UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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UKRAINE

INDUSTRIAL COUNTRY DIAGNOSTICS 2023

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ABBREVIATIONS

ADP	advanced digital production
BSEC	Organization of the Black Sea Economic Cooperation
BSTDB	Black Sea Trade and Development Bank
CBAM	Carbon Border Adjustment Mechanism
CAGR	Compound Annual Growth Tate
CIS	Commonwealth of Independent States
CO_2	Carbon Dioxide
DCFTA	Deep and Comprehensive Free Trade Area
DIVE	Diversifying Industries and Value Chains for Exports Tool
DSM	Digital Single Market
DSO	distribution system operator
EBRD	European Bank for Reconstruction and Development
EG	employment generation
EMA	emerging comparative advantage
ETS	Emission Trading Scheme
EU	European Union
FDI	foreign direct investment
FSC	Forest Stewardship Council
GDD	global demand dynamics
GDP	gross domestic product
GVC	global value chain
HS	Harmonized System
HTS	Hydrogen Transmission System
ICT	information and communications technology
IEA	International Energy Agency
ILO	International Labour Organization
IMS	National Import Levels
IPI	Industrial Production Index
ISV	Index of Structural Vulnerability
IT	information technology
KSE	Kyiv School of Economics
LMI	lower-middle income
LUP	latent untapped potential
MHT	medium- and high-technology
MSME	micro-, small and medium-sized enterprises
MSW	municipal solid waste

MTN	Multilateral Trade Negotiations
MU	material use
MVA	manufacturing value added
NABU	National Anti-Corruption Bureau of Ukraine
NACP	National Agency for Corruption Prevention
NBU	National Bank of Ukraine
NE	New Entries
NEET	not in employment, education or training
NES	National Economic Strategy
NGO	non-government organization
NICE	National Impacts of Circular Economy Tool
NPL	non-performing loan
NRP	National Recovery Plan
OEC	Observatory of Economic Complexity
OECD	Organisation for Economic Co-operation and Development
PEFC	Programme for the Endorsement of Forest Certification
PGO	Prosecutor General's Office
R&D	research and development
RCA	Revealed Comparative Advantage
RMC	raw material consumption
SAPO	Special Anti-Corruption Prosecution Office
SDG	Sustainable Development Goals
SME	small and medium-sized enterprise
TFEC	Total Final Energy Consumption
UAH	Ukrainian Hryvnia
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
UNSD	United Nations Statistics Division
VA	value added
WBES	World Bank Enterprise Survey
WSS	water supply and sanitation

ACKNOWLEDGMENTS

The Ukraine industrial country diagnostic study 2023 was produced as part of the UNIDO green industrial recovery programme for Ukraine and with funding from the Federal Ministry for Economic Cooperation and Development of Germany (BMZ). The substantial support and information from key stakeholders in Ukraine's industrial policy and structural transformation have greatly enriched this diagnostic study. The authors extend their heartfelt appreciation to all individuals and institutions involved for their time, availability and valuable inputs, which significantly influenced the shaping of this report – in particular, the Ministry for Communities, Territories and Infrastructure Development of Ukraine; Ministry of Economy of Ukraine; Ministry of Strategic Industries of Ukraine; State Statistics Service of Ukraine; regional statistics service offices; Ukrainian League of Industrialists and Entrepreneurs; Regional Council of Entrepreneurs of Kharkiv Region; All-Ukrainian network of experts and practitioners in regional and local development REGIONET; State-Owned Enterprise M.P. Shulgin State Road Research Institute, Confederation of Builders of Ukraine, Construction Chamber, Academy of Construction of Ukraine; Donetsk Chamber of Commerce and Industry; Kharkiv Regional State Administration (during the war – Kharkiv Regional Military Administration); Verkhovna Rada (Parliament) of Ukraine; Lviv Chamber of Commerce and Industry; Kyiv Chamber of Commerce and Industry; Chernigiv Chamber of Commerce and Industry; Dnipro Chamber of Commerce and Industry; Local Territorial Organization of Employers of the City of Lviv; and Entrepreneurship and Export Promotion Office.

Consultations were held with Anatoliy Khayetskyi, Anatoliy Kinakh, Andrii Remizov, Anton Slyusarev, Artem Bezuglyi, Dmytro Aftanas, Dmytro Aleksashov, Dmytro Gerashchenko, Dmytro Ivanov, Dmytro Shamin, Eduard Naboka, Grygoriy Shmatkov, Halyna Tretyakova, Halyna Vasylchenko, Hryhorii Tsapko, Iana Stanislavska, Igor Trutayev, Iryna Hubarieva, Kyrylo Dikhtyarenko, Larysa Kryvenko, Larysa Tsygan, Lesia Vasylenko, Lev Perzhaladze, Maxim Anufriev, Mykhailo Kyrylenko, Mykola Merkulov, Mykola Rudya, Myron Kuzemskyy, Nadiya Bihun, Natalia Gorshkova, Natalia Yudenko, Nataliia Karpenchuk-Konopatska, Nelia Kapusta, Oleksandr Dudka, Oleksandr Lebedev, Oleksandr Malin, Oleksandr Palazov, Oleksandr Tarapatov, Oleksii Tymoshyn, Oleksiy Budarin, Oleksiy Mykhaylov, Oleksiy Sologub, Olena Kryvenko, Olena Pastukhova, Olena Romanenko, Olga Boiko, Pavlo Bondar, Pavlo Myroshnichenko, Petro Kulikov, Roman Kropyvnytskyy, Roman Lyubin, Rostyslav Gapatyn, Sergei Kucheriavenko, Sergiy Moroz, Sergyi Kucheryavenko, Serhiy Chaika, Serhiy Zayika, Stanislav Zinchenko, Svitlana Filyppova, Valerii Pavlovskyi, Valeriy Bezus, Viktor Kushnir, Viktor Slobodyanyuk, Vitaliy Maistrenko, Volodymyr Korud, Volodymyr Kostiuk, Volodymyr Mishchenko, Volodymyr Tkachenko, Volodymyr Vlasyuk, Yana Lahunova, Yaroslav Rushchyshyn, Yaryna Skorohod, Yevhen Dubravskyi and Yulia Levinska.

Ukraine: Industrial Diagnostic Study 2023 is an outcome of rigorous research endeavours led by Nicola Cantore and supported by Upalat Korwatanasakul, who spearheaded the diagnostics team including the Global Policy Incubator (in particular, Thomas Bernhardt, María Elena Ayala, Robert Djidonou and Christian Timm), Gideon Ndubuisi, Oriol Gisbert Marti, Ahmed Osman, Overseas Development Institute (in particular, Dirk Willem te Velde and Yohannes Ayele), Giovanni Marin, Elena Paglialunga, Yevgeniya Shevtsova, Nicola Coniglio, Davide Vurchio, Olha Ilyash, Tetiana Salashenko, Volodymyr Buzhan and Viktoriia Khaustova. This collaborative effort involved coordination with UNIDO colleagues Solomiya Omelyan, Mariia Pavlova, Stephan Sicars, Eric Bishel, Steffen Kaeser, Noriko Takahashi, Nobuya Haraguchi, Andrii Vorfolomeiev, Mariia Reva and Florian Hespeel. Advanter and, in particular, Andrii Dilgach and Pavlo Sobolievskyi were the focal points of the UNIDO firm survey data collection.The industrial country diagnostic study has been edited by Mike Fisher and designed by Kateryna Molchanova.

INTRODUCTION

Ukraine's industrial production is facing profound challenges, preceded by a series of shocks that have had an impact on the growth rate of the country's gross domestic product (GDP) (**Figure 1**) and industrial production (**Figure 2**) over the last 15 years.

Comprehensive industrial country diagnostics have been conducted to chart a strategic path for Ukraine's future industrialization and green industrial recovery. This assessment builds on the existing policies of the Government of Ukraine and the Recovery and Reconstruction of Ukraine (the 'Ukraine Plan') of the European Union (EU). It addresses challenges and offers solutions aimed at promoting economic growth, rebuilding and modernizing the country's economic system and fostering deeper integration with the EU to facilitate recovery, reconstruction and reform at all levels (i.e. at the macro-, meso- and microlevel).

Drawing on UNIDO's extensive experience and research in contributing to global public policy debates, the industrial country diagnostics tool is structured around the following four blocks informed by quantitative data and consultations with stakeholders and experts in Ukraine:

Block 1 provides a macro-level analysis and examines the economic, social and environmental dimensions of recent industrial performance to capture the key thematic areas that require policy intervention.

Block 2 presents a meso-level analysis of Ukraine's industrial sectors to gauge their potential and, in particular, sectors that require increased attention due to the impact of the armed conflict.

Block 3 discusses the outcome of a micro-level analysis of Ukrainian firms, with a focus on identifying critical bottlenecks in their business operations. This information is useful for designing effective interventions as part of Ukraine's green industrial recovery programme.

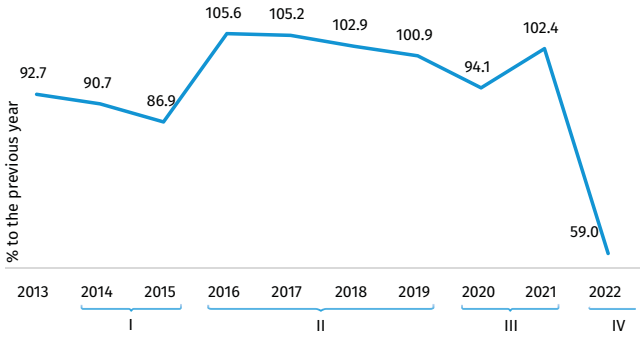
Block 4 entails a product analysis to capture key strategies for Ukraine's economic diversification.

FIGURE 1: DYNAMICS OF UKRAINE'S GDP GROWTH, 2000-2022

Source: World Bank, *World Development Indicators* database (accessed September 2023).

FIGURE 2: UKRAINE´S MANUFACTURING INDUSTRIAL PRODUCTION INDEX, 2013-2022

Source: The State Statistics Service of Ukraine (accessed September 2023).



Note: I – non-recognized annexation of Crimea and the beginning of the conflict in eastern Ukraine;
II – continuation of the conflict in eastern Ukraine;
III – continuation of the conflict in eastern Ukraine and the spread of the COVID-19 pandemic;
IV –full-scale invasion of Ukraine.

1 Macro-level analysis of Ukraine´s inclusive and sustainable industrial performance

1.1 INTRODUCTION AND STRUCTURE OF THE ANALYSIS

Despite numerous challenges, Ukraine is a middle-income country with good growth opportunities. The country possesses fertile land, significant natural resources and a strategic geographical location at the crossroads of Europe and Asia. In addition, it has critical assets based on its entrepreneurial culture and skilled labour force. Today, many of these opportunities are overshadowed by the catastrophe of war.

From 2010-2019, before the COVID-19 pandemic hit, Ukraine experienced negative macroeconomic growth – an average annual gross domestic product (GDP) decline of -0.5 percent – marked by a mix of achievements and challenges. While some sectors such as automotive, agriculture-grains and information technology (IT) registered impressive successes, others lagged behind (World Bank, 2019) (World Bank, 2019) (Grygorenko & Schnitzer, 2022).

Between 2010-2013, Ukraine underwent a series of political shifts, social unrest and external pressures that influenced its economic trajectory. More specifically during this period, the country witnessed political instability and corruption, hindering Ukraine‘s economic progress. In addition, the non-recognized annexation of Crimea and the conflict in Eastern Ukraine had a significant impact on the country’s economy. The war disrupted industrial production, caused a decline in Foreign Direct Investment (FDI) and displaced populations (Dnabrowski, Domínguez-Jiménez, & Zachmann, 2020). Although the government implemented measures to mitigate the economic consequences, the conflict remained a significant challenge for Ukraine‘s economic development.

