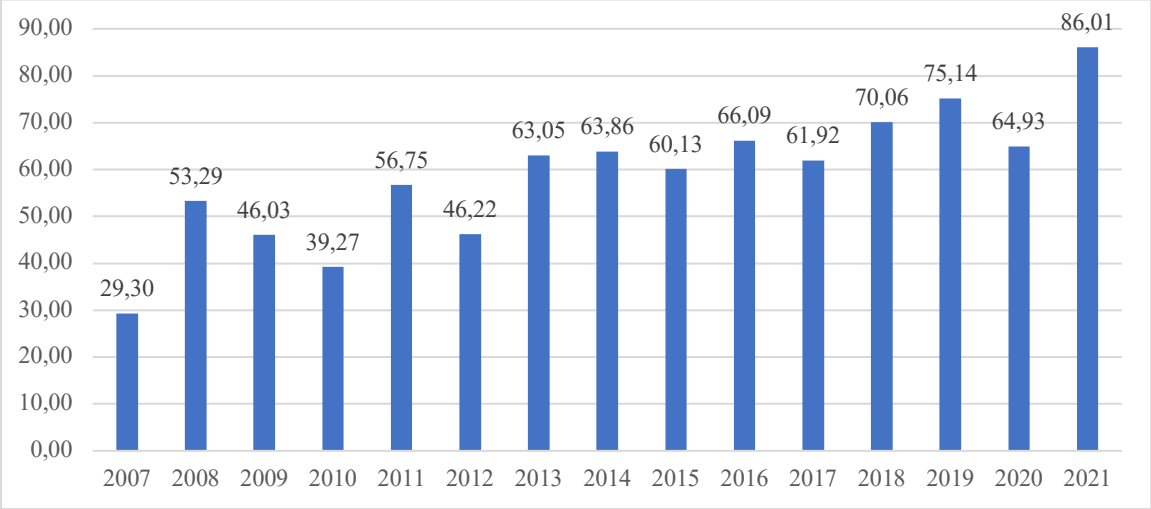
crops grown between 2015 and 2019 on about 70% of the total amount of arable land (Nykolyuk et al., 2021).

R1 and R3 commented:

The Ukrainian agricultural sector is large in terms of size, conglomerating by different sizes of producers: small, medium, and big. One company in the Ukrainian agricultural sector, called Nibulon, has its fleet. (R1)

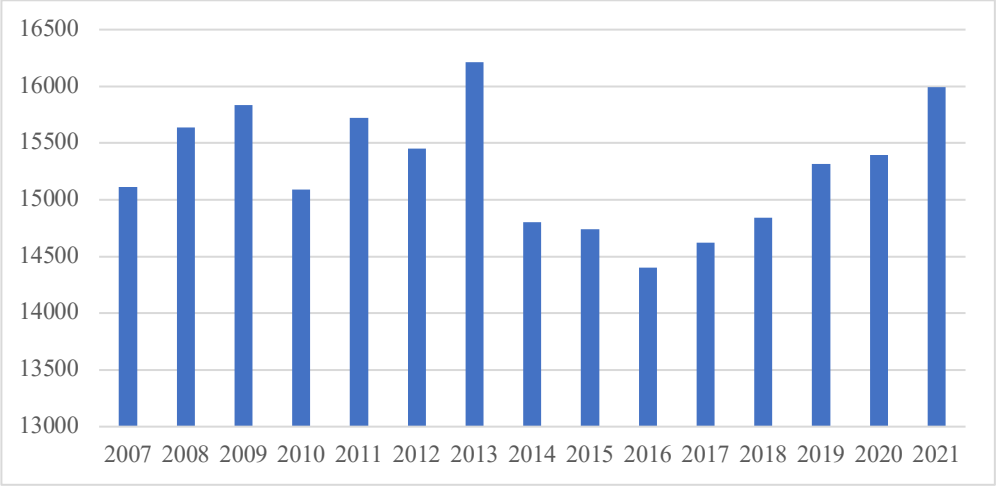
In Ukraine, roughly 1mln ha are cultivated (operated) by transnational companies. That represents roughly 3.5% of the total arable land in Ukraine. (R3)

Figure 9. Cereal and leguminous crops production in Ukraine, mln t



Source: SSSU

Figure 10. Planted areas of cereal and leguminous crops, thous. ha

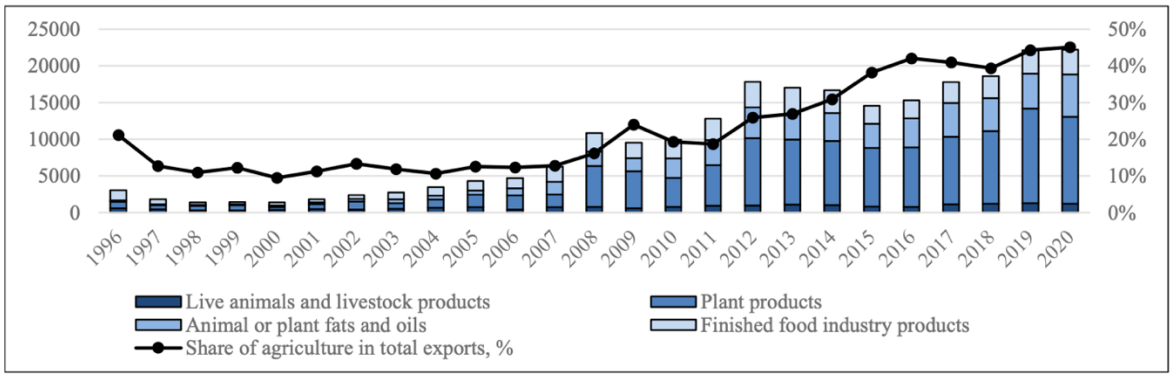


Source: SSSU

Both the agriculture sector's growth and the economy of Ukraine are interdependent. Nearly two years after the start of the military conflict in Eastern Ukraine, which resulted in the destruction of various production facilities and infrastructure in the Autonomous Republic of Crimea and the Donbas region, as well as the alleged "trade war" with the Russian Federation (Decree, 2015), the GDP of Ukraine decreased by 50.3% in comparison to the year before the crisis. However, the gross domestic product of agriculture decreased less, at 31.7%. Its percentage of the GDP increased from 8.8 to 12.1%, respectively. The agriculture industry partially mitigated the economic downturn's consequences by benefitting from exports due to the depreciation of the local currency. The economic crisis of 2014–2015 has also led to a 40.7% drop in agricultural investment in 2015 compared to 2013. The economy only partially recovered by 2019. GDP estimates between 2013 and 2019 differed by -16.1%, gross agricultural product by -14.3% (in current USD), and investments in agriculture were almost at 2013 levels (Nykolyuk et al., 2021).

Role of international trade. Exporting agricultural products injects significant amounts of foreign currency into the Ukrainian economy. Recent years have seen export earnings surpass 22 bln USD, equal to 45% of the nation's overall foreign earnings. The figure shows that crops, which have consistently produced more than half of agricultural export revenues over the previous ten years and are followed in the structure of export revenues by the export of fats and oils with 21-27%, are the primary driver of export growth. These changes made Ukraine a significant player in the world's vegetable oil and crop markets. In recent years, domestic exporters have contributed roughly 9% of world exports of wheat, 13% of corn, 14% of barley, 15% of rapeseed, and 44% of sunflower oil (Gagalyuk et al., 2022).

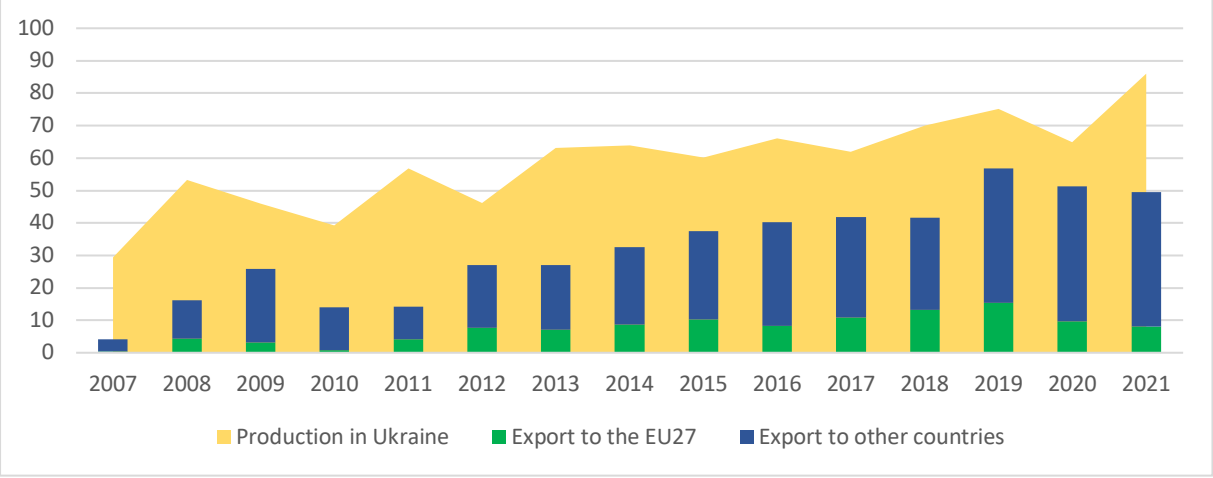
Figure 11. Agricultural exports by major groups of products, mln USD



Source: Gagalyuk et al., 2022.

Notably, after the implementation of the DCFTA between Ukraine and the EU in 2014, a diversification of Ukrainian export destinations has occurred. The percentage of CIS nations declined from 29.5% in 2014 to 10.7% in 2021 in the structure of Ukraine's overall agricultural exports, while the EU's part climbed over the same period from 31.8% to 38.6%. Between 2017 and 2021, Ukraine's agri-food exports to the EU fluctuated around an average of 31.5% of its overall exports, while exports to the CIS countries comprised an average of 6.6%. Agri-food exports from Ukraine increased from 44.7% of total exports in 2017 to 50.3% in 2021 to Asian nations. Ukraine now enjoys a trade surplus with agricultural products worth 20.1 bln USD in 2021 compared to 1.6 bln USD in 2005 (Gagalyuk et al., 2022).

Figure 12. Cereal production in Ukraine and its export, mln t



Source: TradeMap, SSSU

With the quadrupling of agricultural exports and their proportion in overall Ukrainian exports during the past 15 years, the development of Ukrainian agriculture must be viewed as a success story. This progress was made possible by easy access to capital, contemporary technology, and widespread support for agricultural expansion (Gagalyuk et al., 2022).

Respondent 3 and 4 discussed:

For Ukraine joining the WTO marked the beginning of a new era for Ukrainian products, the 2008 alliance set the internal market conditions closer to international rules, and investments started to play a significant role in the sector's development. Ukraine's favourable climate and fertile land make the place particularly good for agriculture. After joining the WTO, the European Bank of Reconstruction and Development, the World Bank and different commercial banks from other countries became significant investors. The financial instruments push the sector to higher standards

making products available to enter international markets. EU, Canada, and USA started to be in the country's portfolio as importers of their products. Around 500 companies in Ukraine have permits to export their products to the EU and other countries that accept EU certifications.

FTAs have enabled Ukraine to increase its participation in international trade and expand its market access to agricultural products. One of the most important examples is the EU-Ukraine Association Agreement. The agreement facilitated the increase of trade between Ukraine and the EU. DCFTA (its trade part) came into force for Ukraine as a unilateral autonomous preference from the EU side in 2014, but the FTA was enacted in 2016.

In general, FTAs and FDIs positively impacted Ukraine's participation in the global agribusiness value chain by improving the regulatory environment, increasing product quality, enabling market access, and bringing in new technologies and management practices. (R3, R4)

Foreign investments. Both domestic and foreign private agricultural investments have grown in absolute terms during the previous ten years. The percentage of agricultural in total FDI inflows increased from 2007 to 2015, reaching a high of 2.3% in 2009. Agricultural investment as a percentage of all FDI ranged from 1.1 to 1.4% from 2015 to 2019. As a result, Ukrainian agriculture receives higher percentages of overall FDI than other EU members, like Germany (not more than 0.03%) and Poland (around 0.5%) (Gagalyuk et al., 2022).

The largest source of FDI in Ukraine comes from European nations. The sector also sees active investment from investors from China and the Gulf nations. Notably, Cyprus, where most Ukrainian firms are registered, continues to get the lion's share of FDI inflows. Notwithstanding the nation's tremendous agricultural potential, investors may encounter significant risks in Ukraine. Rapid political turnover in the nation results in erratic regulatory changes that impede long-term investment and short-term, fluctuating policies (Gagalyuk et al., 2022).

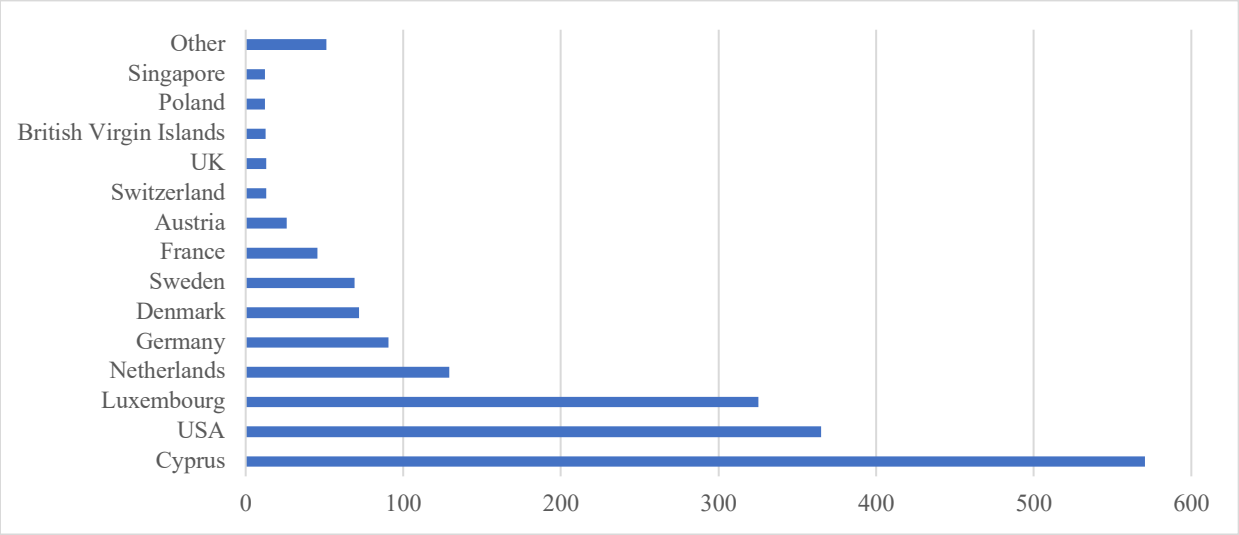
Table 2. FDI in Ukraine, mln USD

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fisheries	n/a	n/a	n/a	50	6	-8	59	-160	625	388	281	-55	29	182	1 209

Source: SSSU, NBU

The negative indicators of FDI indicate that international investors generally withdrew their investments from the agricultural sector and Ukraine.

Figure 13. FDI agriculture, forestry and fishery in Ukraine, 2021, mln USD



Source: NBU

Respondent 4 explained:

When it comes to FDI, besides financing, foreign investors have brought to the sector new technologies, management practices and benchmarks, which have helped to improve agricultural productivity and quality. For example, foreign investors have been involved in modernising Ukraine's grain storage and processing facilities, increasing grain exports' efficiency. FDIs have also enabled Ukraine to diversify its agricultural exports and maybe even move up the value chain. For example, foreign investors have helped to develop Ukraine's poultry and dairy industries.

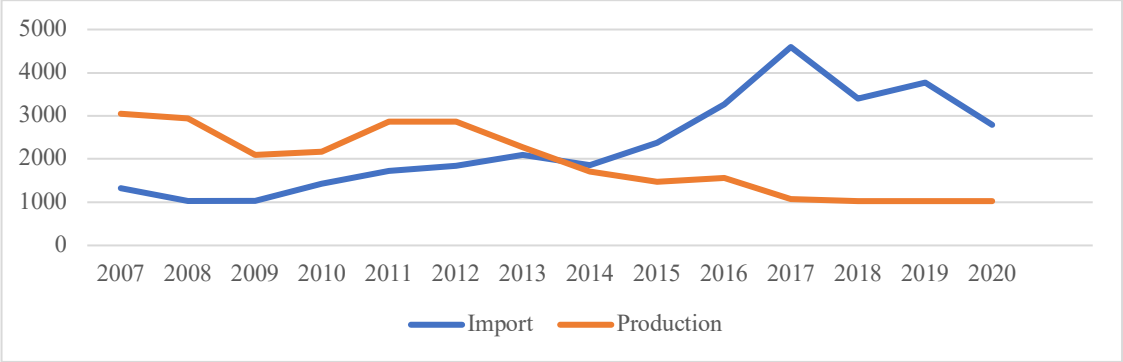
The investments transferred resources and knowledge to the smaller enterprises in Ukraine. Ukrainian agricultural companies started to be listed in the Stock Exchange market, mainly in Warsaw and London, considered one of the biggest news. (R4)

4.2 Inputs of Ukrainian cereal AGVC

Operating logistics and production, availability of inputs and access markets, and a well-thought-out and responsive regulatory environment are all necessary for a well-functioning food supply chain, as stated in the European Commission (2023). Taking part in the GVC is designed to give access to previously unheard-of information, cash, and, especially, sophisticated inputs flow that can hasten and broaden the process of structural change and income creation (Montalbano and Nenci, 2020). Palm (2022), among the inputs of the agricultural sector, notes the following: seeds, plant protection products, fertilisers, energy, equipment, and machinery.

Fertilisers. Fertilisers are supplied to Ukrainian farmers from domestic production and imported from third countries. Moreover, over the past 15 years, the volume of domestic fertilisers has dropped, while the volume of imports, on the contrary, has increased by more than 2.5 times. The most significant international suppliers of fertilisers for Ukraine are Belarus, Lithuania and Poland. More information about the suppliers of fertilisers to Ukraine is in the Annex.

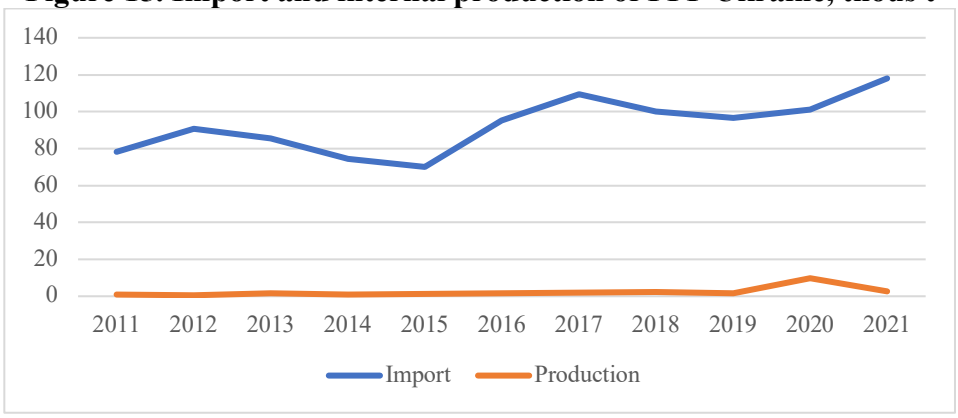
Figure 14. Import and internal production of fertilisers in Ukraine, thous. t



Source: FaoStat, TradeMap, own calculations

Plant protection products (PPP). Domestic production of plant protection products in Ukraine is relatively small and unable to meet domestic demand. Therefore, the volume of imported products from abroad significantly exceeded domestic production volume in recent years. The leading suppliers of such chemicals are China, France, and Germany (see Annex).

Figure 15. Import and internal production of PPP Ukraine, thous t



Source: SSSU, TradeMap

Machinery and equipment. There is insufficient information to compare Ukraine's machinery production and import levels. However, according to UCAB (2019), 70% of the machinery used by agricultural producers was imported. This indicates that Ukrainian farmers prefer imported machinery

even though it is more expensive yet represents more advanced technology. Germany, the USA, China and other European countries are leading agricultural machinery and equipment suppliers to Ukraine.

Seeds. In 2019 UCAB also stated that there was a trend toward strengthening the position of European businesses in the cereals seed market of Ukraine. This was especially true for wheat and barley seed varieties imported by Ukrainian producers that operate in the West of Ukraine. However, UCAB (2019) also stated that the share of imported seeds for cereal production is minimal. Thus, seed import volumes remain small due to the high price for Ukrainian farmers' relatively low stability when hibernating.

Energy. High levels of energy are absorbed by agriculture, either directly with fuel, gas, and electricity or indirectly with agrochemicals like fertilisers, plant protection products and similar chemical products. Many fertilisers are manufactured through energy-intensive processes or are made from natural gas. Diesel is also crucial in functioning tractors, trucks, and autos. Ukraine significantly relies on imports to supply its demand for liquids, including petroleum (Stepanov, 2022). Around 70% of Ukraine's liquid consumption was covered by petroleum imports and other liquids in 2020. Just 74,000 barrels per day (b/d) of liquids, including petroleum, were produced in the nation. Most of Ukraine's petroleum products are imported from Belarus, Russia, and Germany. The only operational refinery in Ukraine is the Kremenchuk facility, supplied by imported crude oil, which is increasingly coming from Azerbaijan and Kazakhstan (EIA, 2021).

Logistics. In 2018, Ukraine's score on the World Bank's Logistics Performance Index was 2.83, while the highest score among the chosen European, Gulf, US, and Japanese countries was 4.2 (Arvis, 2018). The infrastructure in Ukraine is sufficient to enable the exports of agricultural products. The primary transportation routes in Ukraine are rail and road. Although less common, river shipping still has much potential. Most exports and imports took place through seaports along the Black and Azov Sea coasts.

Table 3. Structure of export of agri-food products from Ukraine, thous. t

	2020			**2021**		
	Ports	Land	Total	Ports	Land	Total
Agri-food products	69,4	4,9	**74,2**	65,2	4,1	**69,3**
Cereals	50,9	0,4	**51,3**	50,5	0,2	**50,7**

Source: SCSU

Figure 16. Sea and river ports of Ukraine

Source: Ministry of Infrastructure of Ukraine

Respondent 3 said:

Ukraine has a high level of technological involvement in the Agri sector, and it is driven by new technologies available in the market. The development in the sector was correlated not only to financial instruments but also to the availability of seeds, PPP (plant protection products), fertilisers and machinery. (R3)

4.3 Risks affecting Ukrainian cereal AGVC

All respondents, i.e., R1-R4, stated:

In terms of risks, the principal risk that was described during the interviews is climate change. The impact has been to the extent that in some regions, mainly in the south, like Kherson, the climate has changed to a subtropical climate, so farmers have had to adapt the cultures incorporating plants that would naturally survive in the new climate. Irrigation has now become a problem since they lack a water supply.

Another risk they face is the lack of wheat diversity. Ukraine is primarily known to produce soft (winter) wheat. Hard (summer) wheat, or wheat for pasta, requires more work, and Ukraine lacks the inputs to become a producer. Corn is another crop that Ukrainian farmers produce mostly for feeding purposes. Although farmers understand it would be more profitable to produce white corn, they lack the finances for the switch and the mindset.

The lack of financial instruments for farmers to develop their farming activities has been widely pointed out, which is primarily a problem for small farmers. (R1-R4)

4.4 Disruptive events and their effect on the agricultural sector of Ukraine

All interviewed, i.e., R1-R4 commented:

R1 – R4. The major disruptions mentioned during the interviews were primarily 2008 - 2010 and COVID-19. It was described that Ukraine had not had sanctions in the agri sector nor investigations in charge of the WTO. The 2008 significant impact in the country was directed to the exchange rate as their currency, the hryvnia, devaluated against the Euro and Dollar, making the repayable of loans hard together with an increase of the interest rates. Sector-wise, the country was not reported to have experienced a significant impact as the production was not stopped.

The social-economic crises in 2014 resulted from peaceful protests due to a pro-Russian government and before the Association Agreement with the EU signing. The internal instability led to a crisis in the market.

The international grains arrangement was created in 1968 by the UN to ensure wheat and wheat flour supplies to importing countries/exporting countries and to keep stable markets. Ukraine joined in 1992 as their first attempt to create a solution to the internal market.

Regarding COVID-19, the risks were mainly considered outside, as trade policies during the pandemic reflected uncertainties and unpredictability in societies connected to health protection policies. The internal market in Ukraine changed as consumers changed their food preferences to healthier ones. However, the agri sector did not see significant changes. (R1-R4)

4.4.1 Global financial crises

The global financial crisis impacted the region's economy through decreased capital flows, including a fall in investments, domestic output and exports. Because of a lack of trust between financial partners, the banking system's assets lost value due to fewer capital flows, and cross-border lending decreased. The currency rate devaluation had an impact on inflation as well. For instance, costs rose by almost 25% in Ukraine (Swinnen and Van Herck, 2009). The availability of credit for banking institutions as well as the availability of bank loans for producers or trade enterprises, has undoubtedly been impacted by the crisis. The Ukrainian agribusiness community identified significant issues with financing and lending for all agri-food production and distribution chain actors, as well as their operational effectiveness, asset renovation, and investor involvement. Ukrainian agricultural firms' and farmers' weak financial standing negatively impacted the demand for mineral fertilisers, plant protection agents, machinery, and others. (Artiushyn et al., 2011).