On the upside, following the Euromaidan protests in 2013-2014, Ukraine embarked on structural reforms to improve governance, fight corruption and enhance the business climate. These reforms included deregulating industries, promoting FDI, and establishing an independent judiciary system. Between 2015 and 2019, Ukraine’s economy somewhat recovered, growing 2.9 percent per year. But after this brief period of expansion, the crisis hit again: first, the COVID-19 pandemic and then the war in Ukraine, causing massive disruptions in economic activity and significant damage to the livelihoods of Ukrainian people, infrastructure and the environment (National Recovery Council, 2022). Ukraine’s economy shrank by an annual average of 11.0 percent between 2019 and 2022.

Against this backdrop and considering that Ukraine has historically lagged behind its Central European peers in terms of economic performance, the country needed to establish not just a recovery plan but also national strategic guidelines that outline targeted economic and industrial development, desired quality of life and prospects for environmental protection and climate-change adaptation and mitigation. A selection of the most relevant strategies and plans are highlighted in this report.

The National Economic Strategy (NES) Until 2030, adopted in 2021, establishes that the economic and industrial development of the country needs to be based on a favourable business and investment environment; innovation and the modernization of economic sectors; and improvements to Ukraine’s competitiveness in international markets, the development of human capital, and on ensuring equal rights and opportunities for all in society.

The Strategy of Environmental Safety and Adaptation to Climate Change Until 2030, also adopted in 2021, outlines strategic goals that also apply to the industrial sector, including the reduction of industrial pollution, the creation of an effective chemical safety system, the efficient use of natural resources and the setting up of a legal and economic framework for the implementation of waste-management systems (UNIDO, 2023).

In the face of the full-scale invasion of Ukraine, Ukraine’s government in 2022 adopted the National Recovery Plan (NRP) to address the country’s most urgent needs caused by the war. It provides critical guiding principles for the recovery process. One of them is the build back better approach, which offers

the opportunity to rebuild stronger, safer and more disaster-resilient infrastructure and systems. The NRP paints a clear vision for the country's recovery, establishing as the main strategies the accession to the European Union (EU), access to EU and G7 markets and national security. With a conducive business environment and macro-financial stability as foundations, the envisaged profound economic transformation is to be driven by the development of (1) priority sectors (e.g. defense; metallurgy & machinery; energy; agriculture, including processing; furniture and wood processing; construction and related materials; information technology), (2) strong human capital and (3) adequate infrastructure. The green deal and digitalization serve as cross-cutting strategic vectors for development. In addition, the NRP establishes 15 national programmes (and related projects and key performance indicators) to boost Ukraine´s recovery and to achieve ambitious growth rates, distinguishing between different time-horizons for their implementation: war-time economy 2022, post-war recovery 2023-2025 and new economy 2026-2030 (National Recovery Council, 2022).

Moreover, the government has recently released an updated report, Ukraine Priority Recovery Needs for 2023, that identifies five priorities and the financial resources required to support them: energy infrastructure, humanitarian demining, private sector, housing, and critical and social infrastructure. Some of the specific needs identified relate directly to industrial development, including the need to stimulate exports and imports, support the processing industry and micro businesses, extend access to small and medium-sized enterprises (SMEs) financing, restore and repair power transmission and distribution lines, and restore and decentralize power generation (Ministry of Restoration, Communities, Territories, and Infrastructure Development of Ukraine , 2023).

To comprehensively capture Ukraine's industrialization trajectory, Block 1 conducts a thorough analysis, encompassing macro-level economic, social and environmental dimensions. The methodology uses various indicators and compares Ukraine´s performance to a set of selected benchmark countries. The European Union (EU), which Ukraine aspires to join, serves as a regional benchmark.

In this Block, Argentina, Poland, Romania and Türkiye are comparator countries, chosen as they share certain similarities with Ukraine regarding economic structure (e.g. a large agricultural/agribusiness sector and a comparable mix of industries) and population size. Poland and Romania are, moreover, neighbouring countries of Ukraine and EU members – see (Gylfason, Eduard, & Tadeusz, 2022), for example).

Meanwhile, Türkiye is Ukraine's fellow member in regional organizations such as the Black Sea Trade and Development Bank (BSTDB) and the Organization of the Black Sea Economic Cooperation (BSEC).

Throughout this block, particular emphasis will be placed on assessing the detrimental repercussions of the war on Ukraine's industrialization endeavors. Therefore, each section will incorporate an analysis of the war's impact. Differences across the country's regions will be addressed wherever possible. Additional qualitative information enhances the block's richness by incorporating critical findings from literature sources and stakeholder consultations. **Figure 1.1** shows a visual representation of the structure of the macro analysis presented in Block 1.

FIGURE 1.1 : STRUCTURE OF BLOCK 1

Source: UNIDO elaboration.

MACRO-LEVEL ANALYSIS: INCLUSIVE AND SUSTAINABLE INDUSTRIAL PERFORMANCE

ECONOMIC

1. Economic Growth and Structural Transformation
- Economic growth
- Economic structure
- Employment structure
- Exports

2. Productive Performance of the Manufacturing Sector
- Manufacturing's contribution to total output
- Industrial production index for manufacturing
- Industrial capacity and growth
- Manufacturing labour productivity
- Subsector value added and growth

3. Manufactured Goods Trade Performance
- Contribution of manufactured exports to total merchandise exports
- Manufactured export capacity and growth
- Composition of the manufactured exports basket
- Composition of the manufactured imports
- Manufactured trade balance

4. Manufactured Exports Diversification
- Diversification in export products
- Diversification in export markets
- Degree of processing of resource-based exports

5. Industrial Innovation, Technology Upgrading and Digitalization
- Industrial innovation and technology upgrading
- Digitalization

6. Investment and Finance
- Capital investment
- Foreign direct investment
- Private-sector access to credit

SOCIAL

1. Manufacturing Employment and Wages
- Contribution of manufacturing to total employment
- Employment in manufacturing subsectors
- Wages in manufacturing subsectors

2. Youth and Female Employment
- Female employment in total employment and in industry
- Share of youth not in employment, education or training

3. Education and Skills
- Government expenditure on education
- Students in vocational training

ENVIRONMENTAL

1. Water Use and Supply
- Sectoral water use
- Industrial water use intensity

2. Material Extraction and Consumption
- Material extraction
- Material consumption in manufacturing
- Manufacturing material consumption intensity

3. Energy Generation and Energy-use Intensity use
- Access to electricity
- Electricity production capacity
- Industrial energy use intensity
- Renewable energy

4. Cleaner Production – CO_2 Emissions
- CO_2 emissions of the economy
- CO_2 emissions by sector using fuel combustion
- Manufacturing CO_2 emissions intensity

5. Waste Generation and Management
- Municipal solid waste generation
- Municipal solid waste composition
- Municipal solid waste management

6. Forest Area
- Forest area and net change rate

1.2 ECONOMIC PERFORMANCE

Drawing on available quantitative statistics, this section examines fundamental economic performance indicators to help understand Ukraine's economy generally and the manufacturing sector more specifically. This is supplemented by integrating qualitative information from consultations with Ukrainian experts, stakeholders and secondary sources. Wherever possible and meaningful, the macro-level analysis for the country as a whole will be complemented by regional analysis that sheds light on differences across oblasts.

1.2.1 ECONOMIC GROWTH AND STRUCTURAL TRANSFORMATION

ECONOMIC GROWTH

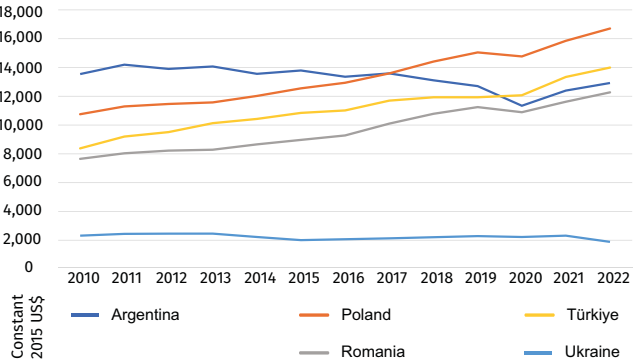
In 2010-2021, Ukraine's GDP per capita remained practically unchanged, as it increased only minimally, from US$ 2,315.1 to US$ 2,317.7 at a flat compound annual growth rate (CAGR) of 0.01 percent. The full-scale invasion of Ukraine dramatically impacted per-capita GDP, which slumped by almost one-fifth (-18.3 percent) in 2022.

The biggest shock to Ukraine's economy was inflicted in the early months after the full-scale invasion of Ukraine. It came in the form of the destruction of production facilities, stoppage of investment projects given ultra-high investment risks, decrease in local demand, destroyed transport infrastructure, blocked ports, restrictions on cross-border currency payments, narrowing of the range of domestic goods, shortage of imported energy resources, pressure on inflation, and currency devaluation (The National Council for the Recovery of Ukraine from the Consequences of the War, 2022).

Compared to the benchmark countries, Ukraine's per-capita GDP significantly lags behind those of Poland, Romania, Türkiye and Argentina. **Figure 1.2** shows that this income gap has widened over time, especially in the European countries. Over 2010-2022, per-capita GDP rose by a CAGR of 5.3 percent in Türkiye, 3.9 percent in Poland, and 2.6 percent in Romania, while it decreased at a CAGR of -5.6 percent in Ukraine. Despite the large-scale challenges in the country, Ukraine´s economy has shown impressive resilience and continues to function surprisingly well. However, a massive turnaround from the stagnant growth pattern of the last decade will be necessary to sustainably improve the population's living standards, speed up the recovery process and narrow the income gap with peer countries.

FIGURE 1.2: GDP PER CAPITA, UKRAINE AND COMPARATORS, 2010-2022

Source: World Bank, *World Development Indicators* database (accessed September 2023).

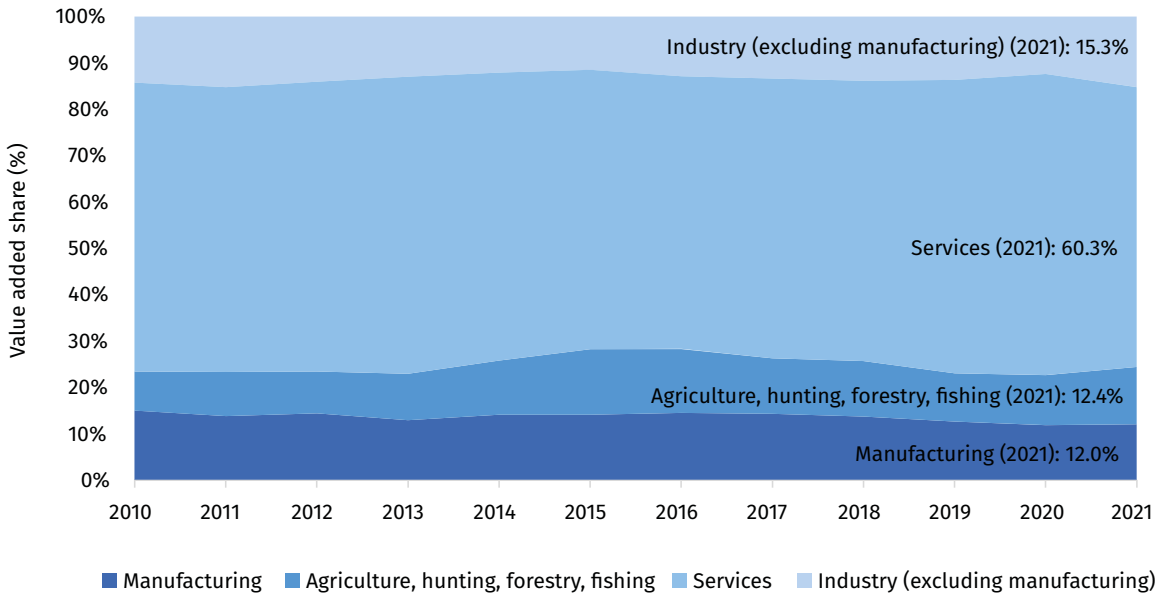


ECONOMIC STRUCTURE

The distribution of value added across different sectors provides insights into a country's economic structure and whether it has experienced a first tier of structural change. **Figure 1.3** shows that the service sector dominates Ukraine´s economy, contributing 62.3 percent of total value added in 2010 and 60.3 percent in 2021, followed by agriculture (8.4 percent and 12.4 percent) and manufacturing (15.0 percent and 12.0 percent).

FIGURE 1.3: UKRAINE´S ECONOMIC STRUCTURE, 2010-2021

Source: National Accounts, United Nations Statistics Division (accessed September 2023).



Historically, Ukraine has been a predominantly agricultural country with fertile land and good climate conditions conducive to producing crops like grains, oilseeds and vegetables, allowing the country to rely on a commodity-based development model. The service sector has declined its share over recent years, as its value added in absolute terms has stagnated, with a CAGR of just 0.4 percent between 2010-2021. Service spans finance, IT and software development, tourism, and retail branches. However, IT and software development have experienced rapid growth and become major export industries[1] (World Bank, 2019).

The manufacturing sector has performed roughly the same as the service sector, registering a decline in absolute terms (CAGR of -2.8 percent) between 2010-2021. The agricultural sector is different: in absolute terms it grew at 3.3 percent during the same period. Therefore, even before the full-scale invasion of Ukraine, the country went through an episode of deindustrialization (see also (UNIDO, 2017); (Taguchi & Abdullaev, 2023)). This has been exacerbated by manufacturing among the sectors most heavily affected by the war – suffering in particular from mass destruction and operational standstills/losses due to the temporary military control of the Russian Federation, as well as from a significant drop in market demand, where heavy industry was one of the most impacted ones. As a result, manufacturing value added (MVA) almost halved in 2022 (decreasing by -43.1 percent), leaving its share of the economy barely over the 10 percent mark.

According to UNIDO consultations with Ukrainian stakeholders, estimates show that manufacturing losses have totaled around US$ 800-900 billion since the beginning of the war, that about 412 enterprises in the sector have been damaged and destroyed, and that direct losses of firms' assets amounted to US$ 13 billion. Total indirect losses stand at over US$ 33 billion. It is also estimated that nearly US$ 25 billion will be needed to restore these manufacturing firms. This significant damage to the manufacturing sector will make it even more challenging to reverse the country's deindustrialization trend after the war (Grigorenko, 2023).

Looking beyond the manufacturing sector, about 1,500 medium-sized and large enterprises were destroyed, about one-quarter of which the Ukrainian economy lost permanently. Large enterprises suffered heavily

from destroyed assets and financial losses caused by the war, including because they have found it more difficult to relocate than SMEs. Eight hundred enterprises relocated to nine regions within Ukraine, and another 4,000 enterprises relocated abroad. The largest number of enterprises relocated to the Lviv (24.0 percent), Zakarpattia (14.5 percent), Chernivtsi (9.8 percent) and Ivano-Frankivsk (8.3 percent) regions in the northwest areas of the country (Ukrainian Stakeholders, 2023).

Reconstruction and recovery costs need to exceed US$ 411 billion, equivalent to 2.6 times the GDP from 2022 (World Bank, 2023). For a successful and sustainable recovery, Ukraine must ensure an annual economic growth rate of 7 percent and attract up to 4.5 million people to its workforce (Ukrainian Stakeholders, 2023). This will require a structural transformation process to diversify the economy and shift towards more manufacturing to reap the positive externalities associated with the development of this sector, such as innovation and productivity growth, knowledge spillovers, employment creation, forward and backward linkages generation, technological upgrading and skills development (UNIDO, 2020a).

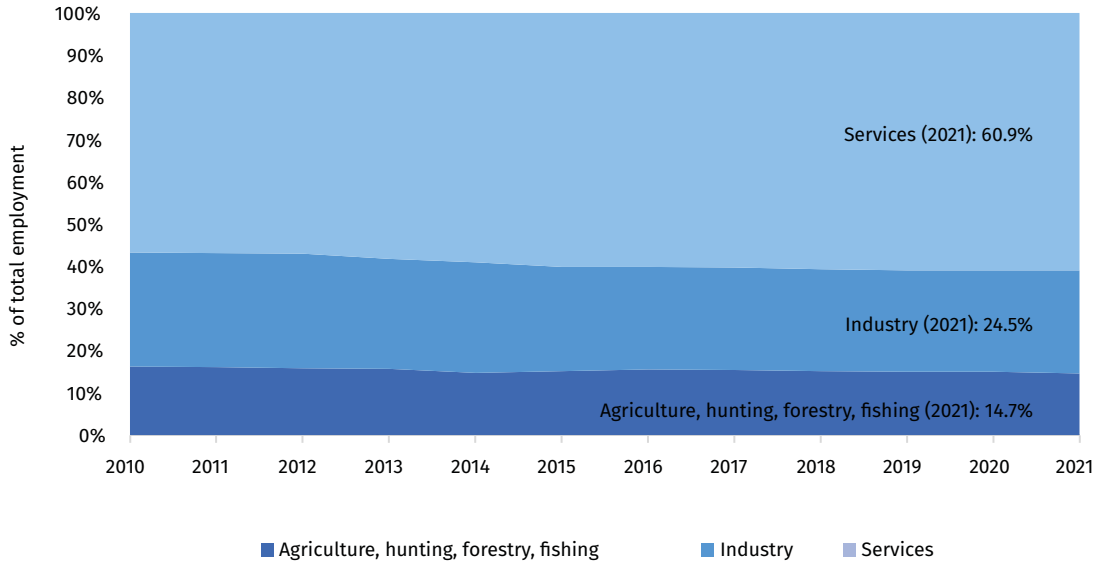
EMPLOYMENT STRUCTURE

Figure 1.4 reveals each sector's share in total employment. Services contributed 60.9 percent of total employment in 2021, followed by industry, which employed around 24.5 percent of the labour force, and agriculture, which accounted for 14.7 percent. Compared to 2010, industry's share has decreased by almost a one-tenth (2.5 percentage points). In other words, the deindustrialization pattern observed with value-added data is also visible in employment statistics.

There is no available data to visually depict the employment structure for the war period (2022 and 2023). However, according to estimates from the International Labor Organization (ILO), between the full-scale invasion of Ukraine in February 2022 and May 2022 alone about 4.8 million jobs were lost. This represents 30 percent of pre-conflict employment in Ukraine. This massive employment loss is mainly due to economic disruption, internal displacements, and the flow of refugees (ILO, 2022a).

FIGURE 1.4: UKRAINE´S EMPLOYMENT STRUCTURE, 2010-2021

Source: World Bank, *World Development Indicators* database (accessed September 2023).



EXPORTS

To complement the general understanding of a country's economic performance, it is important to analyse to what extent it relies on exports, considering the positive externalities involved, e.g. economies of scale, diversification, revenue increase, job creation, technology transfer and upgrading. **Figure 1.5** shows that among comparators and the EU27, Ukraine has the highest share of total exports as a proportion of GDP, indicating that the country's export sector strongly drives the country's economic performance.

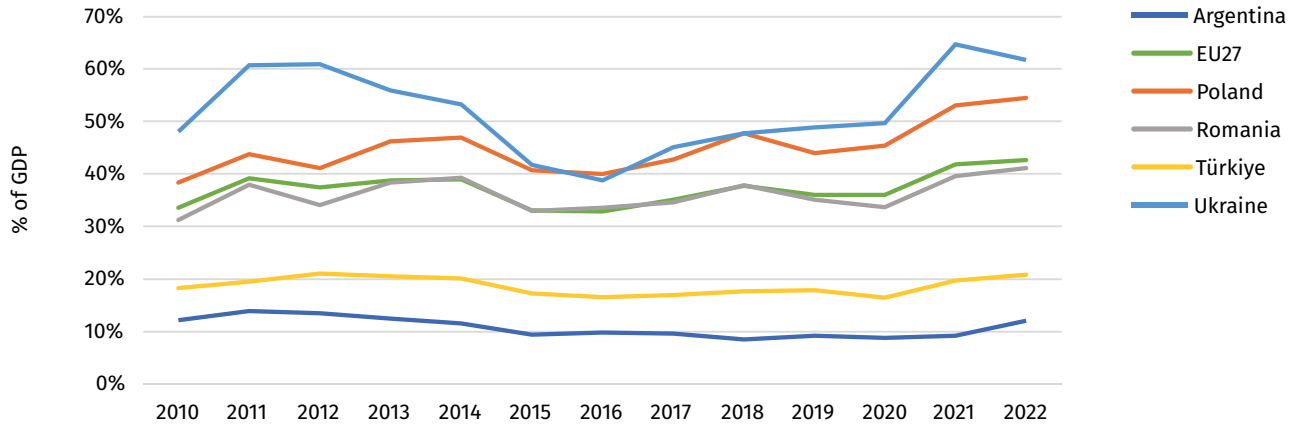
During 2010-2021, all the comparator countries except Argentina experienced increased exports as a share of GDP. This share increased from 48.1 percent to 64.7 percent in Ukraine, the largest increase for any country covered by this analysis. The relatively high shares for Poland, Romania and the EU indicate that deepening commercial relationships are at the core of European economic integration, potentially holding further trade opportunities for Ukraine.

In **Figure 1.5**, the repercussions of the war also become discernable as Ukraine was the only country where the share of exports in GDP declined in 2022. Underlying this trend is a stronger decrease in the export value (-32.3 percent) than in GDP (-29.1 percent). This is because several exporting industries were particularly affected by dramatic drops in production, the disruption of logistics and supply chains, and the loss of access to foreign markets due to a blockade of seaports. One example is the agro-industrial sector, where losses amounted to billions of dollars due to tightening transport logistics, leading to a four- six-fold increase in production costs (Ukrainian Stakeholders, 2023).

In this context, Ukraine's main challenges are strengthening its trade integration strategy and improving its participation in global and regional value chains. This aligns with Ukraine´s National Recovery Plan, where part of the vision is to achieve EU integration and access to EU and G7 markets (National Recovery Council, 2022).

FIGURE 1.5: SHARE OF TOTAL EXPORTS IN GDP, UKRAINE AND COMPARATORS, 2010-2022

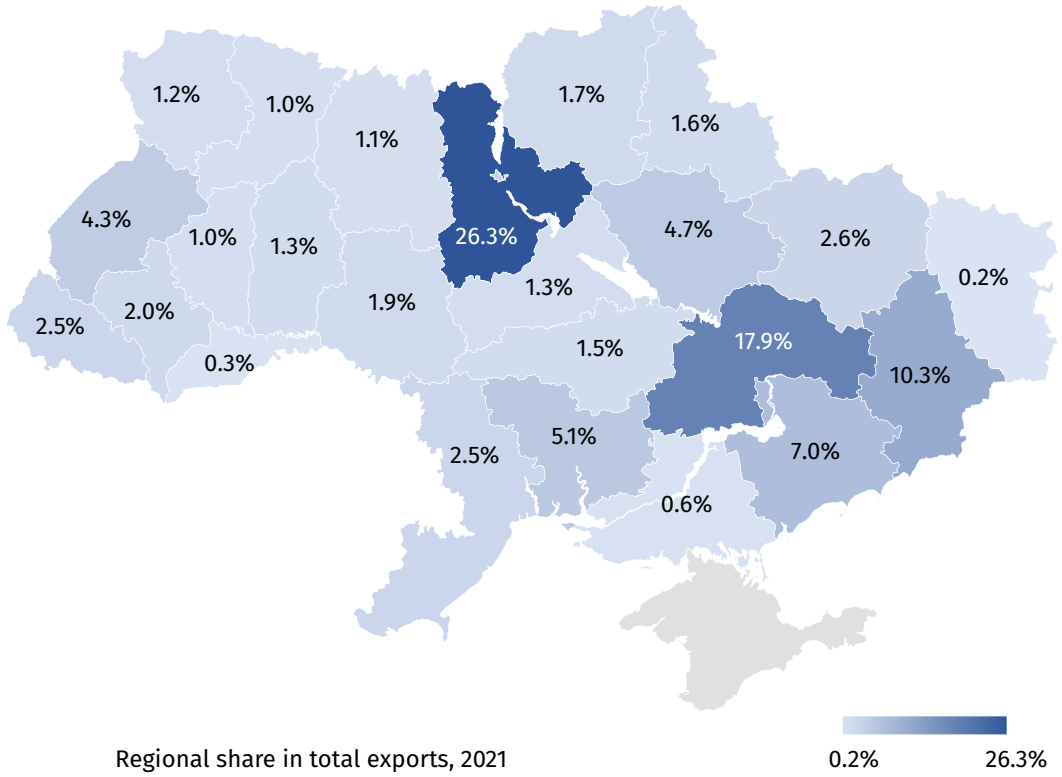
Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* (accessed September 2023).