Due to favourable weather, the 53.3 mln t grain harvest in 2008 set a record for Ukraine's independent era. Producers could complete an effective seeding season due to selling the grain cultivated in 2008. However, a 2009 crisis reduced demand. Grain prices decreased as a result, first and foremost, for domestic consumers. As a result, agricultural producers' circumstances significantly deteriorated in 2009, particularly during the harvest when they needed to buy machinery for fuel and during the autumn sowing season. It impacted the seeding season for the harvest of 2010 (Artiushyn et al., 2011). The main causes were a decrease in grain prices, a downturn in grain demand on domestic and international markets, and banking institutions' unwillingness to lend money to farmers. All small and medium cereal producers saw a worsening in their positions, although the crisis had little to no impact on large agricultural producers (agri-holdings). Many farmers, particularly agri holdings, downsized their lands to cut costs (Swinnen and Van Herck, 2009; Artiushyn et al., 2011). Given the robust harvests in 2008 and 2009, the primary buyers of grain, traders through which grain is exported, saw a relatively favourable influence on grain supply.

Due to the domestic market price decrease, many claimed benefits from the turmoil. Also, while operating in Ukraine, many traders are subsidiaries of major worldwide corporations. Estimates for Ukraine's grain exports in the 2009–2010 MY ranged from 16-18 mln t yet could have approached 20 mln t. (Artiushyn et al., 2011). Nevertheless, the agri-food sector represents one of the most significant segments of the Ukrainian economy, and the global financial crisis has only increased its importance. It is the only sector of the economy that showed growth in both production and sales throughout the challenging 2009. Due to the collapse of other producers or their acquisitions, the crisis allowed most chains' financially solid actors to strengthen their positions (Swinnen and Van Herck, 2009; Artiushyn et al., 2011).

During the peaks of global market prices in 2007/2008 and 2010/2011, numerous countries intervened in the export markets for agricultural products. Fifteen nations-imposed export restrictions on wheat in 2007/2008, including principal wheat exporters, including Kazakhstan, Russia, and Ukraine. With the publicly declared goal of reducing exports that were prompted by the exceedingly high market prices worldwide to secure adequate supplies of cereals in the domestic market, Ukraine imposed constraints on grain exports - the government imposed cereal export quotas as part of a licensing system (Götz et al., 2013).

4.4.2 Military conflict in 2014, the annexation of the Crimea Peninsula

Ukraine faced the most formidable difficulties of the twenty-first century in 2014, such as the economic downturn, the military conflict in the East of Ukraine, and Russia's annexation of Crimea. President Yanukovych was overthrown by widespread demonstrations, which also caused a geopolitical tilt toward Europe. As a result, Russia responded harshly and annexed the Crimean Peninsula in Ukraine, sparking a military conflict that seriously harmed the Ukrainian economy. The real GDP shrank by 6.8%. Except for agriculture and services, all sectors saw a decline in real gross value added due to the violence in the country's east (IER, 2015). Intense fiscal pressure, financial constraints, and escalating inflation caused a 10.8% decline in domestic demand. As real imports decreased more than exports, net real exports positively impacted economic growth. High levels of economic and political unpredictability generated a substantial rise in the demand for foreign money, which sped up the currency's depreciation. The Ukrainian government faced challenging fiscal policy choices throughout the year due to the country's necessity to spend money on security and the military in the face of low budget revenues. However, the Association Agreement with the EU, which spells out Ukraine's responsibilities for future changes, was finally signed in 2014 (IER, 2015; UCAB, 2015). Although agricultural output rose by 2.8% as a result of a peak crop harvest (63.8 mln tons of grains and legumes in particular) and a growth in livestock production, exports of agri-food products declined by 11.5% as a result of Russia's import restriction on a range of Ukrainian goods (IER, 2015; UCAB, 2015). The EU-Ukraine Association Agreement's implementation, which also came with the free trade agreement and required specific reforms, primarily shaped the Ukrainian agricultural policy in 2014. At that time, the share of the EU in international trade with Ukraine did not increase rapidly; instead, it was building slowly but steadily (IER, 2015). Due to increasing sales to Egypt, Spain, Pakistan, and North Korea, grain exports—Ukraine's primary agricultural export commodity — rose by 21.1% (up to 1.9 bln USD). As further financial resources were unavailable or channelled into less risky industries than the agricultural sector, the overall financial position could be described as highly challenging. Since the markets for external borrowings were blocked, it was important for investors, farmers, and politicians to collaborate and develop shared solutions. The credit crisis was anticipated to worsen and impact the entire economy and the world grain market, as Ukraine is among its major players. (UCAB, 2015).

4.4.3 COVID-19

On March 3, 2020, the first case of COVID-19 in Ukraine was formally reported, and on March 12 of that year, quarantine restrictions were put in place. Citizens' freedom of movement was restricted, public transportation was suspended, food and non-food markets, restaurants, cafes, and other public catering enterprises were closed, and employees were put into remote work mode and fired. Agriculture and food industry businesses continued to operate as usual throughout the quarantine (Center for Applied Research, 2020). There were also no plans to restrict the mobility of persons or goods or the export or import agricultural products (apart from buckwheat) for agricultural producers (Khodakivska et. al., 2020). Given this, it is claimed that the industry has lower output losses due to the implementation of quarantine restrictions and the spread of COVID-19 than other industries of the Ukrainian economy. Compared to the same period in 2019, Ukrainian exports of all agricultural commodity products decreased in 2020. Due to bad weather conditions, 2020 was a challenging year for farmers. This caused agricultural plants to take longer to ripen, forcing farmers to replant some crops on substantial scales twice. The best harvesting times were consequently moved to later unfavourable times, which raised production costs. The financial year's results were disappointing: a record-breaking drought caused yields to drop, and in some regions of Ukraine, the crop was lost entirely, resulting in severe business losses. Micro, small, and medium agricultural producers, concentrated on producing speciality goods and goods for the home market, suffered the most tremendous financial and reputational losses. The new restrictive measures had little impact on medium and big agricultural enterprises, whose operations are mainly focused on international markets. Investments in the agricultural industry saw the highest decline as a result of the COVID-19 pandemic's spread and the imposition of quarantine regulations. As a result, capital expenditures in agriculture fell by 35% in 2020 compared to 2019. Similar processes occurred in the food business, where investment volumes fell by 29%. Strategic investors adopted a wait-and-see attitude due to the restrictive measures concerning medium- and large-sized firms. Expert opinions claim that local and international investors who have previously made significant investments in Ukraine's agricultural sector lack trust (Center for Applied Research, 2020; Khodakivska et. al., 2020; Ekonomichna Pravda, 2020).

The following points should be emphasised in the broader context of evaluating the socioeconomic effects of the effort to stop the coronavirus pandemic from spreading: a decrease in economic activity; a decrease in labour force mobility along with a reduction in income from employment and, as a result, a decrease in household purchasing power; changes to the planning of spring harvesting campaigns and field work; a partial reorientation to the domestic market and domestic

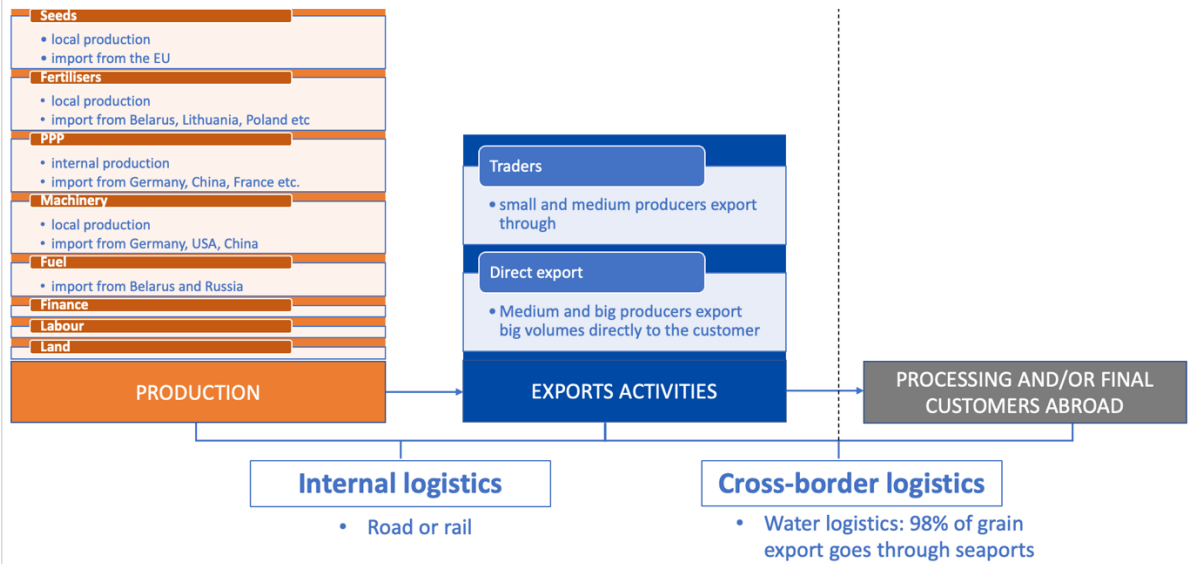
channels of product sales; a decrease in labour demand and a reduction in the possibility of creating new jobs; and a partial closure of export access; lack of working capital at agricultural enterprises to purchase the newest equipment and technologies, particularly under active implementation of digitalisation technologies as a means of distancing people - participants in the economic process (if possible); decline in world prices for products made from traditional raw material exports from Ukraine; oversupply of raw material markets for the development of biological energy sources, such as bioethanol, for which a significant portion of corn was destined – Ukraine is its top exporter globally; a significant shift in the expectations of agrarian entrepreneurs regarding the potential for the growth of their economic activities; structural changes in the way that demand is created for food and agricultural products; disruptions to the supply chains for commodities (Center for Applied Research, 2020; Khodakivska et. al., 2020).

All respondents, i.e., R1-R4, stated:

It is reported that there were almost no bottlenecks in the sector before the military conflict. Importers of Ukrainian cereals have changed a lot during the aggression and are suffering at the current moment.

Based on the conducted data analyses a priori framework of Ukrainian AGVC cereal production was developed.

Figure 17. A priori Ukrainian cereal AGVC framework



Source: The authors based on the data analyses

The previous has aimed to answer the research questions. Different disruptive events have shaken and impacted in different ways not only the Ukrainian VC, but the parties involved in it. Geopolitical events affect the governance as VC will aim to be more efficient and continue be profitable. There were research gaps that had to be addressed before understanding the connection with all the disruptive events previously described. The major research gap initially was putting all the parts together and processes involving the local Ukrainian VC.

The previous reflects on the a priori framework of the general situation of Ukraine and its AGVC. As data suggests, together with the interviews, this military conflict has drastically affected the way transactions and operations are conducted. The general panorama is vastly different, and new entities and processes have reshaped the AGVC. The scale is still unknown, but the following discussion aims to compare the a priori vs the a posteriori framework of the significant ongoing disruption to the "breadbasket" country.

Policy makers and parties with interests involved in VC have impacted directly on how things are conducted at the current moment. The following part will address and compare our findings with the current situation; it will also show how policies either slow down or aim to make more agile the activities and parties involved.

5. DISCUSSION

The key contribution of our study is in the following: we have sought to explain in depth the impacts of the recent disruptive political events on the AGVC. We also attempted to extrapolate the effects that other previous political disruptive events had on the AGVC and international agri-food market in general and assess whether the impact of the ongoing military conflict between Russia and Ukraine is similar to the previous reactions. Also, we analysed secondary data like statistics, news and interviews from the experts of the Ukrainian agricultural sector on how Ukrainian AGVC was undergoing fast reconfiguration to survive and continue supply to the international market.

Most of these results have been discussed in detail in the previous parts of the thesis. However, in this section, we are attempting to organise and deepen the discussion by addressing our research questions through relevant results, contrasting and comparing the results with previous research, and finally outlining the importance of our study. The discussion chapter has been divided into the following sections:

- the effect of the ongoing disruptive event on the agricultural value chain' in terms of: supply of inputs and production, exports and logistics, and consumption (by processors or the consumers of the end product);
- suggestions from the respondents and future contributions for policymakers.

5.1 Impact of the disruptive event on the chain's various links

5.1.1 Supply of inputs and production

Inputs play a crucial role in different production processes and participation in GVC. The risks accompanying the supply of the inputs can cause adverse shocks and create specific disruptions along the whole value chain. Ukraine, taking part in the AGVC in cereal production, has backward linkage, as the country uses foreign inputs to produce exported goods. Thus, its dependence on a stable international supply chain is crucial.

As for international inputs, Ukrainian agricultural producers use the following: fuel, PPP and fertilisers, machinery, partial seeds and financing. As for local inputs, producers use land, labour, partially seeds and finance.

Fuel. From the beginning of the military conflict, Ukrainian fuel storage facilities were subjected to shelling, leading to a significant fuel shortage. Before the aggression, Russia and Belarus

were leading fuel suppliers to Ukraine. Thus, the government had to change fuel suppliers quickly. The world price of fuel has increased significantly, which had the following reasons: first, after analysing past disruptive events, one can notice the regularity of oil price growth in almost every crisis; secondly, a significant shortage of fuel on the domestic market and a sharp increase in demand from Ukraine on the foreign market could not fail to be reflected in the world oil price.

Furthermore, Ukrainian fuel companies bought thousands of fuel tanker trucks to create mobile fuel storage systems, drastically reshaping Ukraine's fuel supply chain. Previously the invasion fuel was supplied by rail and sea, and now around half of it is supplied by road transport (Altman, 2023). While diversifying its fuel suppliers, Ukraine started importing fuel from the USA, India, Taiwan and the Netherlands. Given the geographical proximity of the previous fuel suppliers, new fuel purchases were accompanied by additional transaction costs created due to the logistic distance between the sellers and Ukraine and extra costs connected to the purchase of new transport.

In addition, attacks on critical infrastructure led to power supply shortages. For producers of agri-food products, fuel and electricity use is crucial. Therefore, the use of electric generators during power outages created an additional economic burden on manufacturers: increased cost of production and reduced efficiency, leading to an increase in transaction costs.

PPP and Fertilisers. First, should be highlighted the fact that Ukraine is heavily dependent on imported PPPs and fertilisers. Before the conflict, Ukraine imported most fertilisers from Belarus, Lithuania and Poland, and PPPs were mainly imported from China, Germany and France. As the military conflict also started from the territory of Belarus, Ukrainian producers tend to cut all economic ties with this country. Still, this is not the only reason for such decisions.

Many countries that have developed agricultural sectors are now also reshaping the structure of the suppliers of fertilisers. The EU, the USA, Canada, and other nations slapped sanctions on Russia and Belarus, including limitations on trade and banking activities, transfer of technologies and particular persons. The present sanctions regime seeks to preserve the agricultural industry, especially inputs, to prevent negative consequences on the world's food security. Both nations are large producers and exporters of fertiliser. For example, in 2020, Russia supplied more than 13% of fertilisers on the global market (IFPRI, 2023). Interrupting commerce in those goods would have severe effects on international markets, as well as on agri-food supplies in nations that depend on them. The US and the EU have specified "carve-outs" for the food and fertiliser sectors (EC, 2023). However, sanctions make it more expensive and challenging for businesses to deal with a target country, which raises the expenses of doing business with that country. As businesses invest efforts in finding alternative

suppliers, consumers, or partners, search and information expenses rise. Since businesses negotiate new contracts and agreements with new rivals, the expenses of bargaining and making decisions increase. The cost of enforcement rises as businesses must ensure the sanctions regime is followed and reduce the possibility of facing legal or reputational repercussions. Sanctions can also increase transaction costs by upsetting long-standing corporate ties and supply chains, which can cause delays, suspensions, and losses. These costs may be costly for businesses that have made significant investments in the target nation or primarily rely on its resources, markets, or infrastructure. It should be mentioned that conducted analyses have not identified similar precedents during the past disruptive events and previously imposed economic sanctions, as since March 2022, Russia has become the most sanctioned country in the world (Zandt, 2023).

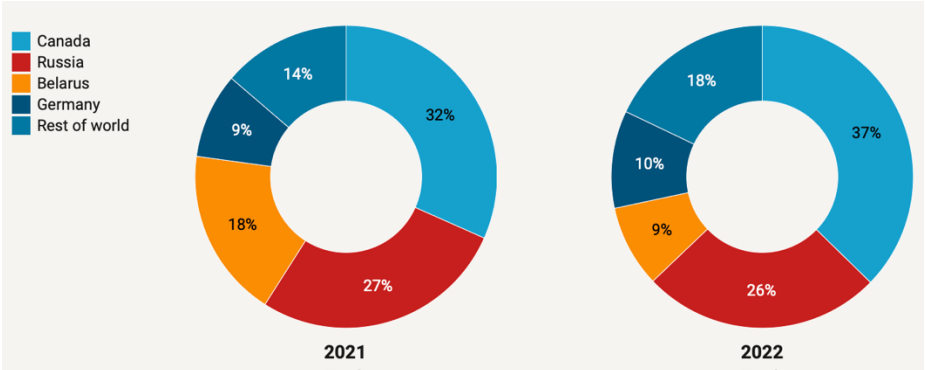
Table 4. Share of Russia's export of the fertilisers in the world market, 2020, bln USD

Category	HS name	World Market	Export, bln USD	**% of the world market**
fertilisers	Nitrogenous	21,7	2,5	11%
fertilisers	Potassic	11,5	1,8	15%
fertilisers	Fertilisers with 2 or 3 elements	19,4	2,7	14%

Source: Source: own calculations based on TradeMap

For example, Brazil is the second-largest potash importer in the world after the USA. Around 20% of Brazil's potash imports during the first nine months of 2021 came from Belarus. This number decreased to less than 10% for the same time in 2022. Imports from Canada, Germany and other countries have partially offset the loss.

Figure 18. Brazil potash imports,
nine months 2021 to the respective period in 2022



Source: UN Comtrade

Another reason to search for new suppliers of fertilisers is the increased cost of fossil fuels. As the production of fertilisers is strongly connected with fossil fuels, namely gas, the increase in the gas price would eventually lead to an increase in the price of fertiliser. Higher production expenses and, ultimately, higher food prices will result from these inputs' higher prices. They might also result in less input use, resulting in poorer yields and harvests in the 2022–2023 growing season, risking further price increases, and endangering future food security worldwide (Stepanov, 2022). The interviews then confirmed the situation since farmers had to reduce input costs.

Machinery. According to the ITA (2020), Ukrainian machinery used for agricultural activities is outdated. As the machinery purchase is considered a significant investment, Ukrainian farmers prefer to work with machinery, which has a long period of exploitation. For the last ten years, the US has been the prime exporter of new and used tractors in Ukraine, followed by European suppliers from Belgium, Germany and Sweden. During 2016-2017, when the Ukrainian Agri sector was booming, producers could update some equipment and machinery. However, with each of the disruptive events that took place in Ukraine precisely and in the world, producers used the available financial resources to comply with technological cards to produce agricultural products, which meant the purchase of more expensive inputs like fertilisers, but not the purchase of machinery.

It should be mentioned the fact that many agricultural types of machinery also suffered from the ongoing military conflict. Some equipment was stolen to Russia, and some was destroyed by the explosion of mines in the fields (Fylyppov and Lister, 2022).

Seeds. Seed production is the same as crop production. It has the same inputs; the output is still used in different value chains. Before the military aggression, Ukrainian producers were almost entirely sufficient with the internal production of wheat seeds and were importing some breeds of corn and barley. However, due to the ongoing military conflict, this part of the supply chain can be significantly damaged, leading to further disruptions in the value chain (UCAB, 2015).

Finance. The main obstacle to agricultural growth is the lack of working capital and credit. Due to Ukraine's challenging business environment, local businesses faced challenges engaging foreign funds. In contrast, domestic loans became almost unaffordable and expensive. According to the NBU (2023), before the military conflict, the average interest rate in 2021 for the loans in national currency for the corporate sector was 8.8% and for the households – 33.6%. While during 2022, the interest rates for credits increased significantly: average interest rates for loans for the corporate sector were 20% and for the households – 36.1%. However, the Ukrainian government started supporting agricultural producers as part of the "Affordable Loans 5-7-9%" state program as early as March 2022. Due to this,

the business received loans from partner banks with a regular interest rate, and the state compensated part of the interest. As of the end of January 2023, almost 44,000 agricultural producers used available credit. The number of loans raised under all lending programs is over two bln USD. However, already during the conflict, the government.

The new trade theory emphasises the importance of government initiatives in developing trade and assisting in creating AGVCs. Government initiatives like trade arrangements, subsidies, and investments in infrastructure can help cut transaction costs and increase the efficiency of the Ukrainian cereals AGVC (Vaidya, 2023).

Moreover, because of the embargo on land sales, farmers were forced to rely on land leases, which restricted access to capital and, for the most part, discouraged investment in irrigation and drainage. Farmers started utilising the land as collateral when the land market gradually opened in July 2021, encouraging them to invest more in equipment and infrastructure in the long run. Ukrainian residents were permitted to buy agricultural land starting in July 2021 (up to 247 ha per individual), while Ukrainian legal organisations will be permitted to purchase up to 24,710 ha starting in 2024. According to the World Bank, liberalising the land market was expected to result in incremental GDP growth of over 2.0 per cent per year in the coming years; this was the case before the ongoing military conflict in Ukraine (Global Security, 2022). Currently, it is unknown the decrease in Ukrainian GDP in the following years.

Labour. Before the conflict, labour was not a sacred resource. However, since the aggression started, the situation has changed dramatically. First, according to the interview results, due to martial law's introduction, Ukraine faced driver shortages. In addition, farmers have been called to serve in the army if not booked by the agricultural enterprises in advance. Secondly, since the beginning of the military conflict, according to UNHCR (2023), more than 8 mln Ukrainians have left Ukraine, and more than 6 mln people have registered as refugees in EU countries. Among Western countries, the most significant number of Ukrainians found temporary shelter in Poland (1.58 mln), Germany (922 thous.) and the Czech Republic (504 thous.). Many Ukrainian refugees caused a strong wave of support in the EU but simultaneously pushed some countries to the limits of their capabilities. After arriving in a new country, refugees often depend entirely on social assistance, at least for some time.

Farming land. According to the interviews and data, the loss of territories due to the invasion and the mining of land has left Ukraine with 2/3 of its original agricultural territories. Another 20% of production is expected to be lost this year. Fields have also been contaminated with shells, mines and other remnants of the conflict, contributing to the future decrease in the quality of the crops. As

respondent 3 stated: *"There are some other problems with fields, which were under heavy shell fire and are now contaminated with the remains of shells, mines, and other things. Of course, in those regions, there might be some issues and problems with the product quality due to the contamination of the soils with some metals and other noxious substances. So, we are preparing to deal with it" (R3).*

Storing. Another part of the production activities and AGVC in Ukraine is storing. According to the US government, by the end of 2022, there were destroyed, damaged, or lost control over around 16% of Ukrainian crop storage facilities due to shelling. The attacks have targeted facilities near ports or critical railways, resulting in around 80% of them being damaged or destroyed. In addition, during the autumn 2022 harvesting campaign, Ukrainian agricultural producers faced a lack of storing capacities due to the closure of seaports, a low level of exports and a large percentage of product stocks inside the country. This led to the fact that farmers harvested part of the cereals later than the technologically established term, which, according to interview 3, partially affected the technical characteristics of the grains (Balmforth and Polityuk, 2022). Also, Ukrainian agrarians began to purchase special long-sleeve bags for outdoor grain storage. Some of these sleeves were also provided as aid from the FAO UN (Euronews, 2022). As a result, the costs of production increased again. Besides problems with storing, the internal logistics costs have increased dramatically (Reuters, 2022). Respondent 1, during the interview, said: "*If previously transportation services were around 8 USD per 1 ton of corn or wheat from inland transportation to the port, now the cost for the same volume is more than 100 USD*" (R1).

When the military conflict started, the country was unprepared to bear the consequences, as logistics and production processes were massively disrupted. Respondent 1 describes the situation that developed in the first weeks of the conflict: "*communication between suppliers and processors took place constantly because many of them did not understand where to buy or where to sell their products; in addition to communication, local and international logistics were severely affected, due to non-working seaports and roads overloaded with civilian transport and checkpoints" (R1).*

5.1.2 Exports and cross-border logistics

The ongoing military conflict in Ukraine has harmed inland transportation networks, ports, and facilities for storing and processing goods. Additionally, it has caused the suspension of all business shipping activities in its ports. Given the limited availability of alternative transportation options, such as rail, river, or road transportation to seaports and smaller processing facilities to make up for the

operations being halted at contemporary oilseeds crushing facilities, this raises serious concerns (Stepanov, 2022). Perhaps, the area of the GVC has been affected the most.