According to UN-COMTRADE data, Ukraine´s total exports amounted to US$ 65.6 billion in 2021 compared to US$ 51.1 billion in 2010 (CAGR of 2.3 percent). **Figure 1.6** shows that exports were concentrated in five regions: Kyiv (26.3 percent[2], Dnipropetrovsk (17.9 percent), Donetsk (10.3 percent), Zaporizhzhya (7.0 percent) and Mykolayiv (5.1 percent), which together represented 66.5 percent of the country's total exports.

FIGURE 1.6: UKRAINE´S SHARE OF REGIONAL EXPORTS, 2021

Source: The State Statistics Service of Ukraine (accessed September 2023).



Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

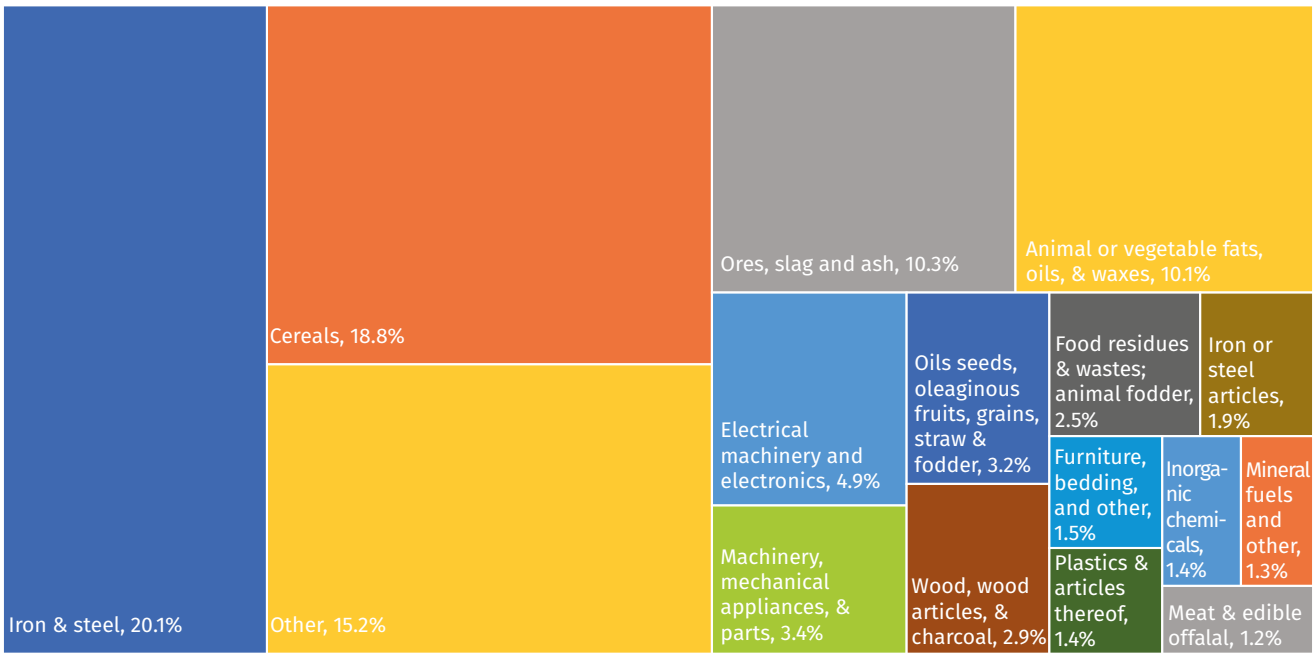
The war made exports fall by 32.3 percent to US$ 44.4 billion in 2022. The regions that registered the most dramatic drops were Donetsk (96.0 percent), Luhansk (94.8 percent), Kherson (86.2 percent), Mykolayiv (52.5 percent), Kharkiv (51.2 percent) and Dnipropetrovsk (48.6 percent), all southeast regions on the front lines of the war. This has had repercussions for outward trade overall, as two of these regions, namely Dnipropetrovsk and Donetsk, were among the top three exporters in 2021.

It is worth noting that nine regions actually increased exports: Cherkasy (46.4 percent), Odesa (41.4 percent), Chernivtsi (38.2 percent), Volyn (28.9 percent), Vinnytsya (22.2 percent), Zakarpattya (17.0 percent), Ternopyl (15.0 percent), Rivne (5.7 percent) and Lviv (3.2 percent). This suggests some signs of resilience, but also that their exports increase could be due to the relocation of enterprises from east to western regions.

Ukraine's exports in 2021 (pre-war period) were dominated by primary or resource-based products such as iron and steel, cereals (wheat and corn), ores, some processed animal products and vegetable oils, where the country has comparative advantages (**Figure 1.7**). Together, they accounted for 59.3 percent of total merchandise exports. The composition of the export basket for 2022 looks quite similar, albeit at lower export values (**Table 1.4** presents the manufactured export composition for Ukraine in 2022).

FIGURE 1.7: WHAT DID UKRAINE EXPORT IN 2021?

Source: Observatory of Economic Complexity (OEC) (accessed September 2023).



In sum, the high reliance of Ukraine's economy on exports, the significant concentration of exporters in a few regions, and the export dependency on a few primary goods and processed agroproducts imply a heightened vulnerability to external shocks (e.g. price volatility of commodities, geopolitical issues, international demand contraction), exposing in particular those regions that are export powerhouses.

1.2.2 PRODUCTIVE PERFORMANCE OF THE MANUFACTURING SECTOR

The previous section presented and discussed various indicators at a macroeconomic (i.e. economy-wide) level. This section focuses specifically on the manufacturing sector.

MANUFACTURING'S CONTRIBUTION TO TOTAL OUTPUT

The share of MVA in total GDP is used to understand the importance of the manufacturing sector in the overall economy. MVA can be conceived of as the returns generated from output value minus the cost of all input materials and services required for production (UNIDO, 2010).

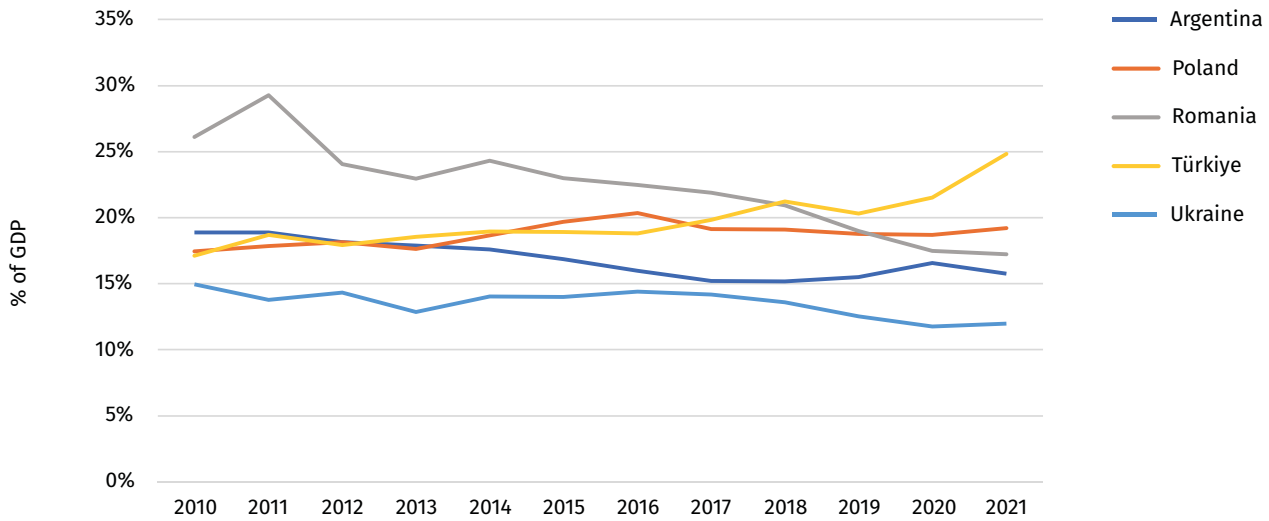
Figure 1.8 confirms the deindustrialization trend in Ukraine that was already presented in the previous section. It shows that the manufacturing sector's contribution to GDP has declined continuously over the last decade. While it stood at 15.0 percent in 2010 – and thereby was in line with that of most comparator countries and the EU – by 2021 it had fallen to 12.0 percent, creating a gap with the benchmark countries, especially Romania (17.2 percent), Türkiye (24.8 percent) and Poland (19.2 percent). Even more worrying is that MVA decreased in absolute terms, from US$ 15.8 billion in 2010 to US$ 11,5 billion in 2021 (in constant dollars).[3]

The overwhelming impact of the war on Ukraine's manufacturing sector is also reflected in the further drop of MVA's share in GDP to 9.1 percent in 2022, according to World Bank data. This is in line with the trend observed in the following subsection when discussing the industrial production index for manufacturing, which puts a further wedge between Ukraine and all comparator countries and the EU.

During consultations, national experts and stakeholders offered explanations for this significant decline in the manufacturing sector's role in the overall economy, highlighting substantial consequences of the war, such as the destruction of production capacity; a fall in output value due to a drop in domestic market demand; labour shortages due to mobilization and departure of population abroad; loss of supply chains; and an increase in logistics cost of export processes (Ukrainian Stakeholders, 2023).

FIGURE 1.8: SHARE OF MVA IN GDP, UKRAINE AND COMPARATORS, 2010-2021

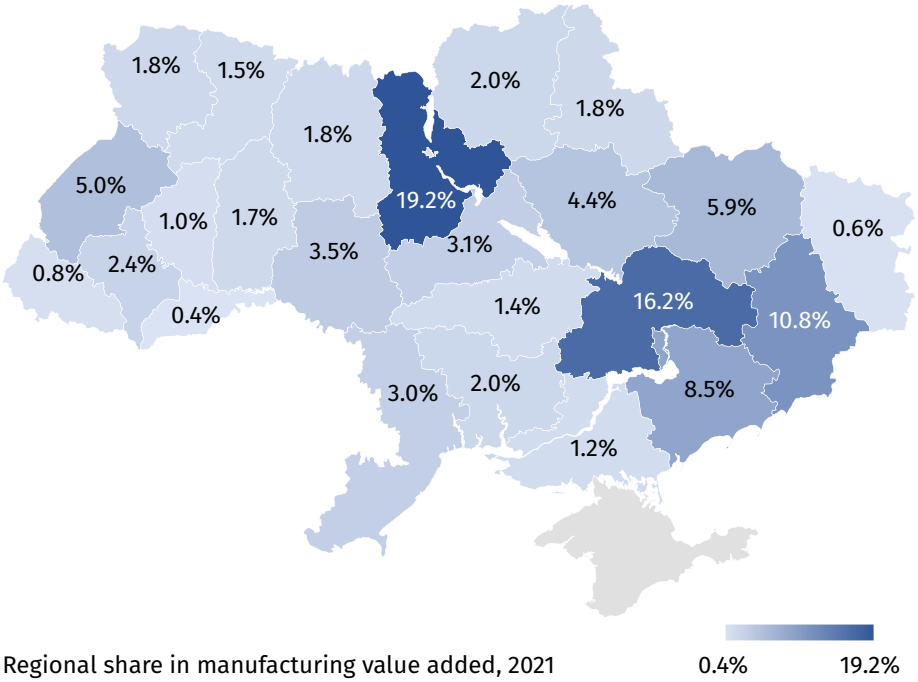
Source: National Accounts, United Nations Statistics Division (UNSD, accessed September 2023).



MVA generation is heavily concentrated in five regions: Kyiv, responsible for 19.2 percent of national MVA,[4] Dnipropetrovsk (16.2 percent), Donetsk (10.8 percent), Zaporizhzhya (8.5) and Kharkiv (5.9 percent). Together, they accounted for 60.6 percent of the country's MVA in 2021. Since several of these regions are located in Ukraine's east and southeast, this made the manufacturing sector particularly vulnerable to war-related wreckage (**Figure 1.9**). It will be necessary for the country to rebalance the distribution of productive activities more evenly across Ukraine to lower vulnerability, increase resilience and make industrialization more regionally inclusive. This process has already started, as more enterprises have begun relocating to the northwest of the country.

FIGURE 1.9: UKRAINE´S REGIONAL DISTRIBUTION OF MVA, 2021

Source: The State Statistics Service of Ukraine (accessed September 2023).



Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

INDUSTRIAL PRODUCTION INDEX (IPI) FOR MANUFACTURING

The industrial production index (IPI) for manufacturing is used to track the performance of a country's manufacturing relative to the previous year. **Figure 2** (in the Introduction section) shows that Ukraine's IPI has fluctuated quite a bit over time, reflecting in part the political instability and various conflicts the country has suffered between 2013 and 2022. First, a downward trend between 2013-2015 can be associated with the Euromaidan protests and the non-recognized annexation of Crimea. The COVID-19 pandemic caused a subsequent drop between 2019 and 2020. However, the IPI downfall between 2021 and 2022 stands out as the most pronounced, illustrating the massive impact of the full-scale invasion of Ukraine on manufacturing production in Ukraine. In 2022, the level of manufacturing output was 43.2 percent lower than in 2021 and 33.7 percent lower than in 2013. Later in this report, **Table 1.2** presents the IPI for manufacturing subsectors for 2021-2022 to paint a more granular picture of how the war has impacted the different branches of the manufacturing sector.

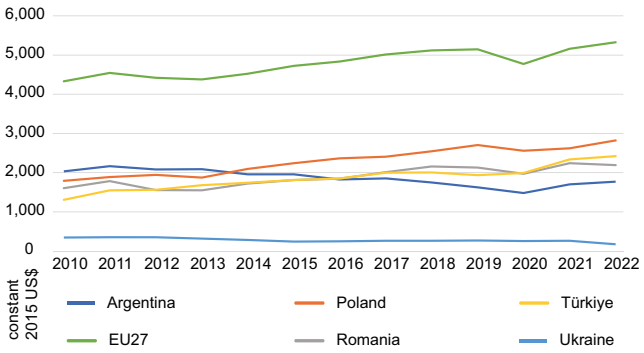
INDUSTRIAL CAPACITY AND GROWTH

While sufficient understanding the overall role of the manufacturing sector in the total economy is essential, per-capita MVA is another useful indicator to capture the level of a country's industrialization. It sheds light on industrial capacity and how it compares with those of benchmark countries (UNIDO, 2013). **Figure 1.10** shows that Ukraine's industrial capacity is limited and has decreased between 2010 and 2021, moving from US$ 340 to US$ 263 of per-capita MVA. This level is far from the industrial capacity in the EU (US$ 5,160 in 2021) as well as in the benchmark countries. In 2021, Ukraine's per-capita MVA was only around one-tenth of Poland's (US$ 2,622) and Türkiye's (US$ 2,339).

Moreover, unlike Argentina, Ukraine is the only country analysed here whose industrial capacity declined over the last decade. This contrasts with the 2010-2021 increases in Poland and Türkiye (CAGR of 3.5 percent and 5.4 percent, respectively).

FIGURE 1.10: MANUFACTURING VALUE ADDED (MVA) PER CAPITA, UKRAINE AND COMPARATORS, 2010-2022

Source: World Bank, *World Development Indicators* database (accessed September 2023).



The recovery in Ukraine's industrial capacity after the COVID-19 pandemic was short-lived (with a slight upward tick between 2020 and 2021). The war caused Ukraine's per-capita MVA to fall again in 2022, down to US$ 172 (around 30 times less than the EU average).

However, some regions (oblasts) were hit harder by military actions and economic damage than others. The regions whose industrial capacity was most affected by the loss of infrastructure, a blockade of seaports, changes in transport logistics and the increase in the cost of production are the following (Ukrainian Stakeholders, 2023):

- Donetsk stands out among the most affected regions. Mariupol, which includes some of the country's largest metallurgical enterprises such as the Azovstal iron and steel works and the Illich iron and steel works, was destroyed;
- Luhansk was well known for the production of mineral fertilizers, in Lysychansk; salt, in Soledar; and glass and metalworking equipment (processing of non-ferrous metals) and mining equipment and tools, in Bakhmut;
- Zaporizhzhya, site of the Zaporizhzhya nuclear power plant, and the city of Enerhodar have been battlegrounds and under siege since 2022;
- Kyiv was partially under the temporary military control of the Russian Federation at the beginning of the war;
- Kharkiv hosts power engineering sub-branches.

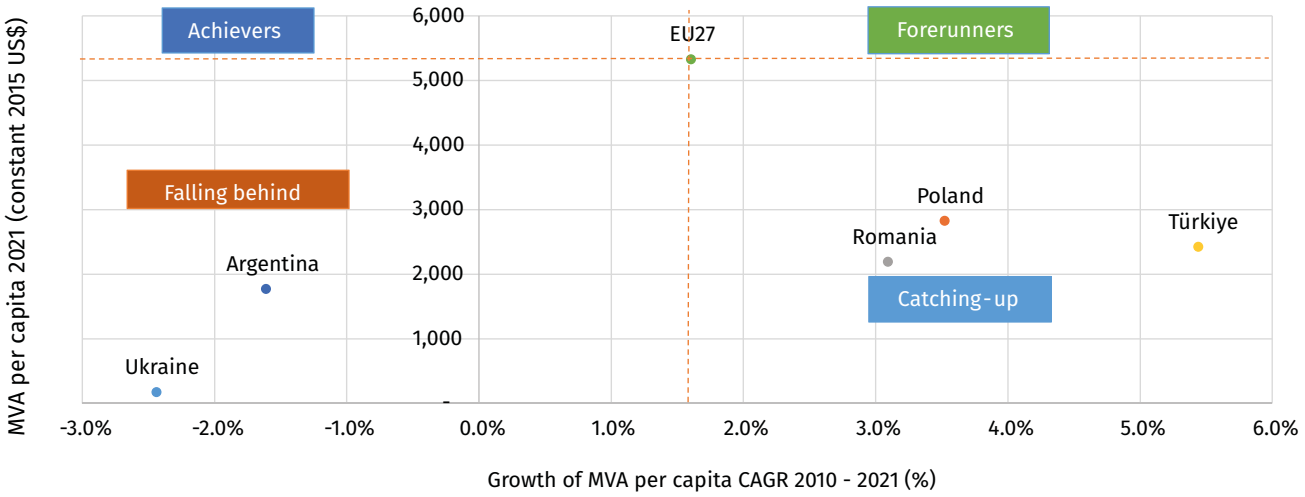
In many of these regions, the loss in production capacity will be persistent or even permanent. Recovering and increasing the capacity of the country's industrial base to add value during the production process will be one of the significant economic challenges for post-war Ukraine. It will also be required to withstand competition in the single market of the EU – should Ukraine join, as it desires – and to catch up with its peer countries.

Figure 1.11 plots the level (on the vertical axis) and growth (on the horizontal axis) of per-capita MVA. Taking the EU average as a point of reference allows us to categorize countries into "forerunners", "achievers", "catching-up", and "falling-behind" countries. **Figure 1.11** shows that even before the war, Ukraine, together with Argentina, was among the countries falling behind the EU benchmark, given that the level and the growth of both countries' industrial capacities were significantly below the regional average.

If **Figure 1.11** extended to 2022, the picture for Ukraine would look even bleaker. For Ukrainian policymakers, the analytical framework underlying **Figure 1.11** could help establish realistic performance targets for its manufacturing sector once the country exits the war. In doing so, they could look at other countries for inspiration, including Türkiye, Poland and Romania, which have managed to catch up with the EU over the past decade.

FIGURE 1.11: INDUSTRIAL CAPACITY GROWTH, UKRAINE AND COMPARATORS, 2010-2021

Source: World Bank, *World Development Indicators* database (accessed September 2023).



Note: CAGR = compound annual growth rate; MVA = manufacturing value added.

Forerunners demonstrate an industrial capacity that exceeds the EU average and a growth rate above the average, indicating they are further increasing their industrial leadership among comparator countries. Achievers show an above-average level of industrial capacity but a growth rate below the average, suggesting that they have achieved a good level of industrial capacity but need to establish strategies to maintain their performance. Catching-up countries perform lower than the EU average, but their growth rate exceeds the average. Those with below-average industrial capacity and slow or negative growth are falling-behind countries, deepening the widening gap with more prosperous countries.

MANUFACTURING LABOUR PRODUCTIVITY

Manufacturing labour productivity determines how efficiently inputs into the production process can be transformed into outputs. Higher labour productivity can be translated into lower unit costs, enhancing a sector's competitiveness. In addition, labour productivity also helps to capture, or at least proxy, the technological and skill levels deployed in the manufacturing process. For all these reasons, labour productivity growth is a crucial driver for industrial growth and its sustainability.

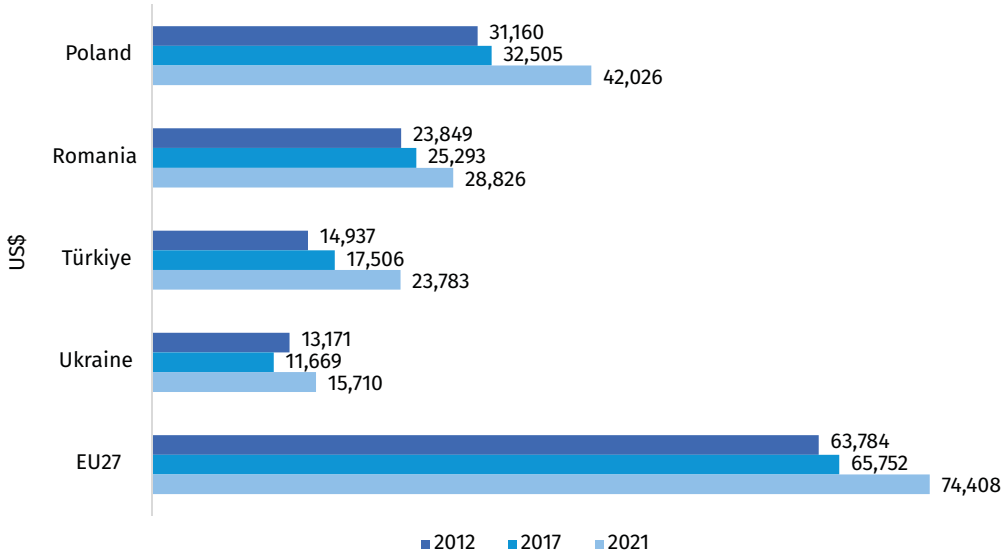
Figure 1.12 shows that Ukraine and Romania exhibit the lowest manufacturing labour productivity, (measured as the MVA generated per manufacturing em-

ployee). In 2021, it stood at US$ 15,710 of MVA per employee after an annual average increase of 2.0 percent since 2012. However, behind this increase is a stronger *decrease* in manufacturing employment (CAGR of -3.8 percent) than in the level of MVA (CAGR of -1.9 percent). Moreover, this productivity growth has not served to close the gap with peer countries such as Poland, Romania and Türkiye, let alone with the EU average (US$ 74,408 in 2021).