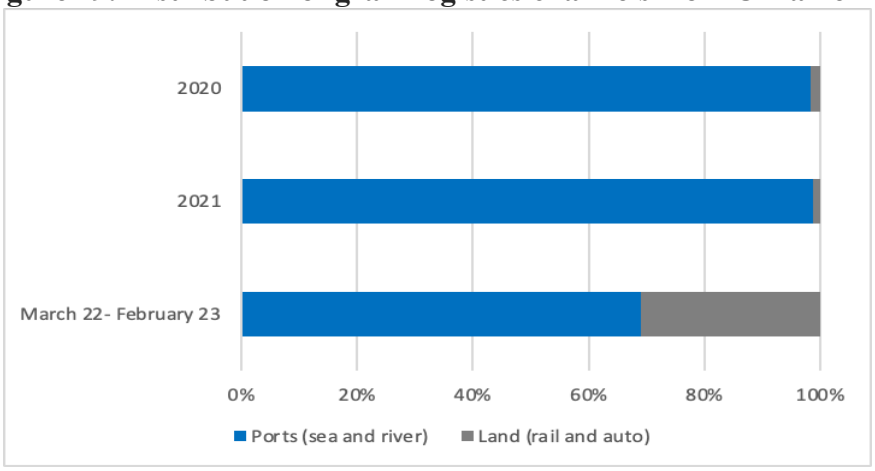
Export operations – Traders. Traditionally traders were important actors of Ukrainian AGVC. Usually, they are the subsidiaries of MNEs. Traders used to purchase cereals from small and medium farmers, form big dispatches and export them directly to the final customer. In this case, traders were responsible for all the export documents and logistics organisation. However, since the start of the conflict, most traders have put all their business activities on hold. This created additional obstacles for small and medium farmers to export their products. In actual circumstances, the producers faced all the transaction costs that traders were responsible for. Furthermore, now these producers also look for any opportunity to export their products since the internal consumption has shrunk and the internal market's price is lower than on the global. Respondent 4 reflected on this situation: "*Most often, such exports end immediately somewhere outside the Ukrainian border - in Poland, Romania, Bulgaria or Moldova. At the same time, big agricultural companies, which can form large batches of products, export in transit through EU countries", (R4),* as maintaining appropriate export and logistics departments can be much cheaper than using the services of third parties

Cross-border logistics. The effect of the military conflict on the transportation system is a current source of logistical worry. This includes inland infrastructure (primarily railways) that transports food exports to Odesa and Mykolaiv ports, Ukraine's major ports for bulk agricultural commodities. Due to the conflict, all business shipping across Ukraine's ports has been halted. There are continuing efforts to increase Ukrainian agricultural exports via alternative modes of transportation, such as trains via neighbouring nations and river barges. The loss of Ukraine's national maritime shipping capacity, which typically manages 90% of the nation's commodities exports, cannot be made up for by other modes of transportation (Stepanov, 2022). The rising cost of insurance premiums or the absence of specific insurance coverage in contracts for ships entering the Black Sea has increased the price of importing food by exacerbating the already high cost of marine transportation (Stepanov, 2022).

The absence of rail cars in neighbouring nations limits the number of goods transported by rail. Additionally, even if the supply of railroad cars were to increase, deliveries via Ukraine's western borders with Poland to the nearest grain seaports would necessitate the change of railcar chassis due to using different gauges in Ukraine the EU countries. The alternative is to transport the freight onto various railway cars. Early in the conflict, locomotives were prioritised to remove civilians from the front lines of combat. About 300 thous. t of agricultural products was typically exported monthly via

rail when seaports were accessible. At this time, alternative routes were used monthly to move about 500 thous. t of agricultural products. These routes' maximum practicable export capacity, which is thought to be 1.5 mln t, has not yet been achieved, even though these volumes have since increased. Even then, it would not be enough to equal the prior capacity of maritime routes (Stepanov, 2022). The following chart shows the transportation shift since the conflict:

Figure 19. Distribution of grain logistics channels from Ukraine



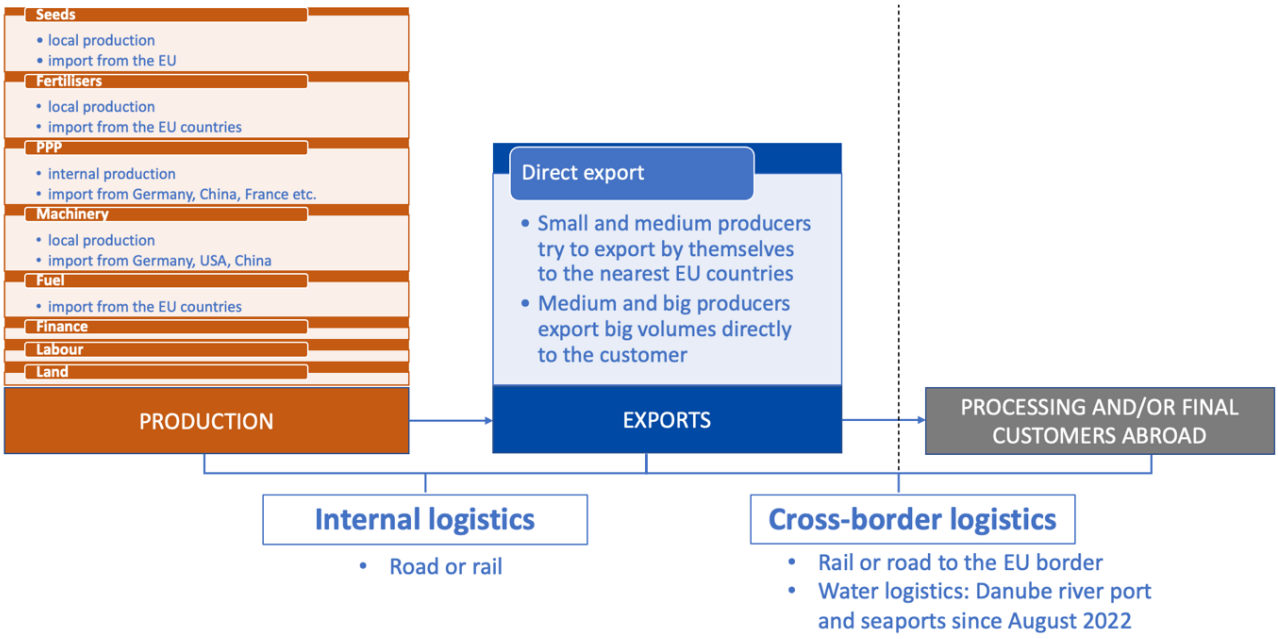
Source: own calculations based on the SCSU and UIFSA, 2023.

Since maritime ports were blocked until the Black Sea Grain Corridor was established in June 2022 and till September 2022, most exports went through roads, railways and some small Danube River ports previously not frequently used for exporting. Exports that go through the grain corridor must be inspected by the Joint Coordination Centre, formed by representatives of Turkey, Ukraine, the UN and the Russian Federation (UN, 2023). However, according to the R1, representatives of Russia are not interested in making this process agile. Although the optimal number of these inspections should be 25 per month to ensure the right amount of commodities to the world, only three of those inspections were reported in February 2023. Now, Danube River ports are part of the new routes used to export commodities. Ports that before were not taken seriously recently have become more relevant. As Respondent 1 stated, "*In terms of logistics, before the war, most of the grain was leaving through ports with the biggest monthly exports around eight mln tons. Furthermore, 95% of all commodity exports, primarily cereals, went through the ports located in Odesa, Kherson and Mykolaiv ports and, to a lesser extent, throughout the ports in the Danube River… Before the war, the ports in the Danube River had only a director and docking area, as the main exporting ports were Odesa, Pivdennyi and Chornomorsk. However, big companies with terminals are now exporting through those small ports in the Danube River, and it is estimated to be exporting around one mln t. In contrast,*

around two mln t go through railways and trucks" (R1). Also, referring to the changes in the export destinations, R1 added: *"And now farmers are forced to sell their commodities for the price that does not cover their production cost. Moreover, the biggest importers of Ukrainian wheat and corn became Poland and Romania. As both countries have two grain ports each, and all the terminals in these ports are private, the possibility of exporting for Ukrainian farmers through these terminals is non-existent if you do not have a contract with Romanian or Polish colleagues. Therefore, the farmers are just selling the products at the border. Now Romania and Poland became the biggest importers of Ukrainian cereals in 2022 — something I can describe as a normal situation under these circumstances, which follows with the re-export of Ukrainian cereals from the EU port to its final destination*". Also, R3 reflects on the high international logistic costs: "*Even though we see the price for wheat on the other markets at 450 USD per ton, it is not reachable for Ukrainian farmers because only logistics from Ukraine is now 200-250 USD per ton" (R1).*

Given all the changes that took place in Ukrainian cereal AGVC since the beginning of the military conflict, a priory framework had to be amended to reflect the alters. Thus, we have formed a posteriori framework for the Ukrainian cereal AGVC.

Figure 20. A posteriori Ukrainian cereal AGVC framework

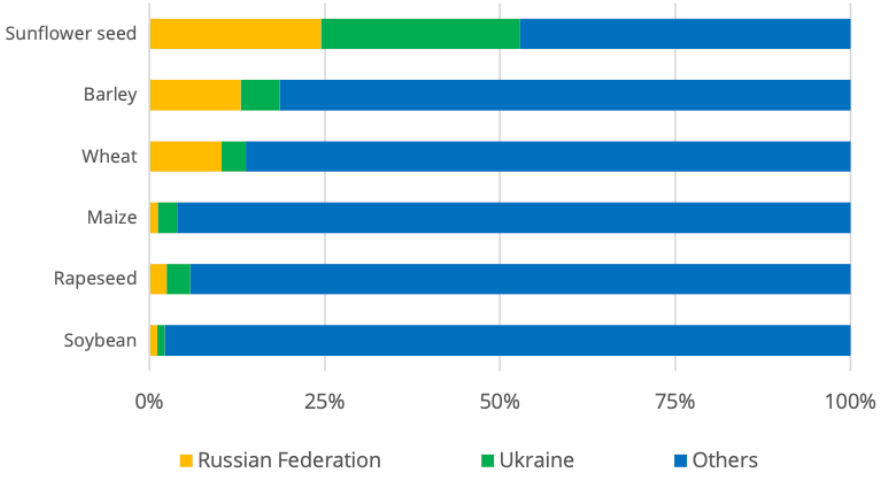


Source: The authors of the study based on analysed data

5.1.3 Consumption

The world's top producers of agricultural products are Russia and Ukraine. Their contribution to the global market is particularly noteworthy for the cereal industry's barley, wheat, and maise. Between the 2017 and 2021 marketing years, the two nations jointly accounted for 18% of the global output of such crops, with Russia accounting for 14% and Ukraine - 4%. With well over half of the world's output of sunflower seeds coming from these two nations during this time, their role in international oilseed production was particularly significant. Their average production proportions in rapeseed and soybeans are lower, with Russia supplying 6% of production and Ukraine - 2% (USDA, 2023).

Figure 21. Share in global production of crops (2017-2021 MY)



Source: Stepanov (2022)

Ukraine is a net exporter of agricultural goods and a significant food source for the world market. The exportable supply for the world's food markets is frequently concentrated in a few nations, rendering these markets unstable and susceptible to shocks. For instance, Ukraine was the sixth-largest wheat exporter in 2021, exporting 20 mln tonnes of wheat and meslin, with a 10% share of the global market, in the sector of wheat and meslin, while the seven biggest exporters cover 89% of the world's trade (USDA, 2022).

As evidenced by the record price index on the basic cereals (wheat and corn), disruptions in Ukraine's grain market and the sanctions imposed on Russia by developed countries jeopardised the food security of many nations worldwide, particularly vulnerable to food insecurity. It should also be mentioned that the international market reacted similarly during the Global financial crises of 2007-2008 and the food crises of 2010-2011 (FAO, 2023).

As Respondent 1 reflected:

It is a normal market reaction because food is a primary product essential for every human. Panic behaviours and over shopping, making food less available, also increase the final price of the food products. Based on my own experience, at times, different interpretations or incorrect translations of interviews of representatives of the Ukrainian MAPF regarding the limits of the domestic grain market led to immediate changes in prices on world commodity exchanges. (R1)

Figure 22. Price charts for wheat over the last 25 years, USD/Bu

Source: Trading Economics, 2023

Figure 23. Price charts for corn over the last 25 years, USD/Bu

Source: Trading Economics, 2023

The import-dependent nations, including Tunisia, Mauritania, Djibouti, and Lebanon, were the most affected by grain price fluctuation and the availability of Ukrainian cereals on the market. The

UN Security Council warned in May 2022 that the conflict in Ukraine would cause significant shortages in the global food supply, leaving millions of people in danger of famine. Food export bans in at least 23 nations worldwide, introduced in May 2022, suggest a decline in global food security (UN, 2022).

What follows if one of the world's leading exporters of agricultural goods leaves the market? The following part reflects on the influence of the military conflict in Ukraine on other nations during the first and most critical months.

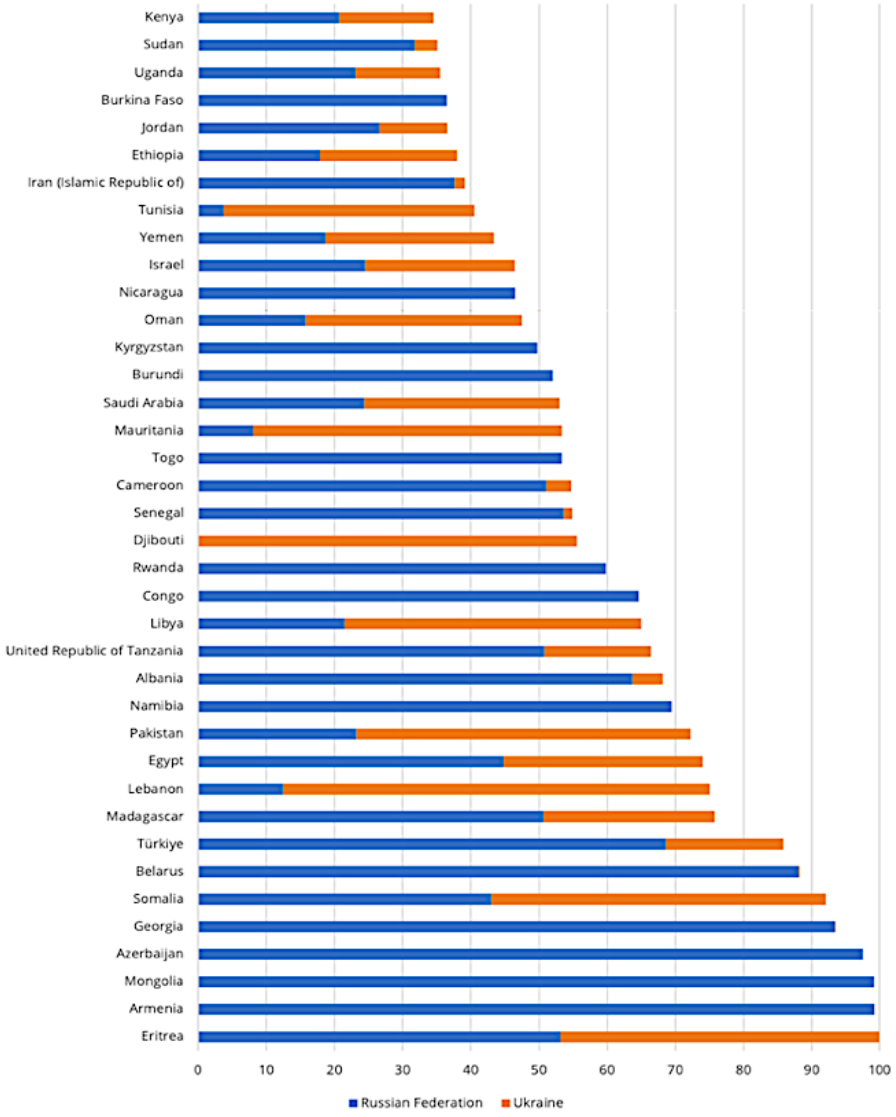
The production of meat in Europe could have decreased in the absence of Ukrainian corn and soybeans. The fourth-largest corn exporter in the world is Ukraine. The EU, China, and Egypt are the top importers of grains. Like non-GMO soybeans, the culture manufactures food goods and animal feed. Due to the threat of cutting the number of animals on their farms, EU farmers have urged the government to assist them. Hungary, Serbia, and Moldova also restricted grain export due to a lack of feed (Jones and Corvino, 2022). In order to prepare for a potential scarcity of animal feed, on March 15, 2022, the Spanish government announced that restrictions on corn imports from Brazil and Argentina would be temporarily relaxed (AFP, 2022). The EU regulations restricting governmental help to the agriculture sector were attempted to be repealed in Italy. Corn stocks in Italian ports were sufficient for 25 days in March (Jones and Corvino, 2022). Local farmers said there had been much hype surrounding crops used as animal feed. Cyprus requested authorisation from Brussels to assist the island's farmers, who were struggling due to a vast increase in feed prices. Cypriot farmers demonstrated against the rise in grain prices on Monday, March 21, 2022, in Nicosia. Cyprus's government claims there was enough grain to last until May (Financial Mirror, 2022). In order to promote domestic food production, Germany partially abandoned its environmental policy. Areas that were formerly ecologically protected were opened to farming. Also, the nation's leguminous crops from Germany are now more competitive (All about feed, 2022).

Food insecurity could have resulted in a worldwide shortage of Black Sea wheat. Ukraine supplied 20 mln t of crops abroad in 2021–2022 MY, or about 10% of all exports. Egypt (16.5% of all exports), Indonesia (15%), and Turkey (8.8%) were essential importers. Ukraine restricted wheat exports on March 9, 2022, to maintain domestic supply levels (CNN, 2022).

In February 2022, Ali Moskheli, Egypt's Minister of Supply, reported that the nation had supplies for the next five months (Abay et al., 2022). However, due to a rapid increase in the price of flour during March 2022, bread prices in Egypt reached a record high (Xinhua, 2022). As a result, on

March 21, 2022, Egypt's state-regulated the price of bread, according to The Guardian (Butler, 2022). There were talks about importing wheat from Turkey, China, Bosnia, Sudan, Nigeria, and Iran to Egypt and plans to buy cereals from India. Indonesians purchased instant noodles from a well-known manufacturer as they also felt the effects of the conflict in Ukraine (Mishra, 2022). Joko Widodo, the president of Indonesia, informed the nation of the impending rise in food costs due to rising grain prices on the international market (Llewellyn, 2022). Due to the military conflict between Ukraine and Russia, Turkey lowered its value-added tax on essential items from 8% to 1% (Xinhua, 2022). Politico stated that the world's poorest nations, including Yemen, Bangladesh, and Madagascar, will be impacted by rising food prices. Global commodity prices increased in every direction as traders attempted to substitute wheat shortages with other crops (Wax and Galindo, 2022).

Figure 24. Wheat import dependency, net importers, %, 2021



Source: Stepanov (2022)

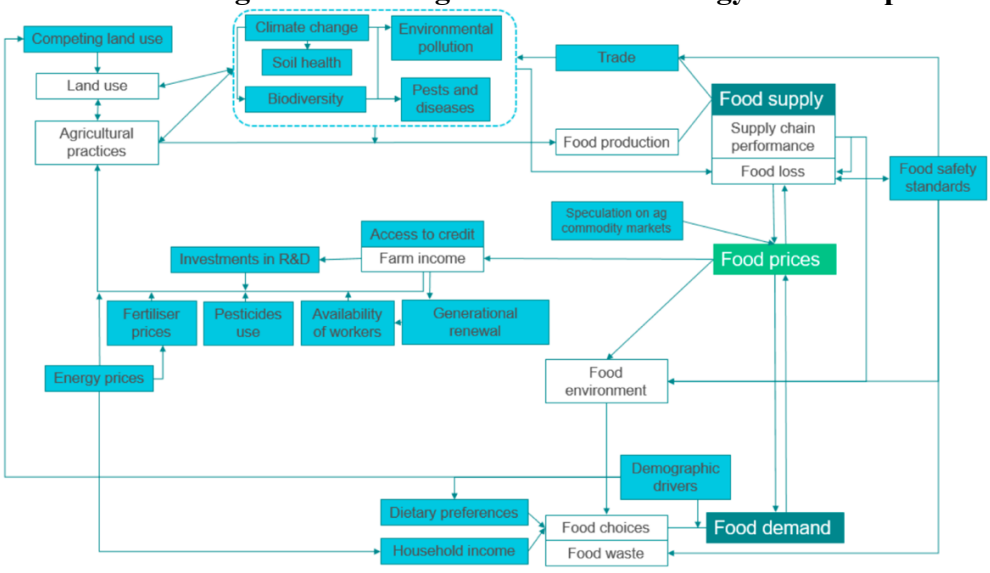
The UN specifically addresses the threat to the world food supply, which was already experiencing turmoil following the COVID-19 pandemic, according to The Guardian (Harvey, 2022). Global indexes of hunger and malnutrition have risen during the last three years. After the Russian invasion, there is a risk of impending starvation and famine in many parts of the world, according to Michael Fakhri, a UN Special Rapporteur, whom The Guardian quoted on March 18, 2022 (Ahmed, 2022).

Respondent 1 commented:

Not only for Ukrainian farmers but mostly for external markets in countries like Lebanon and other African and Asian countries. These countries risk not getting as much food as before. Social protests have already been seen in these countries during the last year due to the lack of Ukrainian food products. But the situation might even worsen. (R1)

Lessons learned during the global food price crisis of 2007–2008 indicate that converting food crops to non-food uses can significantly increase food prices in times of scarcity. Food and fuel prices are increasingly linked through output prices and links through input prices. The linkages are created on the output side by two main channels. The following figure gives a schematic picture of the linkages and "pass-throughs" to food markets to understand better the influence routes of energy prices on food prices.

Figure 25. Linkages between the energy and food prices



Source: European Commission (2023)

Energy crises. Reliable energy sources are necessary for the entire food chain. Energy supply disruptions and rising energy costs have an adverse impact on the food chain at different levels. The

military conflict between Russia and Ukraine has caused a significant spike in energy prices, especially for natural gas. The crude oil "Brent" price increased from about EUR 40 per barrel in 2020 to a peak of EUR 120 per barrel in March and June 2022 before dropping to roughly EUR 90 in October 2022 (EC, 2022).

Figure 26. Crude Oil Brent prices over the last 25 years

Source: Trading Economics, 2023

Figure 27. Natural gas prices over the last 25 years

Source: Trading Economics, 2023

The cost of gas and coal also increased, reaching a peak in August 2022 that was more than four times the 2020 average. Gas price hikes are considerably more prominent in European countries than other parts of the world, significantly impacting power costs. Higher energy prices imply higher production costs even though the proportion of energy inputs used in the production of agricultural, fisheries, and aquaculture commodities can vary among locations. Higher energy prices can result in

lesser input utilisation, resulting in poorer output and higher commodity prices because energy makes up a sizeable portion of the production expenses for the farming and fishing industries. While increasing commodity prices impact consumer food prices, greater energy costs during the food production, distribution, and marketing stages typically also impact retail prices (EC, 2023).

Russia is a critical participant in the world energy market. A highly energy-intensive business, AGVC is impacted by the conflict's accompanying steep rise in energy prices.

Table 5. Share of Russia's export of the fossil fuels in the world market, 2020, bln USD

Category	HS	HS name	World Market	Export, bln USD	**% of the world market**
fuel	2711	Natural gas	229,2	7,8	3%
fuel	2709	Crude oil	607,3	72,6	12%
fuel	2701	Coal and Coke	82,6	12,4	15%
fuel	2710	Refined petroleum	479,2	45,4	9%

Source: own calculations based on TradeMap

Inflation. The shortage of food and energy has led to significant changes in the daily life of people in different parts of the world - prices have risen significantly. If a commodity becomes scarce, its price increases significantly; if it is food and energy, everything else becomes more expensive. According to the FAO (2023), the food price index, which reflects the monthly price fluctuations of a basket of five food commodity groups, reached an all-time high in March of 2022 (since 1961). In the summer of 2020, as supply networks began to feel the effects of COVID-19, food prices worldwide began to increase. The energy price for agri-food logistics and distribution has also increased, which has put pressure on food prices. Fertilisers and energy are two critical intermediate consumption items for some farmers. Another factor that may contribute to, at least in part, increased food costs in the EU is the conflict in Ukraine, mainly because it has decreased the supply of goods, such as cereals and fertilisers (Palm, 2022). According to IMF (2022), global inflation would increase from 4.7% in 2021 to 8.8% in 2022. The yearly inflation rate in the EU hit a record high of 9.2% in 2022. It more than tripled compared to 2021, when the yearly inflation rate was 2.9% (Eurostat, 2023).

Respondent 3 stated:

The influence [of the beginning of the military conflict on the world food market] was dramatic. It also has a dramatic impact on world food security. We can look at the FAO food index prices, and it becomes clear: the prices spike right after the invasion. We had also seen that supply chains were

fragile or had no reserves. Because after the invasion, after the stop of supplying, there were one- or two-week reserves for some food products in Europe (for example, mustard, flour or sunflower oil and others). We can also conclude that there were not enough reserves in the global food supply system for some food products before the war, and they were unprepared for such a situation. Risks and disruptions in the global value chain eventually transmit along the whole value chain. Moreover, these disruptions can affect all value chain sides, including the final customer. (R3)

Conflicts might hamper food production and other supply chain operations. Reductions in supply, as a result, may have an impact on food costs and economic access. More generally, conflict is expected to decrease economic activity and investment, which will result in lowering household incomes and possibly worsening food access. Conflict-related population relocation makes people more susceptible to food insecurity because they lose their means of support, productive assets, means of subsistence, and health infrastructure. The aggression of Russia on Ukraine has interrupted vital supply chains and driven up the cost of food, fuel, and fertiliser. At the same time, the conflict affected the global economy and disrupted supply chains. Most developing countries feel the consequences of the Russian invasion, and some East African states are on the brink of famine (EC, 2023**)**.