To narrow the productivity differential vis-à-vis peers and EU countries visible in **Figure 1.12**, Ukrainian manufacturing firms must become more efficient by improving their workers' technical skills and investing in modern technology and machinery. Without reducing both the capital gap and the gap to the technology frontier, Ukrainian manufacturing firms will struggle to be competitive in national, regional (for example, European) and global markets (World Bank, 2019).

FIGURE 1.12: MANUFACTURING LABOUR PRODUCTIVITY, UKRAINE AND COMPARATORS, 2012, 2017 AND 2021

Source: UNIDO, *INDSTAT* database (accessed September 2023).



Note: Data on manufacturing value added and employment through INDSTAT is only available until 2021.

SUBSECTOR VALUE ADDED AND GROWTH

The composition of the manufacturing sector and the relative importance of individual subsectors are critical determinants of the dynamism and dynamics within a country's industry. Understanding them is crucial for policymakers planning to design subsector-specific policy initiatives. **Table 1.1** shows that Ukraine's most important manufacturing subsectors in 2021 were food and beverages, basic metals, machinery and equipment, chemicals and chemical products, and non-metallic mineral products. Together, these five subsectors accounted for more than two-thirds of total MVA. This high concentration of industrial activity in just five subsectors makes industrial progress strongly dependent on these industries. It implies a considerable vulnerability of Ukraine's economy to internal and external shocks. Of these five subsectors, three are resource-based while only chemicals and machinery & equipment are medium- and high-technology (MHT) industries that offer more potential to create positive externalities associated with technology absorption, skills development and innovation.[5]

TABLE 1.1: UKRAINE´S MANUFACTURING SUBSECTOR VALUE ADDED, 2021

Source: UNIDO, *INDSTAT* database (accessed September 2023).

ISIC CODE AND DESCRIPTION	VALUE ADDED 2021 (CURRENT USD)	SHARE IN MANUFACTURING VALUED ADDED 2021 (%)	CAGR 2012-2021 (%)
D Total manufacturing	21,559,184,673	100.0%	-1.9%
15 Food and beverages	5,855,286,804	27.2%	-2.6%
27 Basic metals	2,741,223,082	12.7%	-0.8%
29 Machinery and equipment n.e.c.	2,119,128,962	9.8%	-2.5%
24 Chemicals and chemical products	1,842,482,992	8.5%	2.1%
26 Non-metallic mineral products	1,833,294,296	8.5%	2.8%
28 Fabricated metal products	1,056,247,911	4.9%	-0.4%
35 Other transport equipment	726,823,458	3.4%	-13.1%
25 Rubber and plastics products	699,422,894	3.2%	-1.3%
34 Motor vehicles, trailers, semi-trailers	593,014,077	2.8%	5.0%
20 Wood products (excluding furniture)	558,556,465	2.6%	4.7%
23 Coke, refined petroleum products, nuclear fuel	531,386,023	2.5%	-0.1%
31 Electrical machinery and apparatus	485,050,932	2.2%	-8.5%
36 Furniture; manufacturing n.e.c.	479,269,643	2.2%	1.0%
21 Paper and paper products	477,650,721	2.2%	-2.7%
16 Tobacco products	390,083,575	1.8%	-3.1%
30 Office, accounting and computing machinery	345,262,439	1.6%	-4.0%
18 Wearing apparel, fur	295,976,145	1.4%	1.2%
22 Printing and publishing	207,133,240	1.0%	-2.7%
17 Textiles	180,112,175	0.8%	3.8%
19 Leather, its products and footwear	141,778,839	0.7%	-0.2%

Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified.

In addition, among these primary industries, only chemicals and chemical products and non-metallic mineral products exhibited a positive CAGR (2.1 percent and 2.8 percent, respectively) between 2012-2021. By contrast, value addition in the food and beverages subsector, which contributed more than one-quarter of total MVA in 2021, contracted during that period (CAGR -2.6 percent).

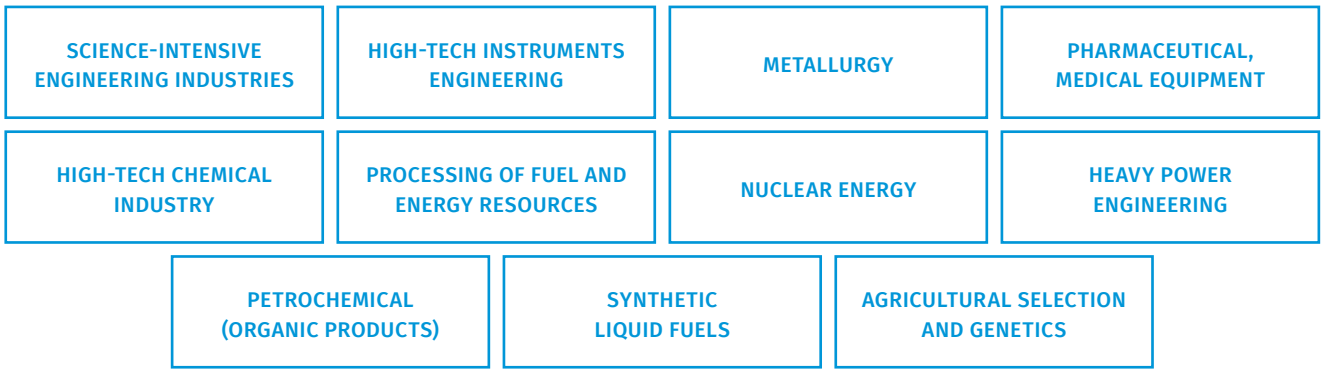
Notable growth subsectors included motor vehicles, trailers, semi-trailers and wood products (excluding furniture), with CAGRs of 5.0 percent and 4.7 percent, respectively. Perhaps relatedly, great hopes have been pinned on the automotive industry. Despite the challenges faced by Ukraine during this period, openness to the outside world, adoption of new technologies and an innovative entrepreneurial spirit are changing the future of this industry, which is firmly integrated with the German automotive industry. It is primarily Western Ukraine that is involved in the production of automotive parts for global manufacturers (World Bank, 2019).

Future policy efforts to promote industrial development should aim to improve the existing MHT sectors while diversifying towards new MHT industries, considering the positive externalities they can generate. At the same time, resource-based subsectors such as food and beverages, where the country has comparative advantages and which are vital for food security, employment generation and value-added creation, should not be neglected. The food sector can increase sophistication and product differentiation through innovation and industry 4.0 technologies. **Box 1.1** highlights several MHT subsectors that national experts and stakeholders consider a priority for Ukraine's industrial development.

BOX 1.1. MANUFACTURING SUBSECTORS CONSIDERED PRIORITIES FOR INDUSTRIAL DEVELOPMENT

Source: UNIDO consultations with Ukrainian stakeholders.

According to consultations conducted by UNIDO with Ukrainian stakeholders, the manufacturing subsectors considered top priorities for industrial development and support of the recovery process in Ukraine are in the following MHT industries.



While MVA data by subsector is unavailable for 2022, it is possible to use the manufacturing subsector level IPI results for 2021 and 2022 to evaluate the impact of the war. **Table 1.2** shows that the production level dropped by at least 20 percent across all subsectors in 2022. However, the war did not affect production in all subsectors equally. Among the most severely impacted subsectors, with drops in the IPI of 60 percent or more, were the industries producing coke and refined petroleum products, basic metals, other non-metallic mineral products, chemicals and chemical products, as well as machinery and equipment. By comparison, light manufacturing, including the food, beverages and wearing apparel subsectors, showed more resilience.

TABLE 1.2: UKRAINE´S INDUSTRIAL PRODUCTION INDEX (IPI) PERFORMANCE FOR MANUFACTURING SUBSECTORS, 2021-2022

Source: The State Statistics Service of Ukraine (accessed September 2023).

ECONOMIC ACTIVITY	IPI SCORE (% TO THE PREVIOUS YEAR)	
	2021	2022
Manufacturing	102.4	59.0
Manufacture of coke and refined petroleum products	105.4	33.4
Manufacture of basic metals	106.2	33.5
Manufacture of other non-metallic mineral products	113.4	35.2
Manufacture of chemicals and chemical products	99.9	38.2
Manufacture of machinery and equipment n.e.c.	103.1	40.6
Manufacture of tobacco products	88.8	42.0
Printing and reproduction of recorded media	98.4	54.9
Repair and installation of machinery and equipment	107.8	55.6
Manufacture of furniture	116.6	58.3
Manufacture of rubber and plastic products	103.8	58.9
Manufacture of computer, electronic and optical products	110.0	58.9
Manufacture of fabricated metal products, except machinery and equipment	104.1	59.0
Manufacture of paper and paper products	103.3	62.5
Manufacture of other transport equipment	103.3	65.4
Manufacture of electrical equipment	119.3	65.8
Manufacture of textiles	113.8	69.1
Manufacture of basic pharmaceutical products and pharmaceutical preparations	97.4	70.2
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	114.7	71.0
Manufacture of leather and related products	109.9	71.1
Other manufacturing	93.8	71.5
Manufacture of motor vehicles, trailers and semi-trailers	123.2	72.7
Manufacture of beverages	100.4	76.2
Manufacture of food products	94.1	79.0
Manufacture of wearing apparel	90.4	80.1

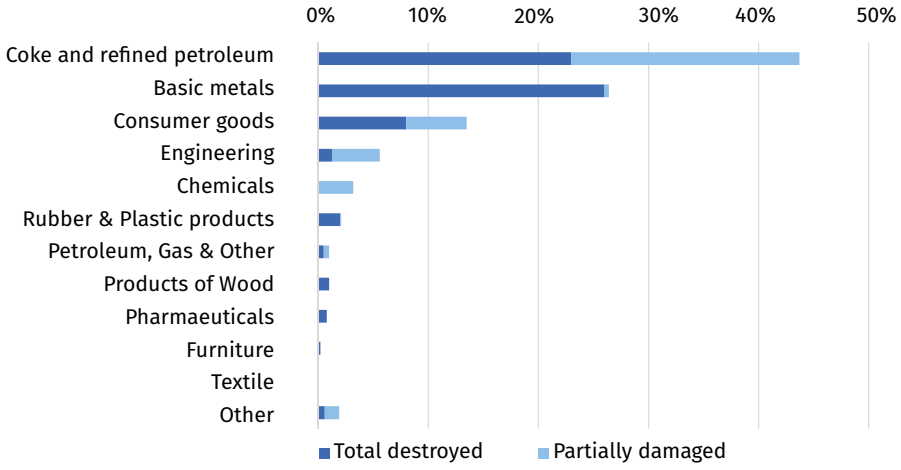
Note: n.e.c. = not elsewhere classified.

This assessment was corroborated in UNIDO consultations with Ukrainian stakeholders who mentioned that the industrial sectors most affected by the war and associated slumps in demand were: (1) ferrous metallurgy, with steel production dropping dramatically from 20 million tons in 2021 to just 4.5-5 million tons in 2022; (2) oil industry, due to the destruction of large enterprises, for example in Kremenchuk, Poltava region; (3) building materials industry, where capacity utilization rates collapsing to only 20-25 percent in 2022; (4) energy industry, with at least 271 verified military strikes on energy enterprises, causing damage to half of the industry; and (5) the mining and iron ore industries, where the destruction of mining and processing plants and a three-fold-fourfold increase in transport costs due to more complicated logistics made the volume of production plummet by 70 percent (Ukrainian Stakeholders, 2023) (Grygorenko & Schnitzer, 2022).

In addition, estimates based on an assessment methodology developed by the World Bank show that most of the damage is related to the destruction of the physical assets of enterprises rather than their partial damage (**Figure 1.13**). According to these estimates, by September 2022, the coke, refined petroleum and basic metals industries were the most affected, with 44 percent and 27 percent, respectively, of their assets damaged or destroyed (Moroz & Bondarenko, 2022).