5.2 Suggestions from the respondents and future contribution to policymakers

Suggestions from the respondents that participated in interviews can be seen as the wishes of the interested party to the international decision-makers. Therefore, such an approach from the respondents can be considered as wishful thinking. Wishful thinking is the deliberate choice to accept an alternative version of reality. The assumption is that some current well-being depends on anticipating future outcomes. When the present seems unpredictable, agents care about the future because beliefs affect the current well-being. Wishful thinking is most robust when uncertain results and pay-off differences are significant. (Caplin and Leahy, 2019).

The reflection during the interviews shows how the participants expect different players to step up processes in place to compensate for the demand that Ukraine is unable to fulfil. There is a general concern that the disrupted cereal VC in Ukraine leads to a lack of cattle or pork and subsequently increases the price to the final consumer. The Ukrainian role as a European breadbasket can be displaced if the war is long enough.

During the interviews, it was discussed that keeping the dictions in Russia and Belarus will allow alternative countries to become global suppliers. Some African countries might become

international fertiliser players and support the current demand. This aligns with wishful thinking as interviewers stressed the potential for other nations to become essential players in the GVC of cereals.

R1: *"... Ukraine needs a transportation corridor from Europe and through Europe. In my opinion, this is a win-win situation as Europe will earn from the logistic servicers, and the Ukrainian farmers will get revenues that are so much needed*".

R2: "*... substitute Russia for African countries regarding fertiliser supply and African countries can easily become global players in this market. We can reach an even more significant effect by keeping the sanctions and introducing the opportunity for alternative countries-suppliers. But suppose the world introduces the opportunity during this sanction period to other countries that are able to produce similar products. In that case, it can have a very interesting effect: African countries, which depend on grain supply from abroad, can become more independent as they will receive the opportunity not just to consume, but exchange produced fertilisers for grain. This can be a completely different development path of relations between consuming and supplying countries. In my opinion, we need to use the sanctions period to substitute the limited number of suppliers with a wider number of new suppliers. ...when we talk about Ukraine, it faces a different problem: it is important that Ukrainian producers not leave the global market completely. We have just finished the discussion about the global fertiliser market, and here is a similar situation. If Ukraine cannot supply cereals to the market, other countries will supply this amount of grain instead of us. And this problem is more Ukrainian than global. Ukraine needs to participate in the global market"*.

R3: "*We expect that even if we recover the free shipment from our seaports, there should be some support from the government to support these alternative routes in case other similar events happen in the future. We had also seen that supply chains were fragile or had no reserves. Because after the invasion, after the stop of supplying, there were one- or two-week reserves for some food products in Europe (for example, mustard, flour or sunflower oil and others). We can also conclude that there were not enough reserves in the global food supply system for some food products before the war, and they were not prepared for such a situation. Risks and disruptions in the global value chain eventually transmit along the whole value chain. And all value chain sides can be affected by these disruptions, including the final customer*".

Partially, the proposals voiced by Ukrainian agricultural experts during the interviews could be used for assession and further consideration of governmental officials and decision-makers in agricultural companies and financial institutions. This is because the ideas expressed by the experts

partially correlate with the risks, to which the new or the a posteriori framework of the Ukrainian cereal AGVC is exposed.

During the interviews, the respondents were asked to identify the risks that took place prior to the conflict and those that arose since the start of the military aggression of Russia against Ukraine. Hence, the experts have identified the following risks applicable to the a priori framework:

- Climate change – "*In some regions, mainly in the south of the country, the climate has changed to a subtropical climate, so farmers have had to adapt the cultures incorporating plants that would naturally survive in the new climate. Irrigation has now become a problem since they lack a water supply".* Depending on the authors, based on the conducted literature review, this risk refers to the production risk or weather-related risk.
- Finance and inputs – *"the lack of affordable financial instruments for farmers to develop their farming activities has been widely pointed out, which is primarily a problem for small farmers". According to the literature review, this risk fits under* price and financial risk or market-related risk.
- Political and regulatory risks: "*Ukraine, for the last few years, has been developing a new taxation system, developing new regulations, and other. This instability, especially from a long-term perspective, can create uncertainty for investors and slow down the development or modernisation of the chain".* The mentioned risk falls under the Institutional and public policy risk.

According to Jaffe et al. (2010), all these AVC risks can transmit to the subsequent value chain actors. Thus, for international processors, the a priori risks could cause uncertainty in the availability, price and quality of the product; availability and price on the other products; create a need to procure from other sources; increase logistics costs and operating costs. It could also be concluded that any cost increase would ultimately lead to a decrease in the efficiency stated by the TCT.

However, risks identified by the interviewees and the assessment of other secondary data associated with the a posteriori framework differ. This is how R4 reflects on the risks now connected to Ukrainian cereal AGVC: "*Geopolitical tensions, such as conflicts and trade disputes, can lead to disruptions in the transportation and export of cereals, which can affect the competitiveness of Ukrainian grains in international markets. Economic uncertainty, such as recessions and currency fluctuations, can affect the demand for cereals and the profitability of producers and exporters".* Thus, logistics also should be added to the list of already existing risks. Since the beginning of the military conflict, the logistic issue has been crucial for Ukrainian agri-food producers. However, in this case,

according to Jaffe et al. (2010), the appearance of this risk connected to agricultural producers will not create any additional problems for international processors besides those already mentioned; instead, it will further complicate their situation.

Still, as the agricultural sector is strongly connected to energy products, the emergence of new risks associated with these products puts additional pressure on all participants of the AGVC. So, imposing economic sanctions on critical suppliers of fossil fuels who also partially appeared to be significant suppliers of fertilisers may jeopardise the AGVC in all its stages: from the input suppliers to distributors and final customers, as such costs like logistics and energy consumption are at each stage of the AGVC. Therefore, in such circumstances, according to Jaffe et al. (2010), AGVC's stakeholders will be subjected to:

a) increased demand for the inputs, face problems with the repayment for inputs on credit from the input supplier side;

b) changes in the planting decisions, volumes of used inputs, resulting in a possible decrease of the income from the farmers' side;

c) availability, price and the quality of the product from the side of the processors, traders, distributors and final customers.

Therefore, understanding the transmission of the substantial risks through the AGVC gives a possibility to devise a plan to minimise the impact of the specified risks in current or future identical situations.

- *Climate change*. While most technologies have implications for the climate, some are particularly relevant to agriculture and climate change, especially in developing countries (Muhumuza, 2018). The implemented technologies should cover: • Planning for climate change and variability; • Sustainable use and management of water; • Soil management; • Sustainable crop management; • Sustainable livestock management; • Sustainable flora and fauna management (Zhu et al., 2011).
- *Financing.* As R2 stated during the interview: "*Some banks offer credits with a 30-40% interest rate. So, finance is available but is not affordable".* Thus, cheaper and more affordable financing of the Ukrainian agricultural sector would reduce the risk and its impact on the entire chain. Ukrainian government already tackles this risk with cheaper credits. However, these measures are not enough, so attracting more funding from abroad will significantly affect the resilience of the entire chain.

- *Logistics*. Before the beginning of the military conflict, the logistics of Ukrainian grain were concentrated on sea transportation. Therefore, the closure of ports from the first days of the aggression led to a supply shock and ripple effects throughout the chain. To restore logistics, Ukraine and its European partners have started an accelerated process of updating and expanding existing alternatives to sea exports. The share of river and road exports has increased significantly over the last year. Therefore, as R3 stated, "*We expect that even if we recover the free shipment from our seaports, there should be some support from the government to support these alternative routes in case other similar events happen in the future".*
- Lowering dependence from a small number of critical suppliers of vital inputs. Ukrainian and international agricultural producers recently started experiencing a lack of fertilisers. As Russia and Belarus produced a significant amount of these inputs on the world market, the imposition of the sanctions has led to the reluctance or inability of agricultural producers and distributors of agrochemical products to purchase fertilisers from the specified countries due to the fear of being imposed with secondary sanctions, not even taking into account the fact that Russian and Belarusian goods, necessary for agricultural production, were not subject to economic sanctions of the EU, USA, Canada and others. However, companies' fear of loss of reputation or an increase in production costs inevitably led to a reduction in the purchase of Russian and Belarusian fertilisers, creating significant shortage of the input on the world market, leading to an increase in its price. Therefore, as R2 stated: *"substitute Russia for African countries regarding fertiliser supply and African countries can easily become global players in this market. We can reach an even more significant effect by keeping the sanctions and introducing the opportunity for alternative countries-suppliers".* Thus, the global fertiliser market will be filled with new players, reducing dependence on a few influential players.
- After the military conflict in Ukraine began, European processors and supermarkets realised that they had minimal stocks of products (from 2 to 4 weeks for supermarkets and up to 6 months for processors). A possible future stock policy revision can ease disruptive events' impact on the AGVC.

6. CONCLUSIONS, LIMITATIONS AND IMPLICATIONS

The following chapter of the research paper will consist of three parts: conclusions, limitations and implications.

6.1 Conclusions

Over the last few decades, global interconnectivity has expanded, deepened, and accelerated due to globalisation, resulting in the development of GVC. On the one hand, international business has access to a low-cost supply of high-quality raw materials and qualified personnel; businesses can expand, enter new markets, build extensive business networks and so on. However, besides the opportunities, globalisation also creates additional daily risks that international business faces. Businesses are subject to various challenges and risks, including production, logistics, finances, reputation, and many more. These risks can be controlled and addressed to decrease their impact on the company's activities. However, dangers like political crises, financial crises, military conflicts, industrial catastrophes and pandemics can hardly be controlled. Thus, these disruptive events can have a much more substantial impact on both companies and GVC in general.

One of the recent disruptive events, the COVID-19 pandemic, shook the whole world and called attention to the GVC model's drawbacks. COVID-19 caused extensive GVC disruptions in a variety of markets across many different countries. The first few months of the pandemic shocked the world, so MNEs management was working on identifying and reducing risks. Not so much time had passed since the pandemic ceased to be a significant threat to business when a new critical event took place - Russia's military aggression against Ukraine. However, the impact of this crisis phenomenon is somewhat different implications.

The objective of this thesis was the investigation of how GVC has been affected by previous disruptive events like global financial crises and COVID-19 and compare it to the effect of the current military conflict between Russia and Ukraine.

The context of the study was the agricultural sector of Ukraine. Therefore, we analysed agricultural GVC, its risks and effects on this specific GVC of the previous disruptive events. In order to conduct the research, secondary data from newspapers, trade journals, industry magazines, and reports were collected and analysed through qualitative thematic analysis and content analysis. In addition, we have conducted four interviews with the representatives of the Ukrainian agricultural sector, which included a former high-ranking official from the Ministry of Agrarian Policy and Food

of Ukraine, a head of the trade development department of the Ministry of Economy of Ukraine, a representative of a specialised business association and a direct representative of the agricultural sector of Ukraine.

According to the study's findings, Ukrainian agricultural producers and international businesses involved in the AGVC with Ukrainian cereals have been seriously affected by the current conflict. Nevertheless, the global agricultural industry was also impacted by the energy sector crisis due to the close ties between the two industries. Because of the ripple effects of the ongoing conflict, suppliers, manufacturers and consumers suffered.

This thesis can contribute to the existing research literature on the impact of the military conflict between Russia and Ukraine on various sectors through an empirical study of the Ukrainian cereal AGVC. According to the analysis carried out for this thesis, some potentially beneficial contributions for policymakers have been made. They include recommendations to review the food storage practices of retailers and processors, reduce reliance on a few suppliers for crucial inputs like fuel and fertilisers, and secure extra foreign funding to help Ukraine regain its pre-conflict production capacities.

This thesis might conclude that theoretically and empirically, it is impossible to comprehend and study the complete Russia-Ukraine military conflict. This is merely a result of its intricacy and the fact that it is a phenomenon that is subjectively characterised. As a result, research on this issue will always be limited to specific appliances in specified contexts.

6.2 Limitations

During the construction of this thesis, the researchers faced some limitations:

At the time of starting this research project, the significant disruption had just started, so there was minimal information aside from the news of the current picture in Ukraine.

Also, many of the current research papers prepared in Ukraine and Russia were not in English, leading to problems in finding the information and translating it. The translation process was merely long; taking the needed data also took a considerable amount of time.

In Ukraine, the level of research is relatively weak. Although the government and different institutions had information, it was not always very insightful and had to be complemented by interviews.

Although the Ukrainian agricultural sector is significant to the world's agri-food supplies, the information about the local VC is minimal. Information from many different sites was needed to

understand the internal situation during the research process. The companies involved globally had information, but it was instead about the companies rather than their actual processes or influences. Since company names were not mentioned, the data was only used to picture the linkages between Ukraine with the rest of the world.

Generally, very few research papers are available regarding the Agricultural GVC. However, the EU has released very recent data about the linkages of Ukraine with the EU and the ongoing conflict's influence. The same limitation was encountered when trying to picture bottlenecks, disruptive events at a local level and how they were addressed.

The researchers used quantitative data to see fluctuations in the price of commodities and link them with the panorama of Ukraine at the time of the fluctuation. It was mandatory to connect also FDI, imports and trade treaties that could explain the situation to draw attention to them later during the interviews.

If looked purely at Russian news, the information given was distorted from reality; therefore, Russian information could not be used due to the lack of veracity.

It was vital to have interviews as part of this research project. Getting access to them needed much planning since the interviewees have high ranks in the Ukrainian agricultural sector or worked as policymakers. Since the country is currently under attack and policymakers have to react fast, the people seem occupied. Getting them on board for this project needed much flexibility on the researcher's side. Although most interviews were long and solid, a couple took time outside working hours or had to be rescheduled a few times.

6.3 Implications

Students studying international business will benefit greatly from this research. The study partially sheds light on trends in the effects of disruptive events on the global food sector. Our conclusions and conceptual framework help other researchers comprehend Ukraine's agriculture industry. Researchers may use it as a starting point to do in-depth research on disruptive events' effects on other nations' agricultural industries.

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8. ANNEXES

8. Annexes

Annex 1. Interviews

The following is an edited transcript of the interview. The aim is to have the transcript cleaned up, excluding pauses, status and filler words and also clean the grammar. Some small parts were summarised for the sake of clarity. Colours were used to highlight the coding method.

Acronyms:

R1. Respondent 1
R2. Respondent 2
R3. Respondent 3
R4. Respondent 4
I1. Interviewer 1
I2. Interviewer 2

List of questions for the semi-structured interview:

Value chain characterization	1. On your opinion, what is involvement of Ukrainian agricultural sector in AGVC? 2. What are the most widely used Ukrainian agri-food products that are involved in AGVC? 3. How did FTAs and FDI influence UA participation in AGVC? 4. Based to your knowledge, how the AGVC with Ukrainian cereals is built? 5. What are the types of inputs used for the cereal production? How is the AVC financed? 6. What are the main bottlenecks in the AVC? How are the goods usually transported?
Risk Identification, Analysis	7. What are the main risks affecting the performance of the AVC? e.g., weather, price, environment, labour standards, logistics, operational, trade policies. 8. Have you observed AGVC disruptions in last 15 years? If so, what? And what were the consequences of such disruptions for the AGVC and world food market in general? 9. What effects does a loss in production have on other actors in the AVC? Who is affected how?
Conflict influence	10. What has changed during the ongoing Russian aggression against Ukraine? 11. How do you expect this will influence world food market?

Initial Coding:

Involvement of the Ukrainian agricultural sector in the GVC

FDI, FTA – Investments in the sector in general, General Finances

Risks

General Description and AGVC configuration

Bottlenecks

Disruptions

Military conflict related issues

Recommendations; future research

Final Coding

Ukrainian AGVC configuration

Ukrainian role in GVC

- Risks
- Bottlenecks
- Disruptions

FDI and FTA contributions to development

Ongoing major disruption and consequences

Expert recommendations on Ukrainian AGVC

RESPONDENT 1.

R1. Is an Expert in the Ukrainian Agricultural sector and former Deputy Minister of agricultural policy and food of Ukraine.

I1. In your opinion, what is the involvement of the Ukrainian agricultural sector in the AGVC?

R1. This sounds like an easy question, but it is not easy to answer. The answer will depend on the product we are talking about. For example, if you look at the different commodities such as wheat, corn, rapeseeds and some other oil cultures, the involvement is huge, as Ukraine is considered as a global supplier. Only a small part of inputs, like fertilisers and a small part of seeds, around 30%, if we are talking about wheat, come from imports. However, if we are talking about processed products: flour, bread and other deep-processed products – our share on the global market is not so huge, we export not for really big amounts, about several hundred of thous. of USD. But if we compare with the wheat and corn, the export reaches several billions of USD. The amounts go around 10-15 bln USD as per year. The involvement is, therefore, huge, but it depends on the product, the duration of the food processing cycle and the food production cycle. For of plants, we have more involvement, but it is not as big an involvement when it comes to dairy products, beef, pork and live animals.

I1. Can we then conclude that the biggest involvement of Ukrainian AGVC is through cereals?

R1. Cereals, yes and poultry. We could also include honey and berries, but their export volumes are not as big as cereals.

I1. In your opinion, how did FDI and ITA influence the involvement of Ukrainian agriculture in GVC?

R1. It is important to mention that the times we live in are very different from those before the war.

I2. We are trying to find information prior military conflict; perhaps, consider a time period of the past 15 years to elaborate your answer.

R1. The Bifurcation point for Ukrainian agricultural sector was joining of Ukraine the WTO. The conditions on the internal market became similar to international rules. From this time point, external (international) investments started to play more and more significant role. Almost all the big and medium size Ukrainian agricultural companies have received investments from institutions like the European Bank of Reconstruction and Development, the Word Bank and regular commercial banks from other countries. When we talk about medium and small agricultural companies, they are mostly focused on the access to internal Ukrainian financial institutions. Different programs and grant funding schemes, supported for example by the European Investment Bank, also come to Ukraine for these small and medium agricultural producers.

I will then talk about farmers in the small and medium size category. The medium size is between five and ten thousand hectares, while small are up to one thousand hectares. FDIs are very important as it pushes the agricultural sector to higher standards, which, thus, makes the products available to enter foreign markets. Previously, Ukraine delivered products to countries in need of products with low prices. However, after joining the WTO, Ukraine started delivering products to the EU, Canada, USA or, in other words, countries with high standards of food security and food safety. Currently, around 500 companies in Ukraine have permits to export their products to the European Union, meaning they can also export to other countries that recognise the EU certification. But what's happening now, during the war, is very different.

I1. Based on your knowledge, how is cereals' AGVC configured in Ukraine? Perhaps you could describe the structure of the AGVC.

R1. For Ukrainian cereals, let's start with inputs like seeds. They mostly come from world-known companies. And we have fertilisers. Most of the fertilisers are produced in Ukraine. For example, Ammonia comes from Ukrainian plants. Still, we import potassium and phosphate from Belarus, and Complex fertilisers from China and the EU. In Ukraine, we have several seed plants that supply to Ukrainian farmers. This is the first stage. In terms of production, particularly in the case of wheat, corn and barley, then the production happens in three types of enterprises: the small and medium farmers or SMEs, and the big ones, which in Ukraine are referred to as agri holdings. However, it is not the correct name; those are the big companies with more or less 300 thous. ha. So, depending on the producer size, their production processes differ. SMEs sell their grain to processors (milling companies or to some other integrated companies that produce bread with a milling industry as part of them), or they sell the grain to bigger companies, that usually collect from different suppliers to later export; and/or they also sell to traders. Those are MNEs with subsidiaries in Ukraine, who sell mostly all the commodities to external markets. This was again before the war; now, the picture is different. At the same time, big agri holdings prefer to export independently without intermediaries.

In terms of logistics, before the war, most of the grain was leaving through ports with the biggest monthly exports around 8 mln tons. And 95% of all commodity exports, primarily cereals, went through the ports located in Odesa, Kherson and Mykolaiv port and to a lesser extent throughout the ports in the Danube river. But now the picture is different. In Ukraine we have only one company with own fleet, Nibulon, which exports products independently. Importers of

Ukrainian grain. If we talk about corn: Spain, Asian and African countries as well as China. Again, this was before the war, and now the situation is completely different.

I1. Based on your knowledge, what are the main bottlenecks in Ukrainian participation in AGVC, as an importer of inputs and an exporter of cereals?

R1. In terms of cereal production, we import inputs for production. Ukraine is considered a net exporter of food as the internal market has enough for its consumption. As a supplier to the global market Ukraine provides commodities such as cereals and sunflower oil to European Countries and some Middle East countries. Ukraine exports export cereals to Turkey, as this country – is the biggest flour exporter in the world due to their national policy of processing support.

Before the war, there were almost no bottlenecks in logistics. Though the agricultural sector has been dealing with climate change. In some regions in the south of Ukraine, like Kherson region, there are areas with a subtropical climate, something atypical for the region. So, the farmers had to adapt and change the cultures they sow. Now they produce mainly lemon, ginkgo biloba and other plants, not typical for the country but which would survive the new climate of the region. All these raise the issue of irrigation since the area lacks enough water supply.

Moving further. Every producer in Ukraine can tell you that there is a lack of finance for further development like storaging, logistics and other. Small Ukrainian farmers or those with less than 100 ha almost did not have access to loans. Only a few per cent had access to farming loans, but the help is insufficient. For example, the highest amount a farmer could get was around 13k USD, which is not enough in reality, especially for fruit gardens or horticulture, making it impossible to ensure the quality and make their products available to be sold outside Ukraine. The third risk, before the war, around 40% was considered household production in terms of animals, meaning the product is not considered an economic production but rather something they do as a hobby. However, due to the law in Ukraine, those producers have the right to sell in the market, although product control is not in their homes. However, at the selling point, therefore, it is almost impossible to trace back the source of an infected/unsuitable for selling a product, especially when it comes to animals.

Regarding cereals, especially wheat, 23% was produced in households. This is around ⅕ of the total production. This household system has opened the door for "tax optimisation" or the lack of tax payment.

I1. Let's move to disruptions in Agricultural VC. We are interested in those related to the global financial crisis or sanctions. Have you observed any of those in Ukrainian agriculture?

R1. The ones I can recall were the ones in 2008, then COVID-19. Ukraine has not had sanctions per se, and I do not recall even WTO investigations in the sector; everything has been working clearly.

The economic crises experienced back in 2008 hugely impacted the country. However, this issue was mostly related to the exchange rate of the national currency (hryvnia) against the USD and Euro and access to the finance (loans) as the interest rates increased. The crisis made the currency so low that the loan costs could not be covered because it made it impossible to repay loans. It was not only in Ukraine, but also globally.

But then we had COVID-19, and I can say that the problem was stronger for the European Countries since the Ukrainian labour came back to Ukraine and the countries experienced a lack of labour availability in their plants. However, in the sector, there were not important issues. In Ukraine,

people continued their normal consumption, but the distribution, especially to businesses, was interrupted as restaurants and other places, where food was served, were closed for visitors. Phone applications related to deliveries to home proliferated, and they were available 24/7 for consumers. Restaurants had problems changing their production systems as now they had to switch to Ready to Eat meals (MRE). Also, consumer preferences changed during the pandemic and the lockdown switching to healthier and organic options, including more fruits and vegetables in their diets and cutting on processed food. However, for agribusiness, especially cereals production, there was no major impact.

I1. Our research has shown a correlation between the price of agricultural commodities and the different crises.

R1. It is normal reaction of the market because food is a primary product and essential for every human. Panic behaviours and over shopping, making food less available, also increase the final price of the food products. Based on my own experience, at times, different interpretations or incorrect translations of interviews of representatives of the Ukrainian Ministry of Agricultural policy and Food regarding the limits of the domestic grain market led to immediate changes in prices on world commodity exchanges.

I1. Which key transaction points or interactions do you perceive as the riskiest and most uncertain before the ongoing military conflict?

R1. From my knowledge, the problem I can see right now is wheat quality. In Ukraine, there is no Durum, only soft wheat. In terms of corn, Ukraine doesn't grow white corn, but yellow corn, which is used mostly for feeding purposes. The crops must be changed, but any change comes with greater economic needs in terms of fertilisers, seeds, fuel, and operations, among others. And farmers have neither the finances nor the mentality to switch.

I1. Let's move to the military conflict now the country is facing. What has changed during the last year?

R1. Almost everything. First, in VC, from the beginning of the war, logistics were massively interrupted. We moved from digital work to manual work as we had to personally answer and call people to provide them with information about where they could collect wheat for processing since supply chain was broken. That situation lasted around three weeks, and people started accepting the situation in the country. Later on, logistics continued being a problem but targeted towards eastern, northern and southern regions and, of course, until the ports were opened again to the western borders that transported to the EU. In the beginning, checkpoints were installed on the Ukrainian roads, that slowed down the movement of food trucks. Later on, the situation changed with the removal of the unnecessary checkpoints so the food trucks, together with humanitarian trucks, got special permits for fast track.

The second problem we encountered was the lack of drivers since a lot of men were mobilised due to martial law. Even now, big bread plants in Kyiv do not have enough drivers to distribute bread to supermarkets. Also, now, the situation with the availability of food is better. However, the panic demand for food, especially for long-term storage products, which observed at the beginning caused empty shells in the supermarkets.