FIGURE 1.13: DAMAGED STRUCTURES, BY INDUSTRY, AS A SHARE OF TOTAL INDUSTRY ASSETS IN UKRAINE, BY SEPTEMBER 2022

Source: Reproduced based on (Moroz & Bondarenko, 2022).



Later estimates using the same methodology put the total direct losses of industrial companies' assets at US$ 11.3 billion by February 2023. The authors of one study suspect the actual figure to be higher, as not all businesses can report damages, especially those in territories that are or have been under the temporary military control of the Russian Federation (KSE (Kyiv School of Economics) et al., 2023). They also identify those industrial companies that have suffered the largest asset losses. **Table 1.3** lists the top 15 companies. Many belong to the metallurgy, coke and oil refining industries, confirming the quantitative and qualitative evidence provided above that these have been the most heavily affected subsectors. The mass destruction of industrial assets and infrastructure will require massive flows of investment (foreign and domestic), not only to recover but also to reverse the deindustrialization trends described earlier and to build back better – a mammoth task in a country where the fixed capital investment rate was below what was already needed for high and sustainable economic growth prior to the war (Klimkin & Mikloš, 2022).

TABLE 1.3: TOP 15 INDUSTRIAL COMPANIES WITH THE LARGEST ASSET LOSSES DUE TO THE WAR, AS OF FEBRUARY 2023

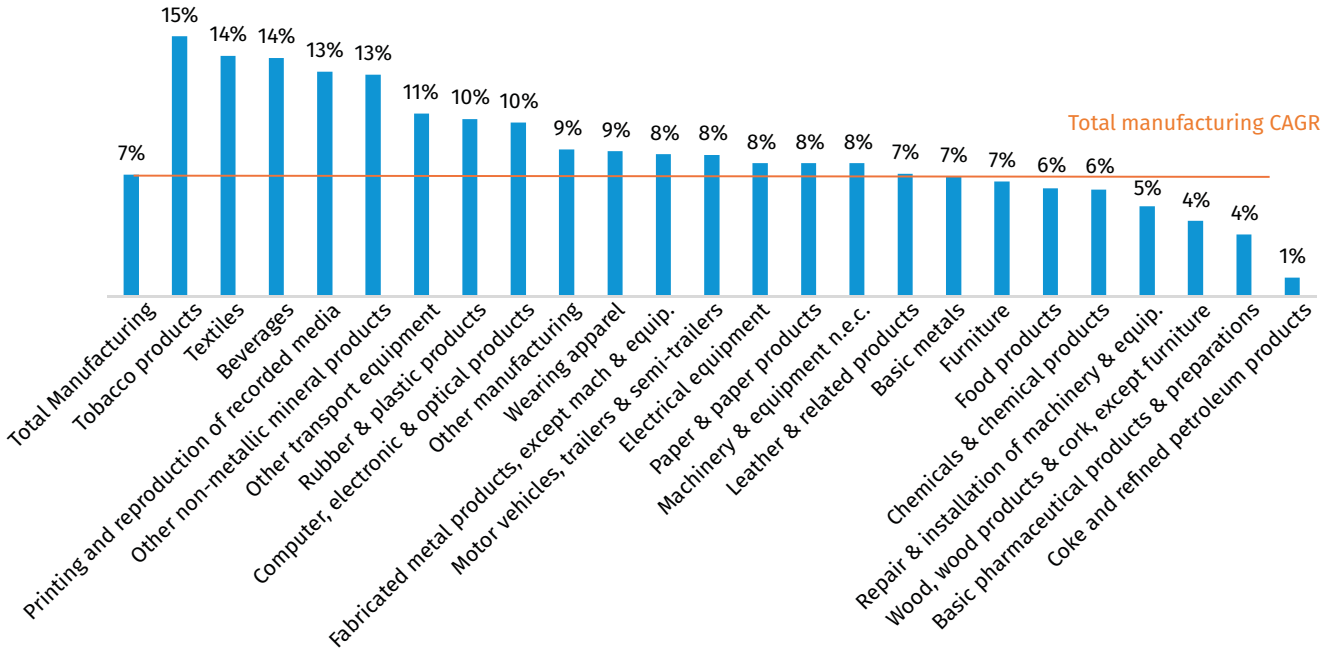
Source: KSE et al., 2023.

RANK	COMPANY NAME	SUBSECTOR	STATUS	Estimated damages (million US$)
1	Illich Iron and Steel Works	Metallurgy	Destructed	2,385
2	Azovstal	Metallurgy	Destructed	1,777
3	Motor Sich	Mechanical engineering	Damaged	450
4	Ukrtatnafta	Oil refining	Destructed	405
5	Zorya-Mashproekt	Mechanical engineering	Destructed	264
6	Ukrainian Energy Machines	Mechanical engineering	Damaged	181
7	Avdiivka Coke Plant	Coke and Chemicals	Damaged	166
8	Philip Morris Ukraine	Production of cigarettes	Destructed	154
9	Antonov	Aircraft construction	Damaged	151
10	Lysychansk Oil Investments Company	Oil refining	Destructed	126
11	Organic systems	Food industry	Destructed	121
12	Novokramatorskyi Machine-Building Plant	Mechanical engineering	Damaged	113
13	Rubizhne Cardboard and Packaging Plant	Paper production	Not available	98
14	Mykolaiv Alumina Plant	Metallurgy	Damaged	97
15	Dneprospetsstal	Metallurgy	Damaged	87

Yet, the most recent data offers a silver lining against the above gloomy picture. In March 2023, Ukraine's manufacturing output was already 7.2 percent higher than in the same month a year before. Looking at year-on-year growth rates for March 2022–March 2023 reveals that all manufacturing subsectors show signs of recovery (**Figure 1.14**). Some of the most dynamic subsectors were tobacco, beverages and textiles; other non-metallic mineral products; rubber and plastic products; other transport equipment; computer, electronic and optical products; wearing apparel; and motor vehicles. On the other hand, the production of coke and refined petroleum, basic pharmaceutical, wood, and food products has also bounced back, but to a lesser extent. These subsectors will require special attention for revitalization, considering their importance and potential for Ukraine's economic development.

FIGURE 1.14: GROWTH IN MANUFACTURING OUTPUT, MARCH 2022-MARCH 2023

Source: The State Statistics Service of Ukraine (accessed September 2023).



Note: The horizontal line represents total manufacturing compound annual growth rate (CAGR).

1.2.3 MANUFACTURED GOODS TRADE PERFORMANCE

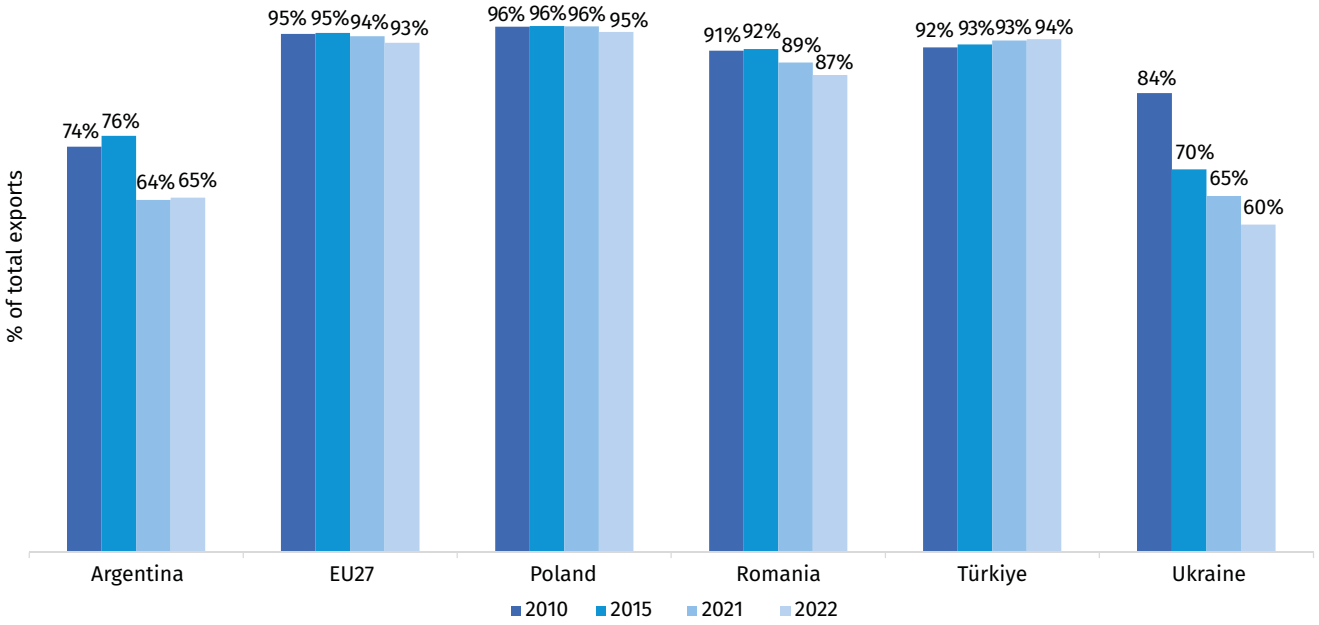
CONTRIBUTION OF MANUFACTURED EXPORTS TO TOTAL MERCHANDISE EXPORTS

The share of manufactured goods in total merchandise exports helps establish whether a country exports predominantly primary products or processed goods. This is important as manufactures are typically tradable and, compared to commodities, less exposed to price fluctuations, climate conditions and unfair competition policies, while having higher income elasticities of demand (Hausmann, Hwang, & Rodrik, 2007), (UNIDO, 2013).

Figure 1.15 demonstrates that for the EU 27 and the European comparators used in this analysis, this share was consistently above 87 percent for 2010-2022. In the case of Ukraine and Argentina, however, the share of manufactured exports in total exports was lower and showed a declining trend during this period. It is not a coincidence that these two countries, which rely more relatively on exports of primary products, have a less stable performance.

FIGURE 1.15: SHARE OF MANUFACTURED EXPORTS, UKRAINE AND COMPARATORS, 2010, 2015, 2021 AND 2022

Source: *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



In the case of Ukraine, manufacturers' contribution to total merchandise exports decreased from 84 percent in 2010 to 65 percent in 2021, before dropping further to 60 percent in 2022 (**Figure 1.15**). While the conflict in Eastern Ukraine (which implied a loss of production assets and mineral deposits) and the COVID-19 pandemic have played a role, to some extent this trend also reflects a loss of international competitiveness in key export sectors such as metallurgy – due to a failure to upgrade outdated technologies, e.g. through FDI, and elevated prices for inputs – and heightened international trade protection measures such as anti-dumping and other safeguards (Movchan & Rogoff, 2022). Moreover, this trend can partly be explained by the surge in exports and competitiveness in agricultural products, where Ukraine is a world leader in producing many crops and items (FAO, 2022) (Grygorenko & Schnitzer, 2022). Increasing value addition in priority sectors (including agribusiness, metallurgy and machinery) will be one of the transformation engines for Ukraine's recovery (National Recovery Council, 2022).

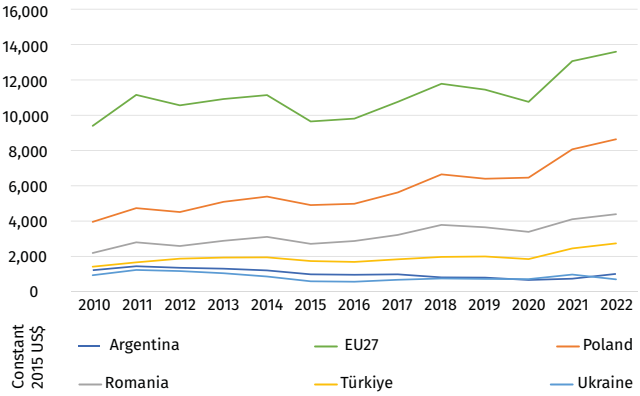
MANUFACTURED EXPORT CAPACITY AND GROWTH

The capacity to export, especially of manufactured goods, is a crucial element for economic growth (Frankel & Romer, 1999; Lederman & Maloney, 2012). Manufactured exports per capita captures "the ability of a country to produce goods competitively and to implicitly keep up with technological changes" (UNIDO, 2013). It is thus a basic indicator of trade competitiveness that helps to analyse the capacity of a country to meet global demand for manufactured goods in a highly competitive and changing international environment (UNIDO, 2013).