Now about food processing. As the war started, some of the producers, especially bread, poultry, etc., started giving their products for free and humanitarian aid. Humanitarian help, an addition to the logistics problems and freeze of the market led to some financial problems for the processors, especial in the first month of invasion. At the same time, banks, international financial

institutions and insurance companies were not ready to give money to Ukrainian producers to support their production activities due to the war. Those institutions were not ready to hand out money since they were not sure how it would be used and repaid back. When the food processors accepted the situation, they went back to work, but in April, they realised they had a lot of commodities stock. However, the processing companies were not ready to accept all the stock since the demand was not there, especially for bread and flour. It is important to remember that Ukraine is a net exporter, as the domestic market only uses 20% or less of the total production. Now the issue of exporting has arisen. Europe was not ready for the amount of export that would go transit through its territory as the capacity of roads, railways and ports even now cannot meet the demand.

The following months were devoted to negotiations among Turkey, Russian Federation, Ukraine, and the UN. Later in August, when the numbers of yields arrived, we realised Ukraine had already lost ⅓ of their production compared to previous season due to occupation and landmines placed along the agricultural areas. However, it was still enough extra to export since Ukraine, at that point, had around 20 mln tons of wheat and 28 mln tons of corn. At the same time, the internal market only needed for internal consumption only 4 mln and 8 mln of the types of cereals respectively. Furthermore, households and small enterprises cut their costs because, due to logistic and financial problems, they could not support the situation. They just needed some income to survive, and the internal market reduced as many people fled the country, reducing internal consumption. It is estimated that around 8 mln people at that point have left Ukraine to go abroad as refugees.

Before the war, the three ports in Ukraine were open and provided 47% of cereal exports worldwide. However, right now, the exports also have an additional step to go through as the inspections are provided by a joint Turkish-Ukrainian-UN-Russian Federation initiative called Joint Coordination Centre (JCC) that inspects the vessels that go through the maritime humanitarian corridor. Optimal number of these inspections is around 25, but just this February, we had only three. So, the Ukrainian farmers are discouraged about their crops since they cannot export them. These next few years even come with greater challenges as the farmers face: 1)lack of finances; 2)lack of inputs, even though some inputs are supplied by our partnering countries as a humanitarian aid, and 3)lack of storage, especially in the months after harvest and before the New Year. What is happening now is that Ukrainian farmers just collected yields from 2022, which was big enough. However, the sowing land under the wheat reduced by ⅓ due to the excluded occupied territories. Farmers are not ready to sow corn as it requires a lot of energy to dry after the harvest. However, due to missiles, since October 2022 till February 2023 the electricity supply was interrupted, and food processing companies faced problems due to constant shutdowns. The generators we have been provided with require excessive amounts of gasoline. For example, one generator for one big production facility requires 250 litres of fuel per hour, raising enormously the costs of any activity that requires electricity. Although now the electricity is more stable, we still face a lot of challenges.

Returning to the export activities, the structure of exporters has significantly changed. Traders, that were one of the most important export players before the war, now do nothing, as their mother companies understand they cannot ensure the contracts. They have been advised better to do nothing, and now medium size enterprises and small producers are becoming exporters themselves.

Before the war, the ports in the Danube River had only a director and docking area, as the main exporting ports were Odesa, Pivdennyi and Chornomorsk. However, big companies with terminals are now exporting through those small ports in the Danube River and it is estimated to be exporting around 1M tons. In contrast, around 2M tons go through railways and trucks. But as I said, Europe was not ready for these volumes of transit. The rest of the exports goes through Odesa ports under this Black Sea Grain Initiative. But due to the lack of inspections conducted by JCC, the highest volume of commodity exports was only around 4.7M tons in one month. Ukrainian farmers realise they cannot sell their products neither internally, nor externally, but still need income. Still, the logistics costs have increased dramatically. If previously logistics cost around 8 USD for 1 ton of corn or wheat from inland transportation to the port, now the cost for the same volume is more than 100 USD. And now farmers are forced to sell their commodities for the price that does not cover their production cost. And currently the biggest importers of Ukrainian wheat and corn became Poland and Romania. As both countries have two grain ports each, and all the terminals in these ports are private, the possibility of exporting for Ukrainian farmers through these terminals is non-existent if you do not have a contract with Romanian or Polish colleagues. Therefore, the farmers are just selling the products at the border and now Romania and Poland became the biggest importers of Ukrainian cereals in 2022 — something I can describe as a normal situation under these circumstances, which follows with the re-export of Ukrainian cereals from the EU port to its final destination.

This is a good example of why Ukraine needs a transportation corridor from Europe and through Europe. In my opinion, this is a win-win situation as Europe will earn from the logistic servicers, and the Ukrainian farmers will get revenues that are so much needed.

I2. I cannot stop wondering, what are the real incentives for these farmers if they sell below their cost price? Do they still make money?

R1. Their options are only two: to get money or to get nothing.

I1. You are saying that the risks we can see now will continue affecting the agricultural sector of Ukraine the following years. Is this correct?

R1. The most complicated year will not be even 2023, but it will be 2024 due to the time-lagged effect and the lack of financial products. I am not sure what will be the size of the wheat sowing area this autumn. Also, winter wheat cannot stay in the field for longer times, as for example corn can. And the farmers will need help in terms of inputs: seeds, fertilisers and other elements of the production technology. Big producers currently do not plan to sow corn. Instead, they plan to reorient their crops to oil cultures, such as sunflower, rapeseed, soybean. But the problem comes here: oil extraction plants have no possibilities to reach international markets. Before the war, Ukraine had around 60% of the global sunflower oil market, and now we only have around 34% of the global market. Also, these plants produce oil extraction by-products, like sunflower meal. These products have expiration dates, thus, require specific storing with certain temperature regime, which requires extra energy consumption and consequently increases the production costs. However, these facilities are unable to sell their products and eventually only incur losses. Other producers are only exporting sunflower seeds and oil crop seeds.

I1. So, this autumn will be challenging for Ukraine.

R1. Not only for Ukrainian farmers, but mostly for external markets, in countries like Lebanon and some other African and Asian countries. These countries risk not to get as much food as before. Social protests have already been seen in these countries during the last year due to the

lack of Ukrainian food products. But the situation might even worsen. Ukraine also faces social pressure as work availability has been reduced due to war. Thus, Ukraine needs to restore exports as it is the best way possible to get the money needed to continue production.

I2. Thank you for taking part in our interview!

RESPONDENT 2

R2. Director of the department in the Ministry of economy of Ukraine

I1. In your opinion, what is the involvement of the Ukrainian agricultural sector in the agricultural global value chain?

R2. I think Ukrainian agriculture became a natural part of the global value chain during the last 15 years. From a very regional and, I'd say, small supplier, Ukrainian agriculture became a significant supplier for several products, namely grain, cereal, some fat and oils, and now has a growing share in some other value chains. So, I can say that Ukrainian agriculture is a part of the global value chain. And during the war, it was confirmed with the reflection on markets, and the market price was correlated with the limitation of supply from Ukraine. So, this also proves that Ukraine is an important part of the supply chain.

I1. From your point of view, what Ukrainian Agri products are involved in the global value chain?

R2. Unfortunately, cereal and oil, fat and oil, but predominantly this is sunflower oil, and I can mention a couple of other products, which are soybean and rapeseed, but the role of these products is not very important; some types of meat products, probably the sugar and the confectionery but with a minimal number of markets.

I2. How do you think, how did FTA and FDI influence Ukrainian participation in the agricultural global value chain?

R2. Historically, Ukraine went through different stages of development. 15-20 years ago, export was not so interesting for Ukrainian agricultural producers because they were oriented to the internal market. An inner consumer was their initial goal. After, I would say, 2005-2010, more and more subsectors started to participate in foreign trade. Export became a "national agricultural mood"; everybody wanted to export and join in foreign trade. When we talk about investments, it is another story. For the Ukrainian agricultural sector, the main investments were in transferring knowledge from big companies to smaller ones. The first examples of Ukrainian agricultural companies listing on the international Stock Exchanges were the biggest news for the whole country. Now Ukrainian agriculture can be described as a combination of big and medium-level companies invested with foreign investments and many medium and small companies who prefer to work with the national capital.

I2. Based on your knowledge, how is the Ukrainian participation built in the agricultural global value chain?

R2. Ukraine has a high level of technological involvement in the agricultural sector and absorbs the new technologies available in the market. The same situation is with crop protection, fertilizers and machinery. So, from the point of production, Ukraine is highly dependent on new technologies and other inputs. I think that the progress in the development of the agricultural sector of Ukraine during the last 10-15 years was correlated with the availability of crop protection, seeds, fertilizers and machinery inside the country. We are at the beginning of this process when we talk

about manufacturing (processing?). Historically, our manufacturing and milling industries were created during the Soviet period. It means that currently, Ukraine cannot compete with neighbouring countries for higher product quality and satisfy consumers' expectations. But the situation can change in the next 10-15 years because the internal market became smaller over the last year, we lost approx. ten mln consumers. This fact brings to the industry the understanding that if they want to stay in the market and keep companies alive, they need to develop export direction and create an export strategy. It means they need to renovate technologies inside the companies. When we talk about the place of the Ukrainian grain and milling industry in the world, Ukraine is one of the biggest suppliers of wheat and barley. There are also big opportunities for corn. Ukrainian corn is mostly a technical crop (used for feed production), but this is one of the top exported crops from Ukraine. With regards to flower and other milling products. Last year Ukraine increased the supply of these products to the EU 10 times more than before the war. Still, the important thing is that the quality of these products is acceptable for the European market at the moment.

I1. What inputs does Ukraine require to produce the cereals?

R2. All: technology, crop protection. The crop protection market was 1.5-1.8 bln USD before the war, and 90% of it, I suppose, was imported from abroad. Regarding seeds: 95% of corn seeds and 95% of sunflower seeds were also imported. We do not depend so much on the import of wheat seeds because we have good national production. A similar situation is with rye and barley seeds, as we have producers. Regarding fertilisers, Ukraine had some internal production of fertilisers. But ammonium, phosphor and potassium are normally imported from abroad. Regarding machinery u. Usually, Ukrainian farmer prefers to work with machinery, which has a long period of exploitation, and usually, this machinery is from USA or Europe. It costs more, but the period of usage is longer.

I1. What about financing? Can it be assumed that Ukrainian agricultural might face shortages of available funding during the next few years?

R2. Yes, the production level is decreasing dramatically: we have lost 20-25% of production during the first year of the war, and I think another 20% can be lost this year. We also have limited access to the seaports and sea logistics, which influences the level of internal prices. Currently, Ukrainian farmers lose, I would say, half or even 60% of the price so, the lack of financing will be one of the main challenges for the next five years.

I2. As you also mentioned, the seaport. What is the seaports' role in conducting cereals export from Ukraine?

R2. Sea logistics is the cheapest way to export cereals from Ukraine. When we talk about the different logistic options, seaports are the cheapest and the most appropriate option to export from the point of the volume of products supplied. One logistic batch is about 35,000 tons of grain. If we use land logistics, it means that the supplier will have a much lower volume of products and higher costs of transportation. That's why sea logistics was the most convenient and reasonable way of exporting cereals before the war.

I2. What, in your opinion, are the main countries involved in the AGVC with Ukraine?

R2. When we talk about cereals, the number of countries consuming Ukrainian grain is more than 60. These are African countries, the European Union, countries from the Middle East, and Asia. But I would say that Ukraine's main area of interest is the Mediterranean region because there is the majority of consumers of Ukrainian cereals around the Mediterranean region, and with the

sea routes, we have the easiest logistics for them. At the same time, China and Indonesia are also significant consumers of Ukrainian grain.

I2. From your point of view, what are the main risks affecting the performance of the agricultural value chain?

R2. War as a critical event. Also, I think weather conditions are still one of the most important sources of risk for the agricultural sector. But I would also say that recently, it has become less important because almost all countries that supply significant volumes of cereals and are recognized as global suppliers work with the weather through technology. Access to inputs can be seen as a risk. From the pre-war experience and COVID-19, logistics and supply chains are also sources of risk. Trade policy can also be a source of certain risks. For example, trade policies during the COVID-19 reflected uncertainties and unpredictability in societies connected to health protection. During the COVID-19, the logistics and supply chain faced the problem of trade policy. To sum up, in my opinion, the main risks for the agricultural value chain are access to finance, access to inputs and trade routes.

I1. You have mentioned COVID-19, and the next question is: have you observed any agricultural global value chain disruptions in the last 15 years?

R2. You see, we have some global challenges every 10-15 years. During the last 15 years in Ukraine, we had a financial crisis, draught in 2012-2013, and COVID-19. Normally, any crisis combines some smaller ones, whether financial, institutional or natural. And after every crisis, the supply and demand sides normally face the problem of how to solve this crisis, what instruments can be introduced, and how to communicate between the sides. The creation of the Grain convention, for example, was the first attempt to present a solution to these problems. It has existed almost for 7 years, and until now, the demand and supply sides do not communicate properly. In 2008, during the global financial crisis, the main problem to which the supply side tried to find a solution was analysing and understanding the level of stocks critically. At that time, few instruments for supplying and consuming countries were introduced, which provided a clear understanding of the availability of stocks.

I1. In your opinion, what has changed in the participation of Ukraine in agricultural global value chain during the military conflict?

R2. Many things. Before the war, Ukrainian agriculture was very successful due to a number of reasons. The Ukrainian agricultural sector is quite big in terms of size 5000 ha is a big farm for European, American, Canadian or even Brazilian agricultural sectors. But in Ukraine, we have a large number of 5000 ha farms and even bigger producers that cultivate hundreds of thousands of ha. This conglomerate between small, medium, 500 ha/5000 ha/and 50000 ha companies they do not compete on the internal market because most of them participate in the export (supply chain) of grain, corn, soybean and other crops. When we talk about sunflowers, we have a very developed sunflower processing industry. Ukrainian companies are global leaders in the supply of sunflower oil with a high level of technology. All these companies are involved in worldwide trade and can be recognised as global players. And as far as farmers understand that they want to continue participation in global trade, they need to create a different approach to exporting cereals and grains, and sunflower and sunflower oil. So, they established land routes to the Polish and Romanian seaports. They became more flexible regarding whether they need to store or sell some parts of the available harvest. A number of them started developing an understanding of processing; they realised that they needed to begin their processing activities. The right question should be, why is

the Ukrainian agricultural sector not developing (and, apparently, will not for the next few years)? - because there is a lack of finance. During the last year, Ukrainian companies did not spend money for their own development and business prosperity but instead spent money to support the humanitarian needs and support for the country. I spoke with the owner of a small Ukrainian farm with up to 2 mln heads of poultry and 1500 hundred hectares of nuts orchard. Recently, they stopped investments in storage and manufacturing facilities and continue spending money to support the country and its population. At the same time, they are interested in exporting; they try to find any opportunity to sell products abroad. So, I think this brings us, from one side, the understanding that we have a very strong background, and, from another, these challenges also influence farmers to diversify their production and business activities.

I1. I was slightly interested in what you said at the beginning that companies had opened new transportation routes themselves. So not the national ports like Odessa, but they have opened new paths to transport their goods. Was it was Romania?

R2. It is Romania and Poland mostly. But they are also in Ukraine. Recently, Izmail port became one of the core ports for cereals logistics. With a capacity of half a million tonnes per year, this port was previously not taken seriously because it was a small, underdeveloped regional port with limited access and limited capacities. Today it is one of the core ports, which attracts high interest, money and different players. And we can see the changes in approaches and mindsets in other parts of the Ukrainian agricultural sector.

I1. What do you think about the current input supply to Ukraine?

R2. Stable. Still, access to fertilisers is currently not only Ukrainian but also an international problem. I am surprised that the global community is discussing how to access Russian and Belarusian fertilisers rather than introducing opportunities for African countries. I assume it is easy to substitute Russia for African countries regarding fertiliser supply and African countries can easily become global players in this market.

I2. Do you consider that sanctions imposed on Russia and Belarus can significantly affect the global agricultural value chain?

R2. We can reach an even more significant effect by keeping the sanctions and introducing the opportunity for alternative countries-suppliers. Currently, we face the problem that a group of countries-suppliers of fertilisers influence a large number of countries. But suppose the world introduces the opportunity during this sanction period to other countries that are able to produce similar products. In that case, it can have a very interesting effect: African countries, which depend on grain supply from abroad, can become more independent as they will receive the opportunity not just to consume, but exchange produced fertilisers for grain. This can be a completely different development path of relations between consuming and supplying countries. In my opinion, we need to use the sanctions period to substitute the limited number of suppliers with a wider number of new suppliers.

I2. Which risks, in your opinion, are transmitting along the agricultural value chain from Ukraine to other participants in this value chain?

R2. For example, the problems of cereal production in Ukraine can lead to a lack of feed production in Europe, which can lead to a decrease in the production of cattle or pork and consequently increase the price for the final customer. However, Ukraine is a core feed supplier, but not the only one. And this situation has two different sides: from the point of view of Ukraine and the point of view of the global market. When we talk about the global market and consumers,

it is a matter of price. If we limit, restrict, or decrease the supply, we face increasing prices. But when we talk about Ukraine, it faces a different problem: it is important that Ukrainian producers not leave the global market completely. We have just finished the discussion about the global fertiliser market, and here is a similar situation. If Ukraine cannot supply cereals to the market, other countries will supply this amount of grain instead of us. And this problem is more Ukrainian than global. Ukraine needs to participate in the global market. So, I want to say that, even though Ukraine is one of the critical suppliers on the global market and last year, the ability to export cereals from Ukraine significantly influenced the world price, Ukrainian producers can still lose this position and can be substituted by other country-suppliers during the next decades.

I1. What effect will have the loss of production on other actors?

R2. Normally, the general effect will be the loss of welfare because any such changes in price and production affect the consumer mostly, but at a later period, it also will affect the producers as they will face the problem with higher costs and lower interest.

I1. What are your expectations for the future?

R2. I'm confident in Ukrainian agriculture because I understand that if producers see that diversification is an option, they will progress. I'm very careful in expectations for the consuming side because I assume that a significant part of the world now faces financial problems. And probably the next financial crisis can bring us more unexpected changes in global consumption. So, it looks like we are trying to keep the situation from the supply side, and we do not properly understand what's going on with the consuming side.

I1. If we have a new global financial crisis soon, how will the global agricultural market reflect on it?

R2. I think it will start a new period of stagnation. First, countries will try to fix the level of production costs. Then they will reflect on what will result from this financial crisis. If a financial crisis becomes, it will directly or indirectly affect up to half of the world's population. I don't know who wrote it, but I read in the article that hunger is not a natural risk but a matter of money.

I2. Thank you for taking part in our interview!

RESPONDENT 3

R3. Director General of one of the agricultural associations in Ukraine

I1. In your opinion, what is the involvement of the Ukrainian agricultural sector in the global value chain?

R3. It's pretty big. I would say it also depends on the product. As we are at some products number 3, 4, 5 in the rank of the biggest exporters in the world, when we talk about corn, wheat, sunflower seed, or oil, or meal, and also regarding walnuts honey, chicken meat.

I1. Can we conclude that cereals are one of the top products in the agricultural global value chain?

R3. Yes, grains and oilseeds, I would say.

I2. How did FDAs and FDI influence Ukrainian participation in the global value chain?

R3. Free trade agreements have some impact. I wouldn't say it is too big; I don't want to overestimate their influence. Regarding foreign direct investments, to some extent, they also

influenced the participation of the Ukrainian agricultural sector in GVC. When we look at the agricultural companies here in Ukraine, which produce grains and oilseeds with foreign direct investments, there are some, but not as many as there might be. I estimate that roughly up to 1 mln ha in Ukraine are cultivated (operated) by companies which foreigners directly own.

I2. I mln ha out of total 42 mln ha?

R3. Let's say 30 mln ha, which is arable land. Because 42 mln ha – that's the total amount of agricultural land, incl. Crimea, and with all the pastures, which are not suitable for arable farming. Let's talk about 30 mln ha, which is close to the statistical figures.

I1. And these companies that are owned by foreigners or have a share of international funding, do you know them and where they are from?

R3. We can go company by company. We have NCH company, which has US roots; they farm at the moment roughly 300 thous. ha, here in Ukraine. They do not own land; they just rent this land, but they are involved in production and trading, and distribution of seeds, crop protection products etc. There is another company, which comes from Saudi Arabia, – Continental Farmers Groups. They have roughly 200 thous. ha in Ukraine, mostly in the western regions. There are some companies, which are publicly traded, and there are some Ukrainian guys who are founders of these companies here, but eventually, they sell shares on Warsaw Stock Exchange or London Stock Exchange or other. That's MHP, Astarta and some other companies. Some other foreign farmers are from the Czech Republic, which operates 42 thous. ha in different regions of Ukraine; a French company in the eastern part of Ukraine forms roughly 25 thous. ha. There are also some other smaller German farmers. And when we talk about farmers and say "smaller", we mean those, who farm, let's say, from 500 ha up to 15 thous ha. And we know at least 50 such farmers from Germany, the Netherlands, Italy, Poland, Japan, China, and other countries. In total, they roughly farm one mln ha. Up until very recently,

I2. Based on your knowledge, how is the global agricultural value chain with Ukrainian cereals and corn organised?

R3. I think it will be easier to go crop by crop. First, let's talk about corn. I would say that we have roughly 80% of the seed supplied from multinational companies, which are supplied mostly from their own production or partner production here in Ukraine. So, these MNEs have a partnership with our local, let's say, farmers or farms to produce seed and then provide it to our companies and our farmers on the market. But also, there is part of seeds, which our Ukrainian seed producer's supply. The share is different when we talk about wheat and barley. Here we have more Ukrainian varieties of wheat. And I would say that at the moment, this share is 50%-50%: 50% is supplied by Ukrainian sees suppliers, and the other 50% are imported. Usually, it is European varieties of wheat. Regarding fertilisers. We usually have roughly 60% of our domestic supply of nitrogen fertiliser. Regarding other fertilisers like phosphorus and potassium, or possibly complex fertilisers (NPK), they are usually supplied from abroad. Like 80%-90% are supplied from abroad by big companies or importers. Plant protection products are mostly supplied from abroad. There are only a few companies which produce crop protection products in Ukraine. However, these products are usually not synthesised, but the companies import the active ingredients and then mix them in Ukraine to create a finished product. Machinery. When we talk about tractors or combines,

most of them are imported from different countries, also dominating multinational brands. In Ukraine, a small number of producers in a very small segment of tractors are present, but they are not significant. There is almost the same situation regarding other agricultural equipment. Fuel is mostly imported at the moment. Before the full-scale invasion, fuel was mostly imported from Belarus and Russia. Now it is imported from other countries. Regarding processing. A very small percentage of corn is processed in Ukraine, most of which goes for feed production in Ukraine. Still, the biggest share is exported to Asia, Europe, Africa and others. Export was conducted mainly through the seaports. Before the invasion, almost 98% of cereal export went through seaports, and now, of course, we have a different distribution or different model of logistics. The situation with other types of cereal is similar.

I1. What are the main risks that are affecting the performance of the agricultural value chain?

R3. Traditional risks for the agricultural sector, I would say, are prices and weather. These are the most important risks which have the biggest impact on the value chain and profitability of the farmers. Now in Ukraine, the biggest challenge is logistics. Even though we see the price for wheat on the other markets at 450 USD per ton, it is not reachable for Ukrainian farmers because only logistics from Ukraine is now 200-250 USD per ton. And right now, the logistic window is very narrow, so only a few operators can get through and get this price. The end price for farmers, in fact, is much lower.

I1. During or after the military conflict, have you seen a decline in the quality of the product?

R3. I wouldn't say that we had or will have issues with quality. Yet, this year we had some small problems with the quality of the corn because many fields were staying without harvesting during the winter up to March (which is a normal practice also, but technologically the best quality of corn is before the winter). Many farmers harvested corn in March, so there were some small issues with the technical characteristics of the quality of corn, but these issues were not critical. There are some other problems with fields, which were under heavy shell fire and are now contaminated with the remains of shells, mines, and other things. Of course, in those regions, there might be some issues and problems with the quality of the product due to the contamination of the soils with some metals and other noxious substances. So, we are preparing to deal with it.

I2. The quality of the product is also connected to the question of the availability of finance. If comparing pre-aggression and now during the conflict, will this be an extra risk for the agricultural sector?

R3. The quality will not be a risk. It is already foreseen that Ukrainian farmers will probably use a lower level of nitrogen application. And we understand that it will probably have an impact on the protein content in the grain. It is foreseen that it will be lower than it was in recent years. If we talk about finance, there is definitely not enough affordable financing for agricultural activities in Ukraine. Some banks offer credits with a 30-40% interest rate. So, finance is available but is not affordable. There is also another issue with the finance –a lack of collateral. So, yesterday I talked to one of our friends. He was "lucky" to buy land lease rights for ten thous. ha for an irrigation project in the Mykolaiv region on the 20th of February 2022, just four days before the full-scale

invasion started. These lands were directly on the front line, under heavy shelling. So, their farmyard is absolutely destroyed, machinery is ruined, ten thous. ha are contaminated with the mins, unexploded shells, etc. They also have problems with people (working labour). And the owner told me it was funny when the regional administration sent them a questionnaire about "what kind of help you probably, need: seed or fertiliser, etc.?". And it was funny because their biggest issue is demining these fields. All the rest is not such a big problem. They will try to recover economically and in terms of needed resources. But without demining, this first step – the rest has no meaning. Another risk in Ukraine right now is that there is little or no possibility of working on some lands that are close to the fighting line and on those that are occupied right now.

I2. Besides the ongoing conflict, a very big critical event for the Ukrainian and global agricultural value chain, have you observed any other similar critical events that significantly affected the Ukrainian agricultural sector?

R3. Actually, not really. I would say the COVID-19 pandemic had no big impact on Ukrainian agriculture. If we talk about financial issues with a global impact, like high-interest rates, it is a global process, so we will eventually be affected. In Ukraine, we usually have higher interest rates, and now we have them even higher because of the high global level.

I1. What has changed during the time of the Russian aggression?

R3. Let's start with the supply. We were highly dependent on the supply of diesel fuel, which is most important for farming, from Belarus and Russia. It was roughly up to 75%, or probably 80%, when we talk about 2021. So that was the biggest challenge and the biggest change as of now, supply goes from or through the EU. The logistics changed. The price for the logistics is still very high, much higher than it was before. Even when we calculate it in USD or Euro from Ukrainian currency, which devaluated during the last year, it's still much higher than it was before. The next is fertilisers. We're not importing from Russia, but we had quite a big share of fertilisers imported from Belarus. This also changed, as there is almost no trade with Russia and Belarus. We also lost one factory in Ukraine, in the Luhansk region, which produced fertilisers. And now there are two other factories in Ukraine, which can produce fertilisers, but they don't, as they don't work right now. So, we are pretty much dependent on producers in Ukraine or imports. There is also an interesting situation in the seed market. Many international companies invested in seed production in Ukraine proceed. Last year Ukrainian farmers sowed less corn, and at the same time, there was some deficit for corn seeds in Europe. So, we exported a very large amount of corn seeds from Ukraine to Europe in 2022. This was an interesting change in trade in the last year. Regarding exports, so now, we still have almost 50% to 50% of export routes. We export roughly six mln tonnes of grains, oilseeds, and processed products per month. Hopefully, that goes through Black Sea Grain Corridor through Odesa ports. And the other half goes through the Danube riverports, railway and trucks. So, during the last year, logistics changed dramatically. I think we will need these routes in place for the future because there is still a high risk for the future prolongation of the Black Sea Grain Corridor. We expect that even if we recover the free shipment from our seaports, there should be some support from the government to support these alternative routes in case other similar events happen in the future.

I2. What is your assessment of the influence of ongoing military conflict on the world food market?

R3. The influence was dramatic. We can look at the FAO food index prices, and it becomes clear: the prices spike right after the invasion. It also has a dramatic impact on world food security. We had also seen that supply chains were fragile or had no reserves. Because after the invasion, after the stop of supplying, there were one- or two-week reserves for some food products in Europe (for example, mustard, flour or sunflower oil etc.). We can also conclude that there were not enough reserves in the global food supply system for some food products before the war, and they were not prepared for such a situation. Risks and disruptions in the global value chain eventually transmit along the whole value chain. And all value chain sides can be affected by these disruptions, including the final customer.

I1. Thank you for your participation in our interview!

RESPONDENT 4

R4. Representative of Ukrainian agri holding

I1. In your opinion, what is the involvement of the Ukrainian agri sector in AGVC?

R4. I think the involvement of the Ukrainian agri sector in AGVC is significant. Ukraine is one of the world's largest agricultural producers and exporters. Ukraine has more than 30 mln ha of agricultural land area. Climate conditions are also favourable for the production of different types of crops. And in global terms, the Ukrainian agricultural sector plays a critical role in producing grains, oilseeds, processed products, etc. These products mostly go for export, where they are further processed, packaged, and distributed. Ukraine is an important supplier of raw materials to the global food industry. Its agricultural products are used in a wide range of food and beverage products, including bread, pasta, beer, and vegetable oils. I think we can say that the Ukrainian agricultural sector is an essential player in the global agribusiness value chain, providing a significant amount of raw materials to the world's food and beverage industry. As the biggest volume and the biggest currency inflow falls under grain export, they can be easily considered the main Ukrainian AGVC product, at least as of now.

I2. How did FTAs and FDIs influence Ukrainian participation in AGVC?

R4. I think a combination of FTAs and FDI played a crucial role in the development of the agri sector of Ukraine and the sector's participation in the AGVC. First of all, I need to mention the accession to the WTO, which was in 2008. Since that moment, Ukrainian agribusiness started to develop as a business. Establishing similar rules on the market led to an increase of interest from international investors in the Ukrainian agri sector, of course, not without taking into account the favourable climate and the fertility of the land. Secondly, new FTAs have enabled Ukraine to increase its participation in international trade and expand its market access to agricultural products. One of the most important examples is the EU-Ukraine Association Agreement. DCFTA (its trade part) came into force for Ukraine as a unilateral autonomous preference from the EU side in 2014, but the FTA itself came into effect in 2016. The agreement facilitated the increase of trade between Ukraine and the EU. This agreement has helped to improve the regulatory environment for Ukrainian agricultural products, making them more competitive in the global marketplace. Thus, increasing FDI inflow and supporting export growth. In addition, with the FDIs, besides financing, foreign investors have brought to the sector new technologies, management practices and

benchmarks, which have helped to improve agricultural productivity and quality. For example, foreign investors have been involved in modernizing Ukraine's grain storage and processing facilities, which has increased the efficiency of grain exports. FDIs have also enabled Ukraine to diversify its agricultural exports and maybe even move up the value chain. For example, foreign investors have helped to develop Ukraine's poultry and dairy industries. These industries showed great potential for further development, at least before the full-scale invasion. We will see if the situation will remain after the end of the war. I can say that, in total, FTAs and FDIs had a positive impact on Ukraine's participation in the global agribusiness value chain by improving the regulatory environment, increasing the quality of the product, enabling market access, and bringing in new technologies and management practices.

I1. Based on your knowledge, how the AGVC with Ukrainian cereals is built?

R4. The global agribusiness value chain with Ukrainian cereals is built based on a very complex network of relationships among different actors, which are involved in the production, trade and processing of grains. These actors include farmers, processors, traders, exporters, and consumers.

The first link in the chain is the farmers who grow cereals, including wheat, corn, and barley, among others. These farmers can have different sizes: small, medium, or big producer, depending on the size of the land they work with. These cereals are then harvested and sold either to traders (in the case of small and medium producers), who aggregate the grains and transport them to processing facilities, or export directly to the processor (in the case of some medium and mostly big producers). However, this scheme worked before the war. Now, when international traders have put their activities in Ukraine on hold, the supply chain for these manufacturers has broken down. Moreover, small and medium-sized producers are forced to look for any opportunities to export, since the domestic market is overflowed with products and the price of products is very low. Most often, such exports end immediately somewhere outside the Ukrainian border - in Poland, Romania, Bulgaria or Moldova. At the same time, big agricultural companies, which can form large batches of products, export in transit through EU countries.

Processing facilities, including mills, refineries, and other factories, process cereals into various products, such as flour, starch, and ethanol, among others. The processed products are then sold to downstream users, such as food and beverage manufacturers, animal feed producers, and other industries. Should be mentioned that processing facilities can be both in Ukraine and abroad. That depends on the product we are talking about. However, since most of the export is a raw material, Ukrainian processing has significant potential for improvement and modernization.

Exporters, including domestic and international traders, are crucial in the AGVC for Ukrainian cereals. Exporters purchase grains and processed products from domestic processors and transport them to global markets, where they are sold to customers, including food manufacturers, animal feed producers, and other industrial users.

The final link in the chain is the consumers who purchase and use cereals and processed products in various ways, such as in baking, brewing, animal feed, and industrial applications.

I1. What types of inputs are used for cereals GVC in Ukraine?

R4. The production of cereals in Ukraine involves a range of inputs, including seeds, fertilizers, pesticides or plant protection products (PPP), machinery, fuel and, of course, labour and land. We can check all of the inputs one by one. Seeds: Depending on the crop, farmers in Ukraine can use both imported and Ukraine-produced sources. Fertilizers: The situation with fertilizers is similar. Some fertilizers are produced in Ukraine; some were imported from Belarus, Russia and China. Given the war in Ukraine and sanctions on Belarus and Russia, the next sowing campaign will definitely be more challenging. PPP: The share of PPP produced in Ukraine is insignificant compared to the amount of imported PPP. TOP3 suppliers of PPP to Ukraine in 2021 were China, France and Germany. Fuel: The availability of fuel in Ukraine is solely based on import, and the main fuel suppliers to Ukraine were Russia and Belarus. In 2022 situation has significantly changed, and now Ukraine imports fuel mainly from the EU countries. Machinery: There is some supply of machinery from Ukrainian producers; however, this share is very small. In the agricultural sector, the purchase of machinery is a real investment; thus, it should work for a long time. Therefore, producers choose imported branded and well-known machinery that has already proved itself in the Ukrainian fields. And last but not least – labour and land. I guess that's all.

I2. How is the Ukrainian AVC financed?

R4. True. Finance – is another important input. Ukrainian agribusiness is financed by public and private investment and domestic and international financing. In terms of public investment, this mostly refers to the agricultural infrastructure development from the state budget. I think it is obvious about the other types of financing. What is important is the affordability of finance, which has worsened since 2022.

I can say that small and medium producers tend to get credits to form local financial institutions or investors, while big vertically integrated production companies, we call them agri holdings, tend to cooperate with international institutions. The logic is simple: big companies prefer to conduct export themselves; thus, cooperation with international financial institutions provides extra credibility. Small and medium sell either internally or export through the traders; therefore, do not want to burden themselves with additional obligations. What is also interesting, big companies, when they conduct direct export without intermediaries, decrease transaction costs, increase margins, and stay more profitable. However, this principle does not work for small and medium as they might not have educated export sales managers or, again, don't want to burden themselves with export activities.

I1. How are cereals usually exported from Ukraine?

R4. Previously – seaports. Water logistics was one of the most efficient and rational forms of export. The economy of scale would allow traders or big companies to export bulk, very big amounts in one load. Tens of thousands of tons can be uploaded to one carrier for one customer. If exporters shipped the same amount of cereals by trucks or rail, it would definitely increase their logistics costs and decrease efficiency.

Ukraine has several major ports on the Black Sea, including Odesa, Yuzhny, and Mykolaiv, which were previously used to export cereals.

I2. What are the main countries involved in the AGVC with Ukrainian cereals?

R4. In 2021 Ukraine exported grain to more than 100 countries in the world, half of the world's countries. I will name just the biggest importers of Ukrainian grains over the last few years: China, definitely; Egypt, Turkey, EU, in general, is a very big and important customer; Iran, Saudi Arabia, Libya and others. This factor also shows how important Ukrainian cereals are for the AGVC.

I1. What are the main risks affecting the performance of the Ukrainian cereals AGVC?

R4. In my view, I will name the most important, as several risks can affect the performance of the Ukrainian cereals' agribusiness. Climate change and weather-related risks: Ukraine's cereals production is highly dependent on favourable weather conditions, and any significant changes in weather patterns, such as droughts or floods, can have a significant impact on production levels and quality. And what is interesting, it depends not only on the local weather but also on the weather in other regions of the world, where cereals are also produced. Because weather influences the global market and creates price risks: fluctuations in demand and supply cause price fluctuations, which can affect the profitability of Ukrainian cereals producers and exporters. Changes in import policies and trade barriers in major markets can also have a significant impact on the performance of the AGVC. Infrastructure and logistics risks: This general risk was very low before the war. Now it is one of the most important. Political and regulatory risks: Ukraine, for the last few years, has been developing a new taxation system, developing new regulations, etc. This instability, especially from a long-term perspective, can create uncertainty for investors and slow down the development or modernization of the chain. Technological risks: The cereals AGVC in Ukraine relies heavily on modern technologies for production, transportation, and processing. Any disruption or failure in adopting new technologies can result in reduced productivity and competitiveness for Ukrainian cereals producers and exporters.

I2. Have you observed any AGVC disruptions in Ukraine during the last 15 years?

R4. Yes, there have been some disruptions to the agribusiness value chain (AGVC) in Ukraine over the last 15 years that have affected the production, transportation, and export of cereals. One major disruption occurred in 2014 with the annexation of Crimea by Russia and the ensuing conflict in the east of Ukraine. This led to losing access to important agricultural land and transportation routes, significantly impacting the country's cereals production and exports. Another disruption occurred in 2016, with the government introducing export restrictions on Ukrainian wheat. This led to a decline in the country's wheat exports and caused significant market uncertainty for producers and exporters. In addition, transportation disruptions have occurred due to infrastructure failures or bottlenecks, such as rail track repairs and congestion at port terminals. These disruptions have caused delays and increased transportation costs for cereals exporters; however, they were not so significant.

I2. How did the Global financial crisis of 2007-2008 affect the Ukrainian cereals AGVC?

R4. The global financial crisis of 2007-2008 had a significant impact on the Ukrainian cereals AGVC, as it did on many other sectors of the economy. Firstly, the global financial crisis reduced demand for grains, as consumers and businesses cut back on spending. This led to a decline in export volumes and lower prices for Ukrainian cereals. Secondly, the financial crisis led to a tightening of credit markets, which limited access to finance for Ukrainian cereals producers and

exporters. This made it more difficult for them to invest in new technology and expand their operations. Furthermore, the crisis led to significant fluctuations in currency exchange rates, which, to be fair, positively affected the competitiveness of Ukrainian cereals in international markets; however, the depreciation of the national currency also caused an increase in the cost of inputs and machinery for cereals producers.

I1. How did COVID-19 affect the Ukrainian cereals AGVC?

R4. The COVID-19 pandemic has had some impact on the Ukrainian cereals' agribusiness value chain since its outbreak in 2020. The pandemic has led to disruptions in transportation, particularly at borders, as many countries implemented travel restrictions and border closures. This has affected the movement of goods, and increased transportation costs, which has, in turn, affected the Ukrainian cereals AGVC. COVID-19 has also caused disruptions to global supply chains, leading to delays in procuring inputs, such as seeds and fertilizers, and the delivery of equipment and machinery, which are essential for cereals production. Also, the world experienced market uncertainty, especially in the most panicked first few months. This has led to fluctuations in prices and demand for many commodity products, including Ukrainian cereals. As I said before, labour is also an input. COVID-19 has caused labour shortages in some parts of the agribusiness sector, particularly seasonal labour-intensive activities such as harvesting and fieldwork. But to be fair, I cannot say that the pandemic had a dramatic influence on the development of the sector. We all experienced the VUCA world at that time.

I1. What is your expectation for the future? Do the risks become worse or better? If so, why?

R4. Regarding risks to Ukrainian agribusiness, several factors could impact its future performance. Climate change can affect cereals' production, quality, and availability, leading to reduced yields, increased costs, and lower competitiveness. Geopolitical tensions, such as conflicts and trade disputes, can lead to disruptions in the transportation and export of cereals, which can affect the competitiveness of Ukrainian grains in international markets. Economic uncertainty, such as recessions and currency fluctuations, can affect the demand for cereals and the profitability of producers and exporters. On the other hand, technological advancements, diversification of export markets and investment in the infrastructure could potentially reduce the risks. Overall, the future performance of the Ukrainian cereals AGVC will depend on how the various factors play out and how the sector responds to these challenges and opportunities. So far, I would consider the Ukrainian agricultural sector one of the most resilient sectors of the Ukrainian economy.

I1. How do you expect the full-scale invasion will influence the world food market?

R4. A full-scale invasion of Ukraine had and still has its impact on the world food market, starting from day 1 of the attack. I guess you have seen the price index for any agricultural commodity from late February-March 2022 up till May 2022. Disruption in production and export capabilities caused shortages in the global supply of different products. I remember photos of empty shelves for wheat flour and sunflower oil in European supermarkets from March 2022. This is clear evidence of the importance of Ukrainian agriculture in the global agricultural value chain. The other example from our partners I know is that meat producers in Germany had to terminate the existing contracts for the supply of products because the price did not correspond to the real costs of

production, which increased significantly due to limited access to Ukrainian feed and the high cost of energy carriers.

I1. What effects does a loss in the production of Ukrainian cereals can have on other actors in the AGVC? Who is affected and how?

R4. Disruptions in the production, processing, or logistics of Ukrainian cereals have already shown far-reaching effects throughout the AGVC. That's what I was trying to say in the previous question. All the actors or stakeholders that participate in one value chain don't matter; whether it is local or global, it can be affected alongside the chain if there is a problem with the supply of raw materials. Eventually, this can lead to increasing transaction costs, production costs, and decreasing efficiency of all the actors in the chain, and, eventually, the final customer will have to pay an increased price for the final product.

I1. Thank you for your participation in our interview!

Annex 2. Export of cereals from Ukraine, thous. USD

Importers	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
World	**763 729**	**3 703 787**	**3 556 194**	**2 467 061**	**3 617 212**	**6 971 048**	**6 371 335**	**6 544 132**	**6 057 490**	**6 073 915**	**6 501 877**	**7 240 558**	**9 633 332**	**9 417 292**	**11 843 938**
China	0	0	16	29	1	0	26 092	368 821	676 941	464 140	447 333	552 235	858 653	1 854 821	2 491 200
Egypt	66 000	255 175	324 497	405 843	559 605	1 441 499	1 026 593	1 047 010	758 669	754 963	834 005	666 333	1 310 267	1 119 803	1 377 313
Türkiye	49 302	117 350	74 106	78 740	163 181	59 906	179 519	124 331	57 001	15 563	236 539	184 358	718 407	473 418	833 817
Spain	36 152	393 159	297 570	58 730	522 751	1 056 638	545 984	620 685	593 162	433 109	475 648	642 970	764 825	543 182	660 346
Indonesia	0	2 486	25 245	1 500	745	9 044	64 465	68 928	157 747	330 600	328 625	487 155	537 479	546 711	655 934
Netherlands	1 813	23 426	46 079	7 731	139 713	167 746	261 639	315 457	295 154	202 347	446 506	556 446	623 587	519 373	539 432
Iran, Islamic Republic of	10 881	264 213	205 372	57 680	256 238	423 058	350 776	293 226	110 333	298 065	174 179	221 921	174 343	227 890	498 481
Pakistan	442	45 799	7 614	2 759	277	541	38 129	110 322	6 600	8 684	1 569	468	213	258 380	351 422
Morocco	7 689	14 205	42 110	2 846	25 927	216 245	61 475	123 643	87 001	143 855	115 698	263 416	193 829	256 487	309 209
Tunisia	23 905	151 286	147 242	158 039	160 320	212 650	143 618	212 174	229 878	188 455	259 703	290 334	292 515	346 987	304 033
Libya, State of	5 850	54 283	97 643	143 899	99 281	267 095	222 669	199 680	152 880	214 789	166 989	248 304	241 144	264 662	299 182
Israel	66 908	192 797	205 275	205 203	185 352	403 500	323 005	260 102	263 203	175 968	281 157	237 156	316 076	229 796	267 387
Italy	5 097	133 609	22 506	13 903	120 509	221 887	311 344	292 024	317 230	263 470	340 394	335 632	282 684	159 815	243 611
Saudi Arabia	311 508	615 388	398 340	507 927	471 266	508 643	355 915	546 622	402 849	288 358	295 244	449 472	203 822	155 360	243 530
Lebanon	4 991	17 087	30 693	55 457	65 054	122 589	75 706	96 203	99 047	107 844	95 118	82 954	130 896	184 218	227 577
Yemen	7 144	521	3 984	5 394	0	30 542	11 894	49 151	11 349	30	26 228	96 550	119 625	144 410	198 317
Bangladesh	5 903	34 874	289 236	74 861	28 192	0	75 643	82 693	137 765	288 636	317 211	176 768	420 308	316 731	192 504
Korea, Republic of	0	116 046	254 386	53 816	27 587	239 784	261 514	320 893	306 210	266 232	156 965	175 554	224 629	281 766	170 830
Portugal	0	39 305	17 594	53 572	143 219	262 303	162 878	109 435	129 071	119 374	115 175	113 231	150 673	129 531	150 266
United Kingdom	3 020	16 722	21 368	3 599	10 349	32 239	66 626	108 033	38 307	25 574	52 412	82 930	135 420	116 945	143 012
Ethiopia	0	8 832	13 776	31 499	0	0	29 124	10 256	20 743	35 158	13 953	0	61 174	38 962	142 081
Belgium	1 004	6 681	2 273	1 171	786	79 912	61 299	98 759	45 889	65 358	83 071	104 674	131 456	92 088	134 478
Algeria	986	45 040	59 756	10 245	86 099	61 705	17 246	52 502	59 701	73 113	47 148	10 838	209 483	153 260	124 611
Iraq	0	1 361	9 052	3 586	2 953	255	71	578	8	98	287	482	6 748	18 193	118 802
Oman	0	7 575	90	3 598	165	6	1 600	8	196	11 433	3 462	3 512	1 960	27 192	118 561
Thailand	0	0	4 409	9 330	14 646	23 294	85 401	79 255	260 326	300 512	121 798	105 581	155 771	108 847	117 234
Philippines	0	25 156	131 757	20 795	22	121	53 777	54 151	103 307	139 151	137 023	315 901	169 949	119 187	85 882
Viet Nam	0	1 689	55 693	39 680	1 395	8 151	22 482	65	8 783	8 595	9 690	131	120	87 783	71 619
Ireland	0	1 824	0	0	7 013	62 362	106 737	59 961	49 304	36 416	40 265	62 305	133 900	81 151	66 415
Nigeria	0	1 895	7 477	847	0	0	2 416	2 413	0	14 545	31 222	17 984	50 599	0	65 891
Jordan	6 657	178 244	68 862	61 844	24 625	145 583	103 965	98 318	9 361	47 697	39 844	23 567	53 826	62 039	58 268
Kenya	25 326	18 995	120 280	67 799	9 577	66 164	115 211	79 751	23 648	19 045	64 220	45 159	56 314	18 514	57 825

Importers	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Djibouti	0	6 532	26 242	0	0	0	38 495	41 109	58 095	12 934	5 978	30 178	29 468	4 072	48 697
Mauritania	3 087	904	10 858	0	3 946	9 981	4 323	16 529	17 359	8 660	50 548	54 411	30 057	25 709	47 847
Germany	2 522	1 110	7 578	2 226	8 923	28 327	57 609	86 397	81 266	41 354	41 402	148 330	234 660	61 451	47 068
Tanzania, United Republic of	0	0	0	11 644	0	16 993	2 319	1 405	6 009	0	80	7 652	10 372	8 204	38 742
Mexico	0	0	0	0	0	0	0	8 614	51 664	36 003	30 113	33 766	52 301	6 119	34 328
Japan	0	0	68 403	37 007	30 714	219 251	328 022	76 163	96 460	36 586	19 000	34 613	74	53	25 758
United Arab Emirates	0	19 684	1 482	9 398	7 603	30 221	16 889	13 775	21 359	12 325	9 721	5 983	51 798	26 285	23 466
Greece	3 299	114 779	500	0	15 957	5 260	13 873	9 920	13 734	17 598	25 362	14 837	7 843	18 065	21 625
Cyprus	3 626	69 407	7 821	1 595	4 626	6 024	14 400	21 487	5 603	23 784	33 201	17 749	15 186	16 150	20 326
Taipei, Chinese	0	0	2 683	2 826	5 944	17 481	15 980	6 219	3 558	271	438	1 074	5 883	2 762	16 792
Mozambique	0	0	0	0	0	10 058	3 508	18 013	9 173	2 302	1 193	8 514	5 434	21 170	15 807
Poland	1 734	63 267	1 200	3 136	29 964	14 736	20 185	15 140	23 471	26 000	27 654	35 584	26 929	5 320	14 360
Malaysia	0	368	9 293	3 425	3 473	8 120	19 648	9 778	27 595	12 692	14 640	25 822	43 582	72 917	13 968
Lithuania	1 301	52 871	2 880	2 131	18 300	17 169	39 588	44 482	16 444	4 257	11 694	24 300	60 561	25 967	11 661
Belarus	42 973	68 011	25 433	21 633	32 768	30 936	33 437	34 138	12 317	18 652	24 105	6 177	53 221	19 089	11 570
Sri Lanka	0	3 807	4 496	857	537	26	57	13	1 708	478	6 496	5 365	2 224	21 678	11 553
Cameroon	0	0	0	0	0	2 100	0	2 743	0	1 385	0	0	0	0	10 167
Ghana	0	0	0	0	0	19 781	0	0	197	142	41	646	0	16	10 101
Angola	0	0	0	0	0	0	0	0	301	0	2 645	0	2 240	0	9 935
Somalia	0	0	12 176	0	0	0	0	0	0	1 384	4 053	12	15	9 384	8 474
Hungary	1 327	5 804	17 923	1 256	871	5 419	2 844	2 690	525	1 190	2 120	6 457	4 060	5 376	8 150
Myanmar	0	0	1 273	0	0	909	848	0	2 548	1 889	1 267	2 393	11 310	9 743	7 963
Madagascar	0	0	0	0	0	0	0	0	0	0	328	142	226	183	7 899
Switzerland	0	15 399	17 861	1 114	216	8 599	2 449	3 243	2 731	16 176	17 764	3 779	8 269	5 328	6 060
Eritrea	0	2 585	0	0	0	0	0	0	0	0	0	0	1 494	0	6 015
Albania	1 324	4 646	2 239	1 394	3 314	726	432	0	32	872	1 136	16	2 839	4 576	3 772
Moldova, Republic of	2 263	8 930	686	1 057	2 166	4 322	3 322	1 134	917	1 005	839	2 095	1 515	3 541	3 737
Colombia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 536
Uganda	1 500	7 369	8 453	6 276	0	20 401	8 234	18 420	0	0	2 182	6 426	17 262	0	3 068
Sudan	0	0	0	0	0	0	12 266	16 184	5 821	0	18 234	16 061	31 600	23 883	2 909
Syrian Arab Republic	19 795	210 413	228 163	127 228	164 540	199 753	287 754	70 297	86 812	11 187	0	0	3 267	3 929	2 888
South Africa	181	96	8 424	633	391	100 544	125 296	69 065	49 705	40 426	58 753	12 821	18 671	13 256	2 219
Czech Republic	57	239	115	26	170	77	75	480	445	339	422	254	749	1 002	2 127
Romania	355	436	0	0	0	0	1 227	62	962	12 175	3 904	5 508	2 067	8 174	1 841
Austria	0	2 847	3 070	642	1 118	220	162	1 400	3 058	3 931	5 598	2 658	1 194	1 142	1 792
United States of America	2 243	0	240	0	1	14	7	23	38	96	10	9	7	251	1 669
Kazakhstan	0	12 104	8 545	276	264	459	8	4	2 483	74	131	195	416	670	1 454

Importers	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Côte d'Ivoire	0	0	0	0	0	0	0	0	2 372	0	3 682	13 470	1 557	0	1 400
Latvia	22	12 521	2 171	229	1 413	3 310	4 555	3 706	1 056	118	871	3 892	4 000	1 020	1 371
Bulgaria	705	14 280	265	157	1 023	384	113	170	197	265	474	202	594	601	1 295
Congo, Democratic Republic of the	0	0	1 430	0	0	0	7 411	719	0	0	0	9 165	3 127	0	1 222
India	0	0	505	1 212	0	0	26	562	781	315 606	265 804	645	43 022	2 677	1 217
Denmark	0	0	1	0	0	7 842	21 834	882	0	386	1 353	48 673	34 674	18	936
Gabon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	846
Singapore	0	295	1 487	2	3	169	353	2	868	9 962	226	1 049	204	521	690
Hong Kong, China	0	0	3	2	1	131	31	2	52	25 691	1	22	114	120	681
Kuwait	10 601	19 799	16 591	20 135	17	7 424	25 206	7 618	267	11 313	7 830	105	14 623	10 975	665
Qatar	0	13 313	5 422	0	8 814	70	65	76	6 046	3 463	14 714	18 392	21 406	23 472	641
Canada	0	0	0	0	0	91	911	1	764	65	5	211	2 468	3 536	632
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	592
Norway	0	0	0	2	0	0	0	0	0	14	29	5 228	726	557	433
Azerbaijan	404	40 683	6 452	5 386	6 413	366	2 807	401	15	803	5	244	61	337	309
Costa Rica	0	0	0	0	0	0	5	0	0	0	0	0	1	216	302
Uzbekistan	217	5 135	4 411	2 736	923	541	49	1	692	0	6	163	59	111	298
Serbia	94	117	499	31	140	197	131	467	122	82	30	0	49	23	293
France	0	3	2 654	7 615	3 716	6 926	26 720	13 315	756	1	1 006	10 295	11 827	28	282
Croatia	0	0	0	0	0	0	0	5	0	0	0	0	0	5	203
Georgia	6 484	13 608	7 856	18 311	69 249	3 762	11 381	8 073	4 161	837	383	734	1 922	710	192
Bahrain	0	24	50	82	22	242	6 347	104	114	220	130	79	142	238	168
Estonia	309	4 607	601	377	1 110	2 173	2 369	507	407	483	183	1 041	858	57	115
Finland	0	0	0	0	0	0	14	10	5	6	52	4 866	80	73	108
Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	79	100
New Zealand	0	0	156	0	0	27	0	0	0	0	0	0	0	231	90
Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	281	80	64
El Salvador	0	0	0	0	0	0	0	0	0	0	0	0	0	35	61
Australia	0	0	0	0	0	5	0	44	15	0	104	8	102	112	56
Sweden	0	0	0	0	0	0	0	0	0	58	36	23	27	7	41
Brazil	0	0	0	0	0	0	164	0	0	30	88	56	43	0	34
Liberia	0	0	0	1	0	0	0	0	0	1	20	22	107	50	29
Turkmenistan	0	0	183	111	248	113	0	47	228	356	152	298	0	0	28
Kyrgyzstan	0	448	16	15	6	0	197	29	508	17	0	0	0	16	26
Namibia	0	0	0	0	0	0	0	0	6 286	0	0	0	0	0	24
Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	8	22
Honduras	0	0	0	0	0	0	28	0	0	0	0	0	0	0	20

Importers	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Slovakia	56	494	20	6	49	38	442	208	322	96	9	10	666	74	9
Mauritius	0	0	0	0	0	0	21	0	0	0	0	0	13	0	8
Armenia	3 226	7 370	2 407	5 680	25 559	1 650	3 695	975	567	337	355	0	2 224	8	5
Dominican Republic	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5
Marshall Islands	0	0	0	0	0	0	1	1	187	1	0	1	1	0	2
Panama	715	908	666	4	48	1 230	10	690	397	4	3	2	1	0	2
Cuba	485	0	0	0	0	0	9 412	10 569	0	0	0	0	0	0	1
Malta	0	4 799	3	4	6	0	5	0	9 480	710	986	265	3	7	1
Tuvalu	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Russian Federation	12 236	93 152	4 717	6 860	27 913	8 297	18 191	15 906	0	0	0	0	0	0	0
British Virgin Islands	0	0	0	0	0	0	0	0	408	0	336	0	0	0	
Chad	0	0	0	885	1 764	0	0	0	0	0	0	0	0	0	
Equatorial Guinea	0	0	0	0	14	0	0	0	0	0	0	0	0	0	
Gibraltar	0	0	5 308	0	0	0	0	0	0	0	0	0	0	0	
Korea, Democratic People's Republic of	0	1 681	2 595	2 351	0	13 717	0	1 892	0	365	0	0	0	0	
Area Nes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Afghanistan	0	7 662	175	0	0	0	0	0	0	0	13	0	0	0	
Bahamas	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
Bosnia and Herzegovina	0	0	0	0	0	0	0	0	6	0	0	0	0	0	
Burundi	0	0	0	0	0	2 117	2 345	0	1 652	0	0	0	0	0	
Cambodia	0	1	1	6	208	0	0	370	0	556	0	0	89	71	
Cabo Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Chile	0	0	0	0	0	43	0	1	1	1	1	66	0	0	
Congo	0	0	2 412	313	0	0	1 154	0	0	0	0	233	0	0	
Benin	0	0	0	0	0	0	0	0	0	0	0	0	0	19	
Dominica	0	0	0	0	0	0	0	0	0	0	0	0	153	0	
Ecuador	0	0	3 160	0	0	0	0	0	1 655	2 555	0	0	4 433	6 082	
Gambia	0	0	0	0	0	0	0	0	0	0	0	3 365	1 381	0	
Palestine, State of	0	455	32	708	0	1 513	0	47	0	0	0	0	0	0	
Guinea	0	0	0	0	0	5	0	0	0	0	0	6 485	0	0	
Iceland	0	0	0	0	0	0	0	0	0	205	0	0	0	0	
Lao People's Democratic Republic	0	0	0	0	0	0	0	0	0	0	0	0	413	583	
Malawi	0	0	0	0	0	0	5 562	0	0	0	0	0	0	0	
Mali	0	0	0	0	0	0	0	0	0	0	354	5 603	3 002	0	
Mongolia	0	194	0	0	0	0	5	0	0	0	0	0	0	0	
Montenegro	0	0	0	0	0	0	0	0	0	0	0	1	0	0	

Importers	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Nepal	0	0	0	0	0	0	0	0	0	1 192	0	0	2 278	1 349	
New Caledonia	0	0	0	0	0	0	0	0	0	0	0	50	1 463	219	
Peru	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rwanda	0	0	447	0	0	3 873	0	0	0	0	0	198	0	0	
Saint Kitts and Nevis	0	0	0	3	2	0	0	0	0	0	0	0	0	0	
Anguilla	0	0	0	1 167	0	0	0	0	0	0	0	0	20	0	
Saint Vincent and the Grenadines	0	0	688	0	0	0	0	0	0	0	0	0	0	0	
Senegal	0	0	0	0	0	3 403	0	1 540	0	5 455	22 899	33 880	7 227	0	
Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	44	0	0	
Slovenia	10	111	80	15	33	19	72	218	0	0	0	0	0	1	
Zimbabwe	0	0	0	0	0	0	1 623	599	0	5 314	0	0	0	0	
Sudan (before 2012)	0	4 396	20 105	14 943	5 829	0	0	0	0	0	0	0	0	0	
Tajikistan	0	1 100	290	0	35	0	0	0	0	0	0	0	5	0	
Macedonia, North	0	0	0	0	0	0	0	0	0	4	2	0	0	0	
Burkina Faso	0	0	0	0	0	0	0	0	0	0	0	3 324	400	0	
Uruguay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Serbia and Montenegro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Zambia	0	0	0	0	0	0	0	0	3 049	0	0	0	0	0	

Source: TradeMap

Annex 3. Import of fertilisers to Ukraine, thous. USD

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
World	**321 891**	**603 761**	**257 346**	**417 707**	**726 728**	**780 413**	**816 244**	**593 039**	**708 356**	**822 785**	**1 126 851**	**973 569**	**1 197 689**	**841 504**	**1 554 435**
Belarus	69 016	158 868	30 481	76 555	164 746	162 928	149 139	68 624	119 931	170 927	171 737	218 992	291 227	290 147	533 622
Lithuania	4 464	7 647	130	226	2	476	797	952	3 012	13 501	40 157	68 208	115 752	140 909	227 441
Poland	2 797	6 108	1 934	4 264	7 090	7 465	8 454	6 621	4 713	16 360	40 725	96 538	130 758	101 685	215 554
Kazakhstan	2 410	8 473	0	0	16 507	5 256	3 928	9 912	4 501	15 764	24 040	30 203	32 277	30 742	78 260
Uzbekistan	7 765	30 737	2 315	15 780	18 700	6 983	4 043	4 336	16 526	5 621	38 095	46 629	4 686	6 952	70 295
Bulgaria	0	0	0	0	0	0	0	0	44	1 113	4 235	7 086	69 878	40 993	69 723
Morocco	0	0	0	0	0	0	0	0	0	0	0	0	49 953	41 257	58 620
Türkiye	264	1 081	374	707	930	1 350	2 467	2 581	2 621	3 817	6 535	28 488	53 653	27 423	56 172
Georgia	0	0	0	0	0	0	0	0	0	17	7 636	21 546	47 965	19 861	34 474
Netherlands	4 543	5 215	641	911	2 939	2 959	1 669	2 042	1 828	2 359	3 072	6 208	23 021	18 259	28 808
Serbia	0	405	0	0	0	0	0	0	0	1 864	5 475	14 646	27 059	22 400	22 649
Latvia	0	0	0	0	0	0	0	0	0	0	0	5	1 709	3 614	15 645
Germany	1 709	5 612	1 430	2 986	4 024	4 497	4 872	4 105	3 521	7 327	14 200	17 101	14 178	11 166	14 586
Spain	1	218	182	438	799	1 977	3 249	2 462	1 838	2 435	6 852	8 549	9 751	11 665	14 007
Saudi Arabia	0	0	0	0	0	443	442	0	329	0	1 965	544	190	147	13 738
China	1 160	105	36	414	356	1 090	1 224	681	460	923	1 346	1 797	5 712	6 103	11 566
Israel	1 969	1 875	588	1 190	1 463	1 812	2 470	1 307	1 032	1 162	1 036	1 062	1 342	1 043	10 158
Italy	1 929	4 015	2 407	3 426	6 601	6 416	5 556	3 416	2 833	4 046	4 671	5 382	4 589	5 618	9 762
Turkmenistan	0	0	0	0	0	0	0	0	0	0	0	0	9 226	1 391	9 368
Romania	0	0	0	0	0	0	0	0	0	1	5 493	3 064	15 697	6 754	8 265
Norway	775	1 358	987	1 019	1 131	1 494	1 114	660	591	1 023	1 200	1 176	13 683	16 971	8 179
Finland	2 512	2 014	2 231	3 456	6 492	9 720	9 806	5 258	11 589	8 838	8 770	14 952	8 421	3 834	8 005
Greece	0	0	0	0	0	0	0	150	562	0	25	1 416	11 085	10 375	6 997
United Kingdom	80	0	137	253	2 314	5 048	5 370	3 260	2 927	3 260	4 948	4 992	5 461	5 556	6 461
Belgium	1 702	9 541	650	1 567	6 374	3 819	6 118	1 869	2 991	4 762	11 041	14 495	13 643	5 267	5 259
France	669	471	135	284	690	879	993	834	650	1 747	2 459	3 781	3 767	2 391	3 853
Egypt	0	0	0	0	0	0	0	0	0	0	9 372	8 011	15 657	301	3 321
Austria	12	37	34	0	83	0	1 009	2 652	428	607	134	1 509	2 705	1 294	2 983
Slovakia	21	105	4	48	197	94	621	478	257	318	502	453	547	906	1 576
United States of America	318	476	159	1 012	2 051	1 597	1 915	918	1 996	1 293	5 330	11 661	4 166	1 534	1 178
Hungary	17	72	14	66	120	46	64	4	2	8	165	306	376	693	816
Jordan	73	39	40	31	0	0	0	0	0	24	11	288	6 800	1 682	602
Taipei, Chinese	0	0	0	16	85	30	32	0	0	0	149	665	513	524	492
Sweden	0	0	0	0	0	0	0	0	0	1 277	1 889	342	119	508	474
Brazil	0	0	0	0	0	0	0	0	0	0	0	0	440	345	454

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Estonia	0	0	3	24	31	0	0	0	0	0	50	194	385	18	194
Mexico	0	0	0	0	0	9	0	0	2	81	281	268	327	100	162
Canada	0	0	0	0	121	0	67	1	15	0	0	85	1	1	157
South Africa	0	33	0	61	0	2	22	62	49	49	419	164	87	67	151
New Zealand	0	0	0	0	0	0	0	0	0	0	0	0	0	5	115
Portugal	46	117	0	0	0	0	0	22	0	24	39	41	57	26	98
Denmark	7	0	1	1	0	0	0	0	0	0	54	176	196	157	76
Czech Republic	0	4	7	4	11	11	10	21	11	17	19	20	12	46	46
India	4	0	15	0	0	0	0	0	0	0	12	4	36	48	45
Russian Federation	217 626	358 951	212 399	302 805	482 558	552 744	600 766	469 680	522 935	551 787	701 415	323 020	189 127	66	27
Switzerland	0	0	0	0	2	2	4	2	1	2	2	16	96	2	3
Japan	0	0	0	0	0	0	0	0	0	0	3	1	0	1	1
Ireland	0	0	0	61	0	1 025	0	0	0	0	2	1	0	0	0
Korea, Republic of	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0
Area Nes	0	0	0	0	0	0	0	0	0	0	6	0	0	0	
Azerbaijan	0	0	0	0	0	0	0	0	0	0	0	0	1 638	53	
Australia	0	0	0	0	0	0	0	0	0	0	0	0	0	23	
Sri Lanka	0	0	0	0	6	0	0	0	0	0	0	0	0	0	
Chile	0	109	0	0	19	240	20	127	160	426	1 280	12	570	581	
Croatia	0	0	0	0	0	0	0	0	0	0	0	1 680	2 815	0	
Cyprus	0	0	0	2	0	0	0	0	0	0	0	0	0	0	
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
Iran, Islamic Republic of	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
Lebanon	0	75	12	0	252	0	0	0	0	0	0	0	0	0	
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Oman	0	0	0	0	0	0	0	0	0	0	0	0	2 734	0	
Syrian Arab Republic	0	0	0	17	34	0	0	0	0	0	0	0	0	0	
Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	3 604	0	
United Arab Emirates	0	0	0	0	0	0	0	0	0	4	0	90	0	0	
Tunisia	0	0	0	83	0	0	0	0	0	0	0	7 693	0	0	

Source: TradeMap

Annex 4. Import of PPP (Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles, e.g., sulphur-treated bands, wicks and can) to Ukraine, thous. USD

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
World	**290 021**	**414 433**	**270 567**	**449 813**	**650 731**	**754 597**	**769 455**	**608 350**	**648 864**	**802 990**	**935 097**	**968 736**	**932 875**	**892 123**	**1 022 545**
China	23 830	38 650	28 583	56 702	56 099	83 184	83 974	90 739	84 575	127 135	152 924	162 813	153 386	172 155	260 919
France	73 414	111 812	57 582	93 372	142 142	201 876	221 820	149 376	187 579	239 502	254 477	249 147	238 654	218 384	224 419
Germany	74 435	84 994	68 250	111 914	205 915	187 256	175 302	96 474	104 968	136 094	172 566	176 391	162 977	146 490	125 196
Spain	3 484	4 640	9 587	13 997	26 420	29 467	44 148	23 072	65 738	56 786	69 833	87 817	96 774	70 547	77 683
Israel	7 083	11 561	4 757	12 228	19 560	23 292	17 283	24 481	29 396	44 990	66 128	78 113	61 973	63 693	62 330
Belarus	81	323	314	397	2 368	14 917	25 490	19 397	17 902	20 720	26 900	29 142	28 383	25 970	40 499
United Kingdom	5 050	9 890	8 288	11 244	15 338	28 718	25 775	20 803	24 779	31 365	33 012	33 871	34 688	35 227	38 772
Hungary	2 213	2 315	1 659	3 863	5 152	6 421	7 453	7 516	8 836	16 016	19 818	23 902	20 913	22 476	36 991
Belgium	17 656	31 227	19 069	36 413	46 584	61 903	40 548	64 145	33 199	35 202	45 924	40 525	35 176	36 365	33 601
Poland	1 752	1 761	2 143	2 737	4 122	3 837	4 132	3 224	2 117	9 615	17 938	15 802	21 126	16 092	21 992
USA	14 349	24 742	8 919	15 257	12 455	10 816	11 778	7 808	5 726	6 342	13 318	13 517	17 845	20 604	19 098
Italy	8 023	13 344	7 774	13 185	11 165	12 730	12 195	8 280	6 284	8 330	9 948	10 295	10 652	9 085	12 805
India	312	1 986	1 941	2 006	1 933	3 058	3 924	959	1 894	3 191	4 412	3 455	7 282	8 921	12 445
Kazakhstan	0	0	0	0	0	0	0	0	0	758	6 433	8 245	7 517	6 514	12 369
Austria	9 448	10 112	5 627	9 311	14 096	10 694	9 358	11 839	11 257	13 194	13 786	8 066	6 560	7 511	9 464
Switzerland	8 649	14 010	7 843	11 553	14 784	12 805	11 807	13 941	19 567	24 227	2 760	5 736	3 750	5 608	7 494
Netherlands	2 737	4 767	5 677	5 019	5 459	7 982	4 536	8 198	5 602	1 450	4 465	2 991	5 081	3 090	3 764
Japan	2 766	4 565	2 857	4 917	7 162	5 877	7 721	7 097	4 102	5 140	5 190	3 335	4 691	4 984	3 666
Romania	0	0	0	0	141	311	79	2 499	798	3 009	723	1 562	1 866	877	3 449
Denmark	5 641	8 128	4 904	5 089	7 399	5 851	8 749	3 159	2 345	4 266	2 894	3 081	3 437	4 550	3 358
Colombia	0	0	0	0	0	0	0	0	0	0	0	0	0	1 291	1 684
Türkiye	39	509	281	251	677	677	1 213	805	2 511	1 488	2 462	1 241	1 281	1 014	1 418
Chile	431	295	271	504	448	778	0	70	441	776	850	689	1 121	1 009	1 249
Estonia	2 062	4 043	2 222	2 158	2 120	2 575	2 675	2 174	898	1 149	997	1 434	1 207	1 606	1 049
Brazil	186	1 043	1 190	220	0	330	343	484	859	1 504	491	757	1 924	1 313	918
Czech Republic	135	935	449	657	801	986	1 014	744	772	953	912	1 367	1 552	1 696	830
Slovenia	441	666	425	372	516	622	739	486	767	985	580	512	562	1 242	754
Bulgaria	14	46	70	71	187	423	396	252	143	55	89	156	184	447	640
South Africa	0	0	1	68	141	521	1 088	544	0	478	1 875	1 244	0	603	587
Argentina	0	0	0	0	0	0	0	0	0	439	479	616	826	502	506
Viet Nam	0	0	0	0	0	0	0	0	0	256	697	681	99	111	461
Russian Federation	22 377	24 777	17 933	33 105	46 035	34 940	43 892	38 004	22 306	4 707	546	532	233	241	418

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Thailand	0	0	0	0	0	20	52	79	76	69	102	99	99	181	303
Lithuania	55	21	18	22	0	8	4	21	19	26	1	250	91	169	258
Mexico	0	0	0	0	0	0	264	836	464	0	0	2	76	191	194
Ireland	31	1	30	1 049	0	6	0	6	5	0	0	0	0	330	152
Latvia	1	23	11	184	9	22	44	36	16	27	17	9	100	198	150
Slovakia	2 589	1 643	1 211	1 371	97	240	250	82	105	111	123	137	133	137	138
Greece	243	46	0	0	0	34	0	0	0	0	0	1	27	10	89
Indonesia	240	239	178	192	279	32	129	189	0	26	37	59	148	83	76
Malaysia	68	35	36	85	135	223	327	146	62	86	26	46	108	56	72
Serbia	50	118	84	98	104	168	106	40	59	64	79	59	94	108	62
Hong Kong, China	0	155	25	0	0	0	0	0	0	0	0	306	76	0	39
Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
Georgia	0	0	0	0	0	0	1	0	17	84	0	0	3	64	37
Sweden	0	34	34	0	7	4	12	21	13	33	12	33	13	86	32
Moldova, Republic of	50	23	11	0	0	0	1	26	6	1	9	35	28	13	22
Taipei, Chinese	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19
United Arab Emirates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
Finland	87	260	110	89	88	104	129	25	36	14	25	14	8	8	11
Canada	0	2	0	0	0	0	0	0	0	0	16	0	0	68	7
Korea, Republic of	0	0	2	0	0	0	0	0	0	2	7	7	1	133	1
Korea, Democratic People's Republic of	0	0	0	0	0	0	0	27	1 664	1 607	645	0	0	0	
Area Nes	0	0	0	1	0	0	0	0	0	0	4	0	0	0	
Azerbaijan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Australia	0	21	56	48	445	706	0	0	0	395	251	300	155	32	
Bangladesh	0	80	74	0	0	0	0	0	0	0	0	0	0	0	
Myanmar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Central African Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Costa Rica	0	0	0	0	0	0	0	188	0	0	1	74	0	0	
Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
Cyprus	0	0	0	0	346	0	0	0	0	0	0	0	0	0	
Greenland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Jordan	0	0	0	0	0	0	0	0	0	0	0	0	0	15	

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Lebanon	0	576	0	0	0	0	0	0	0	0	0	0	0	0	
New Zealand	0	16	71	62	0	0	0	59	122	0	0	0	0	0	
Panama	0	0	0	0	0	0	0	0	0	0	0	66	0	0	
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Saudi Arabia	0	0	0	0	0	185	703	0	837	319	314	204	0	1	
Serbia and Montenegro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Source: TradeMap

Annex 5. Import of fuel (Petroleum oils and oils obtained from bituminous minerals (excluding crude); preparations containing >= 70% by weight of petroleum oils or of oils obtained from bituminous minerals, these oils being the basic constituents of the preparations, n.e.s.; waste oils containing mainly petroleum or bituminous minerals) to Ukraine, thous. USD

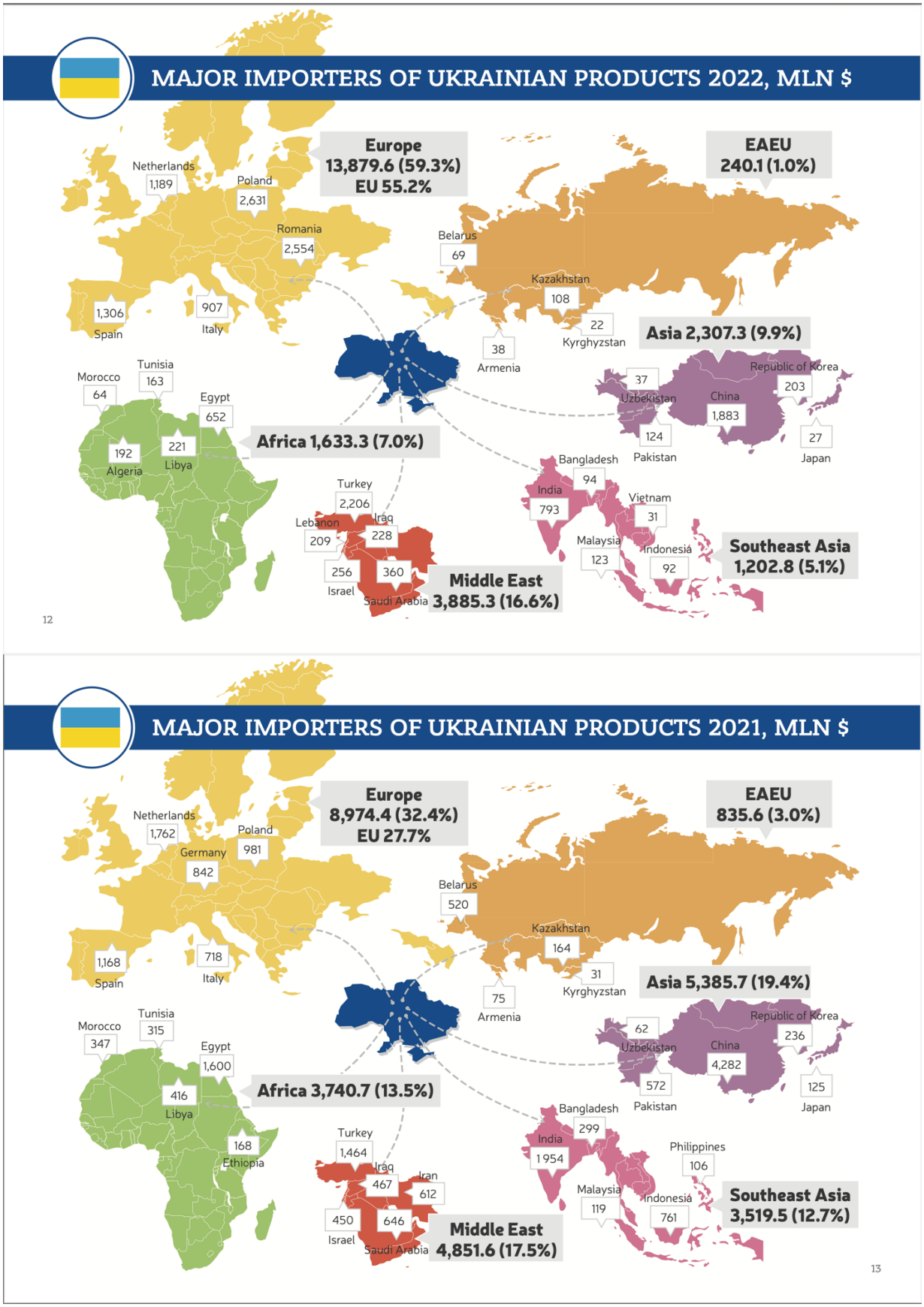
Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
World	**3 026 652**	**5 951 806**	**2 688 461**	**3 905 043**	**6 955 274**	**7 606 735**	**6 418 321**	**6 685 169**	**3 808 958**	**3 254 872**	**4 144 391**	**5 519 876**	**5 365 601**	**3 359 463**	**5 4 0**
Belarus	330 495	1 183 331	975 008	1 503 504	2 852 122	3 726 115	2 272 462	3 103 034	1 695 425	1 786 835	1 824 501	2 103 203	2 036 904	1 201 288	2 3 0
Russian Federation	1 528 180	2 415 687	610 861	930 809	1 932 885	1 630 937	1 859 481	1 220 808	844 596	539 833	1 262 963	2 060 030	1 893 056	1 211 120	1 2 2
Lithuania	197 070	460 539	297 742	482 808	642 726	714 914	769 406	888 863	413 773	354 081	469 316	569 464	629 068	392 940	618 9
Türkiye	59 234	44 811	22 806	62 440	59 026	2 742	1 259	4 198	2 963	4 220	7 390	16 363	70 719	146 708	227 8
Greece	19 865	44 737	263	169	163	17 021	99 751	186 880	163 150	141 148	119 888	144 657	137 637	107 973	169 9
India	0	201	178	455	816	1 512	1 200	1 148	829	23 094	39 943	49 872	86 747	32 380	150 9
Bulgaria	23 190	37 765	24 628	47 064	60 821	48 547	35 725	68 896	111 870	23 805	4 560	35 204	103 268	3 580	138 5
Italy	39 879	223 528	3 492	22 033	57 012	33 946	10 158	23 645	2 461	3 303	55 995	149 747	127 996	26 499	77 8
Libya, State of	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61 0
Germany	29 663	40 116	27 896	44 469	67 068	61 535	56 470	46 616	29 628	35 592	36 368	37 779	39 474	44 221	59 2
Turkmenistan	52	9 128	20 434	25 497	88 232	114 067	91 847	10 577	9 256	22 823	80 983	133 485	66 831	18 033	56 6
Spain	3 402	3 829	1 696	22 396	1 770	3 503	4 808	4 852	3 998	4 401	620	1 301	1 806	3 695	41 2
Israel	5	30 809	0	0	0	110 795	166 676	197 595	70 376	50 329	15 409	20 974	28 429	21 985	33 5
Finland	5 010	5 722	1 945	1 861	4 267	26 673	22 426	18 834	12 813	14 555	15 867	41 225	21 623	22 093	30 1
Belgium	21 944	26 932	19 495	28 509	27 845	23 463	24 638	26 151	17 338	16 890	17 962	20 214	19 381	19 437	27 6
Egypt	238	366	324	393	362	528	740	361	105	180	4 329	8 339	195	282	26 5
Tunisia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25 2
Romania	360 913	619 436	195 741	201 620	490 123	358 182	334 468	408 309	42 999	25 575	13 029	12 817	16 703	25 421	24 6
Netherlands	9 794	8 229	12 251	13 122	13 179	17 202	16 526	14 389	10 446	9 449	15 018	12 475	14 416	16 756	24 2
Poland	26 920	57 963	94 198	124 681	161 708	309 892	459 185	320 158	292 990	86 894	42 846	27 658	23 741	18 802	23 5
Hungary	3 711	17 741	3 275	40 257	75 738	64 186	80 870	86 416	42 616	37 566	27 511	16 336	12 807	9 930	14 0
France	5 272	9 211	10 038	10 685	10 428	6 267	5 848	5 713	5 431	5 155	6 498	6 692	7 461	7 173	11 1
Azerbaijan	7 702	26 022	7 791	13 383	24 185	18 312	14 184	9 250	2 813	16 373	11 210	4 802	3 237	3 382	8 5
Malaysia	0	0	161	63	0	2	69	2	1	26	0	124	98	92	7 7
Kazakhstan	241 971	507 370	299 247	225 488	297 530	227 916	12 554	31	5 131	31 743	10 276	1 475	656	479	7 0
United Kingdom	1 039	10 389	3 434	3 364	4 708	5 677	5 404	3 971	3 054	3 106	3 458	4 203	4 011	5 227	6 7
United States of America	566	5 389	1 046	1 508	45 844	7 788	3 572	2 040	1 502	1 731	1 818	1 949	2 157	2 528	4 2
Korea, Republic of	2 638	4 438	3 606	5 250	5 453	4 911	7 108	4 481	4 121	3 982	3 200	4 098	3 112	3 326	3 8
Japan	52	208	340	814	1 096	586	683	552	463	476	760	998	1 123	1 536	1 8
Uzbekistan	50 526	38 207	12 586	4 014	4 666	6 083	8 023	6 033	471	39	651	156	0	8	1 5
Slovakia	26	54	1 663	26	1	0	67	0	267	100	476	1 194	4 458	3 811	1 4

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Sweden	10 787	22 997	13 741	11 452	16 691	29 648	26 495	13 080	7 366	6 200	6 476	4 810	2 727	1 604	1 1
Canada	824	1 525	998	1 464	2 041	1 909	1 799	1 461	1 389	1 227	1 303	1 356	1 136	911	1 0
Czech Republic	964	1 507	1 497	326	528	1 391	356	92	1 464	353	219	168	250	324	1 0
Latvia	12 288	1 386	1 642	159	272	310	541	1 005	1 602	448	451	651	574	2 674	9
Switzerland	460	5 719	1 767	119	341	251	257	243	110	136	150	186	220	311	5
China	865	891	1 148	1 251	2 178	1 291	740	766	568	464	335	994	825	651	5
United Arab Emirates	99	329	263	328	265	11	3 348	27	24	630	419	719	365	494	5
Thailand	0	7	5	47	26	67	9	31	60	78	40	101	257	314	4
Estonia	6 980	5 032	290	193	314	46	563	523	425	671	578	626	574	227	4
Serbia	0	472	56	0	0	26	5 770	3 676	3 241	0	1 328	1 091	7	267	3
Bahrain	0	0	0	0	0	11	2 898	16	44	76	57	38	288	206	1
Austria	18 411	17 717	10 430	12 990	983	787	881	394	1 540	226	171	195	553	305	1
Georgia	5 159	30 065	0	4	0	0	0	0	0	3	1	0	102	181	1
Denmark	74	1	0	4	2	0	1	0	0	0	2	2	17	59	
Bosnia and Herzegovina	0	0	0	99	0	973	0	20	33	75	1 107	2 575	46	57	
Singapore	0	12	0	0	117	1	15	0	200	876	795	819	338	8	
Slovenia	13	9	3	3	4	5	95	19	0	41	104	63	133	42	
Mexico	0	0	0	1	4	3	5	0	0	1	1	11	0	0	
Moldova, Republic of	166	0	196	16	0	0	0	0	0	0	21	13	63	9	
Taipei, Chinese	0	0	0	0	0	0	3	1	7	0	0	0	3	3	
Portugal	0	0	0	0	0	0	0	1	1	0	0	0	0	0	
British Virgin Islands	144	0	0	0	0	0	0	0	0	0	0	0	0	0	
Area Nes	0	0	0	0	0	0	0	9	0	0	3	12	0	0	
Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Australia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bahamas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Brazil	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
Colombia	0	0	0	0	0	0	0	0	0	0	215	970	0	0	
Croatia	0	1 158	0	0	0	0	0	0	0	0	0	0	12	0	
Cyprus	17	30 119	3 549	59 707	0	0	1	0	0	0	0	0	0	0	
Ghana	0	0	0	0	237	0	0	0	0	0	0	0	0	0	
Guinea	0	0	0	0	0	0	0	0	0	0	0	0	0	23	
Hong Kong, China	0	0	0	0	1 419	0	0	0	0	43	39	0	0	0	
Indonesia	43	44	41	43	0	0	25	0	0	0	0	0	0	44	
Iran, Islamic Republic of	0	0	0	0	15	0	0	0	0	20	0	0	0	0	
Iraq	0	0	0	0	0	0	0	0	0	0	0	0	0	40	
Ireland	2	0	0	0	1	0	0	0	0	0	171	154	0	0	
Jordan	0	0	0	0	0	48	0	0	0	1	0	0	0	0	

Exporters	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Kyrgyzstan	0	517	0	0	0	0	0	0	0	0	0	0	0	0	
Lebanon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Liberia	0	0	0	0	0	0	0	0	0	0	2	0	0	0	
Luxembourg	0	94	0	0	0	0	0	0	0	0	0	0	0	0	
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Morocco	0	0	0	0	0	26 656	7 756	0	0	0	0	0	0	0	
Nigeria	0	0	0	0	0	0	1 155	0	0	0	0	0	0	0	
Norway	0	3	628	114	49	0	0	0	0	0	0	0	0	0	
Pakistan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Panama	0	42	0	0	3	0	0	0	0	0	0	0	0	0	
Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Saudi Arabia	0	0	60	39	13	0	0	0	0	0	37 557	17 488	0	0	
Viet Nam	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

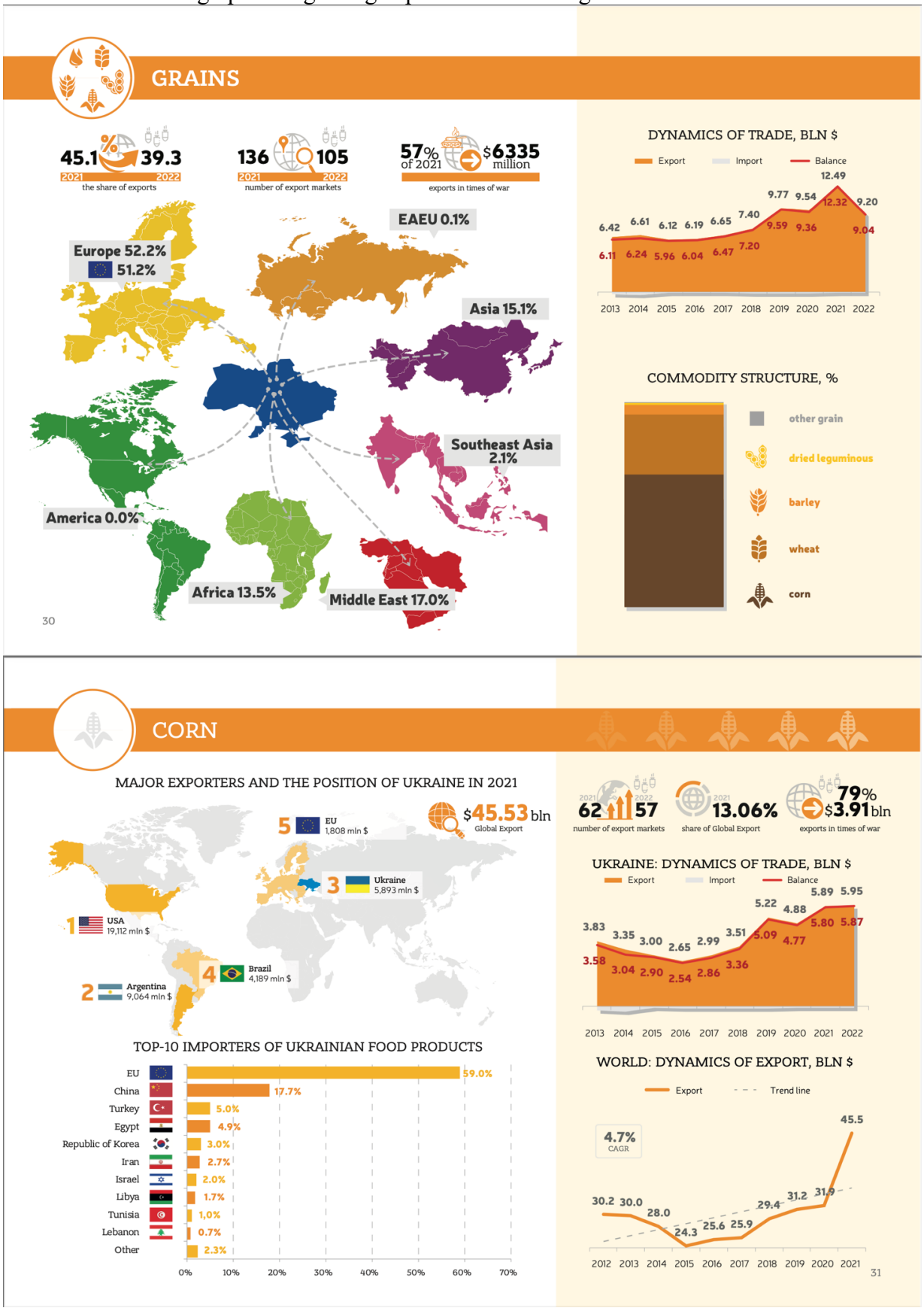
Source: TradeMap

Annex 6. Major importers of Ukrainian agri-food products, 2022 compared to 2021, mln USD



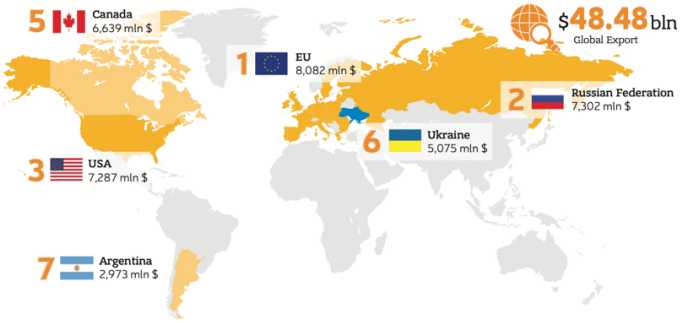
Source: UCAB, 2023

Annex 7. Combined infographics regarding export of Ukrainian grains in 2021-2022

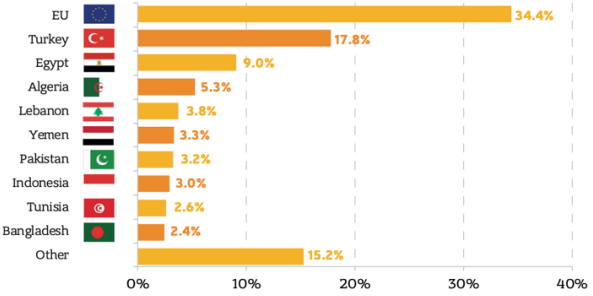


WHEAT

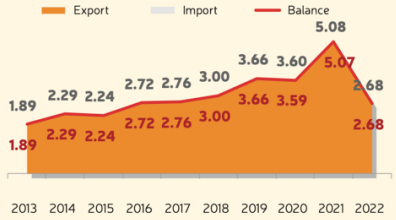
MAJOR EXPORTERS AND THE POSITION OF UKRAINE IN 2021



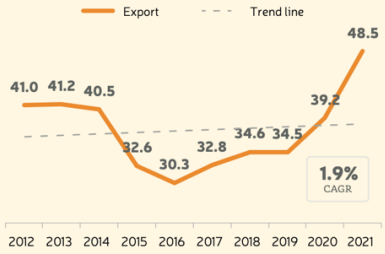
TOP-10 IMPORTERS OF UKRAINIAN FOOD PRODUCTS



UKRAINE: DYNAMICS OF TRADE, MLN $

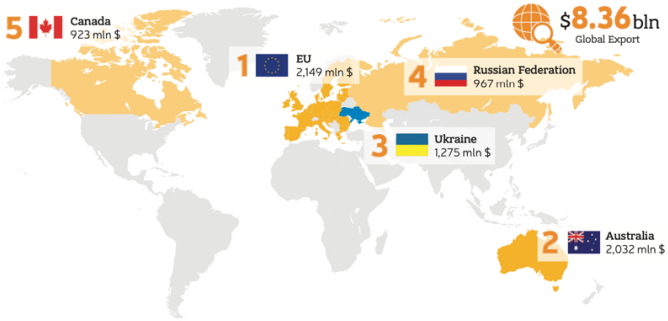


WORLD: DYNAMICS OF EXPORT, BLN $

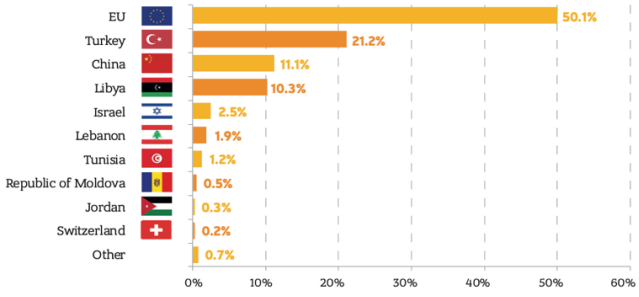


BARLEY

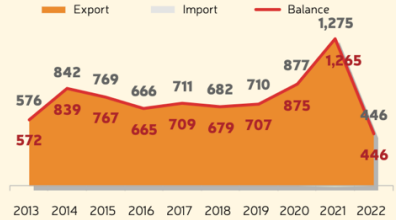
MAJOR EXPORTERS AND THE POSITION OF UKRAINE IN 2021



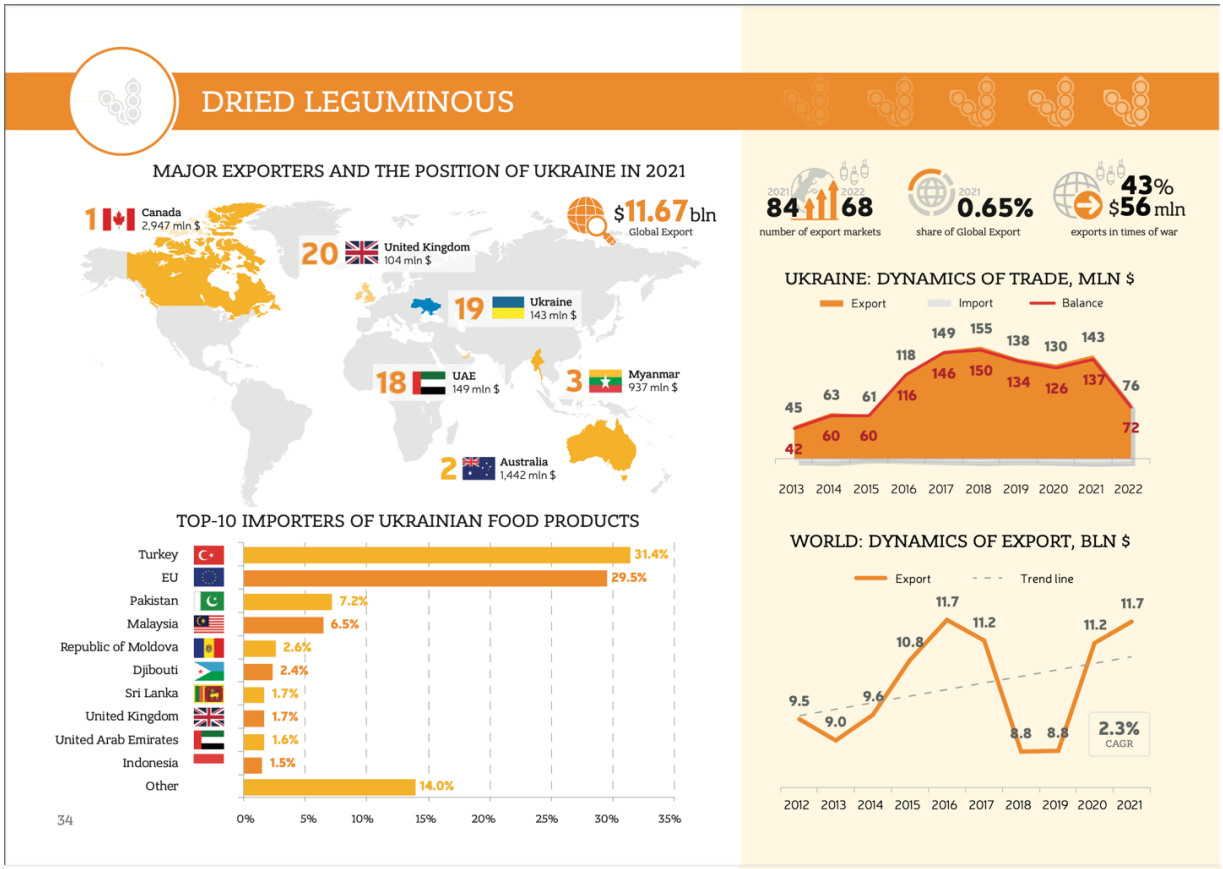
TOP-10 IMPORTERS OF UKRAINIAN FOOD PRODUCTS

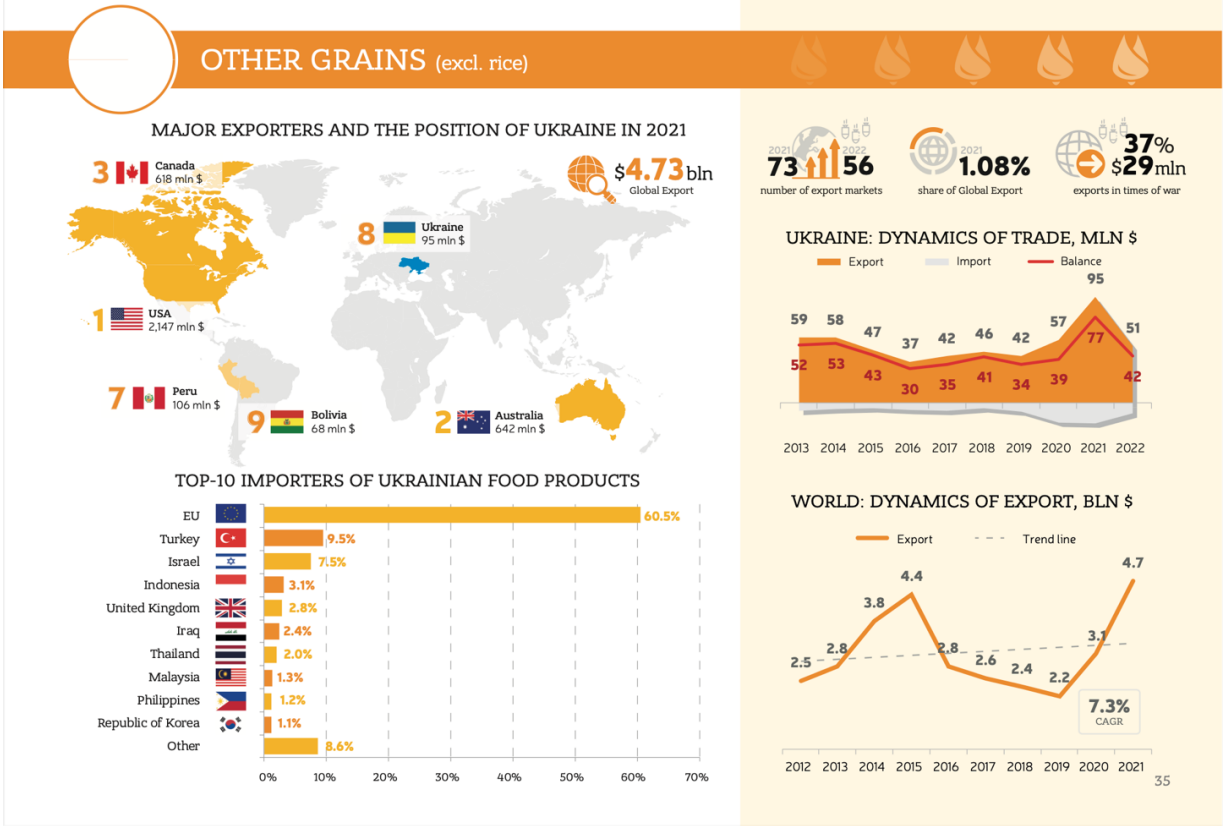


UKRAINE: DYNAMICS OF TRADE, MLN $



WORLD: DYNAMICS OF EXPORT, BLN $





Source: UCAB (2023)