Ukraine, together with Argentina (the other country in this analysis with a strong agribusiness sector), exhibited a limited and stagnant manufacturing export capacity between 2010-2021, far below both the EU 27 (US$ 13,065 in 2021) and Poland (US$ 8,067 in 2021). In fact, between 2010-2021, Ukraine's manufactured exports per capita grew by a meagre yearly average of 0.4 percent, rising just slightly, from US$ 932 to US$ 973; while in 2022, they dropped by more than one-quarter (-28.3 percent) as a result of the war (**Figure 1.16**).

FIGURE 1.16: MANUFACTURING EXPORTS PER CAPITA, UKRAINE AND COMPARATORS, 2010-2022

Source: UNIDO elaboration, based on UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solution* (manufacturing exports) and World Bank, *World Development Indicator* (population) databases (accessed September 2023).



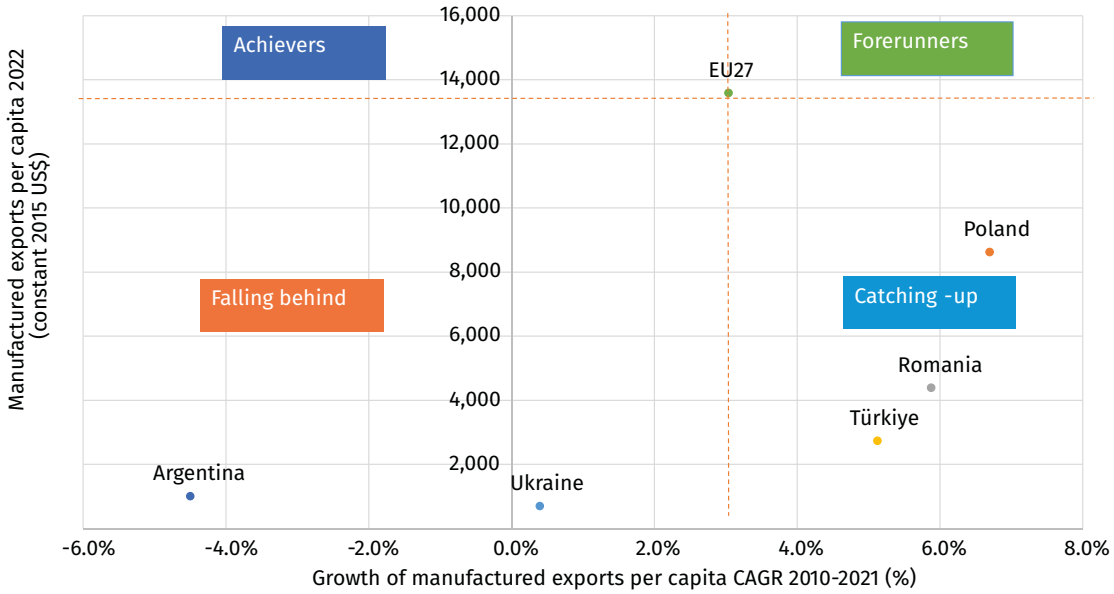
It is worth highlighting that the export capacity gap between Ukraine and Türkiye was insignificant in 2010. However, in subsequent years, the two countries embarked on diverging trajectories so that by 2021, Türkiye's manufactured export capacity, after growing an average of 5.1 percent a year, was 2.5 times larger than Ukraine's. Türkiye's good performance is related to the country's vigorous efforts to promote both light and advanced manufacturing, and to become an important manufacturing and distribution hub, capitalizing on its advantageous geographic position as a bridge between Europe and Asia to benefit from the re-configuration of global value chains (World Bank, 2022). These efforts are reflected in its 2023 Industry and Technology Strategy (International Trade Administration, 2022).

The initiatives promoted by Türkiye through this strategy could serve as helpful reference for Ukrainian policymakers as some of the targeted sectors are similar to Ukraine's priority sectors (as mentioned in the previous subsection). Among other objectives, Türkiye's strategy emphasizes "the use of industry 4.0 technologies" as a crucial vector of development.

Applying the same analytical framework as **Figure 1.11**, **Figure 1.17** plots the level (on the vertical axis) and growth (on the horizontal axis) of each country's manufactured exports per capita. Taking the EU average as a benchmark enables classifying countries into forerunners, achievers, catching-up and falling-behind countries. While this is not always and not necessarily the case for the group of countries included in this analysis, the results of **Figure 1.11** and **Figure 1.17** are similar.

FIGURE 1.17: MANUFACTURING EXPORT CAPACITY AND ITS GROWTH, UKRAINE AND COMPARATORS, 2010-2021

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



Note: CAGR = compound annual growth rate.

Forerunners demonstrate a manufactured export capacity that exceeds the EU average and a growth rate above the average, indicating that they are further increasing their leadership. Achievers show an above-average level of manufactured export capacity but a growth rate below the average, suggesting that these countries have achieved a good level of manufactured export capacity but must establish strategies to maintain an upward trajectory. Catching-up countries perform lower than the EU average, but their growth rate exceeds that of the EU. Countries falling behind have limited manufactured export capacity and show a slow or negative growth trend, leading to a widening gap compared to more successful countries.

Whereas Poland, Romania and Türkiye are on a trajectory of catching-up, Ukraine and Argentina are, again, to be found in the bottom-left quadrant, meaning that Ukraine's manufactured export capacity was falling behind the EU benchmark even before the war, despite a positive CAGR (**Figure 1.17**).

If the analysis were extended to the war period, Ukraine would fall even further behind, as the CAGR between 2010-2022 was negative (-2.4 percent). Solid and coordinated efforts from public and private sectors are required for Ukraine to increase its capacity to export manufactures faster. The prospect of EU integration and easier access to the EU and G7 markets is expected to facilitate this. However, several challenges will need to be addressed; in particular, adaptation to and compliance with standards and regulations on product quality, access to trade finance, modernization of infrastructure, upgrading of firms' technical and technological base, expansion of ties in terms of industrial and economic exchange, and creation of joint transnational industrial companies that manufacture products with high added value (Ukrainian Stakeholders, 2023; Grygorenko & Schnitzer, 2022).

COMPOSITION OF THE MANUFACTURED EXPORTS BASKET

Table 1.4 shows that Ukraine´s main manufactured exports in 2021 were basic metals, food & beverages, chemicals & chemical products, electrical machinery, machinery & equipment, and wood products. The first two subsectors alone accounted for 61.6 percent of total manufactured export revenues.

Among these six key subsectors, wood products and food & beverages have seen the most dynamic export growth over the past decade, registering CAGRs of 11.0 percent and 6.4 percent, respectively, between 2010-2021. Exports of textiles (CAGR 6.3 percent) and furniture manufactures (CAGR 8.7 percent) also rose fast during that period, suggesting that the wood value chain, in general, may have good prospects if adequate measures to support the sector are established. However, in most other subsectors, exports have declined since 2010, with the manufacturing of transport equipment (CAGR -11.3 percent) a particularly dramatic case.

TABLE 1.4: UKRAINE´S MANUFACTURED EXPORT BASKET COMPOSITION, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).

PRODUCT CODE	PRODUCTS DESCRIPTION	2021 (US$)	2022 (US$)	SHARE IN MANUFACTURE EXPORTS, 2021	SHARE IN MANUFACTURE EXPORTS, 2022	CAGR 2010-2021	CAGR 2021-2022
15	Food products and beverages	11,520,484,391	9,974,476,165	27.0%	37.6%	6.4%	-13.4%
27	Basic metals	14,762,843,217	5,578,259,378	34.6%	21.0%	-1.2%	-62.2%
31	Electrical Machinery	2,277,269,564	1,836,759,752	5.3%	6.9%	1.9%	-19.3%
20	Wood products	1,754,687,330	1,631,439,083	4.1%	6.1%	11.0%	-7.0%
29	Machinery and equipment	2,226,352,306	1,481,528,147	5.2%	5.6%	-1.7%	-33.5%
24	Chemicals and chemical products	2,700,776,462	1,305,701,625	6.3%	4.9%	-1.9%	-51.7%
36	Manufacturing of furniture and manufacturing n.e.c.	1,052,731,527	833,322,850	2.5%	3.1%	8.7%	-20.8%
28	Fabricated metal products	805,989,395	598,045,161	1.9%	2.3%	1.0%	-25.8%
26	Other non-metallic mineral products	670,781,862	400,305,737	1.6%	1.5%	2.9%	-40.3%
35	Transport equipment	851,920,393	394,173,114	2.0%	1.5%	-11.3%	-53.7%
18	Wearing apparel; dressing and dyeing of	444,914,049	385,860,096	1.0%	1.5%	-1.3%	-13.3%
25	Rubber and Plastics	625,569,407	363,440,724	1.5%	1.4%	1.8%	-41.9%
17	Textiles	466,882,632	329,171,095	1.1%	1.2%	6.3%	-29.5%
21	Paper and paper products	532,184,444	310,188,581	1.2%	1.2%	-3.8%	-41.7%
32	Radio, television, & communication equip	339,122,312	277,330,939	0.8%	1.0%	-3.5%	-18.2%

Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified. Each product group represents at least 1% of the export structure in 2022.

The onset of the war did not alter the composition of the manufacturing export basket significantly. Still, the relevance of food and beverage exports was considerably higher than before, replacing basic metals (which suffered over-proportionally from destruction by military action) (**Figure 1.13**) as the top manufactured export subsector. Together, food & beverages and basic metals accounted for 58.6 percent of Ukraine's manufactured exports in 2022, a slightly lower percentage than in 2021.

Table 1.4 also clearly illustrates the impact of the war. In 2022, export values decreased in all manufacturing subsectors. Among the most severely impacted were also some of the most critical export subsectors, including basic metals (where export revenues fell by -62.2 percent), as well as machinery and equipment (-33.5 percent), and chemicals and chemical products (-51.7 percent), which are, notably, medium- and high-technology industries.

COMPOSITION OF MANUFACTURED IMPORTS

During the industrial development process, the composition of manufactured imports is important, as raw materials and other assets and elements needed as inputs into the production process might not be available locally or in sufficient quantities. Moreover, imported goods could be substituted with national production if a country exhibits comparative and/or competitive advantages. **Table 1.5** shows that Ukraine's main manufactured imports in 2021 were chemicals & chemicals products; coke &refined petroleum; machinery & equipment; motor vehicles, trailer & semitrailers; and food & beverages. These five subsectors accounted for 61.7 percent of the country's total manufactured imports, and all except for coke & refined petroleum increased their import value between 2011-2021.

TABLE 1.5: UKRAINE´S MANUFACTURING IMPORTS COMPOSITION, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database, accessed September 2023.

PRODUCT CODE	PRODUCTS DESCRIPTION	2021 (IN 1,000 US$)	2022 (IN 1,000 US$)	SHARE IN MANUFACTURED IMPORTS, 2021	SHARE IN MANUFACTURED IMPORTS, 2022	CAGR 2011-2021	CAGR 2021-2022
23	Coke, refined petroleum	7,565,397	9,883,251	12.4%	20.9%	-0.6%	30.6%
24	Chemicals and chemical products	11,247,093	7,587,869	18.5%	16.0%	1.2%	-32.5%
34	Motor vehicles, trailers and semi-trailers	6,432,668	4,906,577	10.6%	10.4%	2.2%	-23.7%
29	Machinery and equipment	7,577,297	4,136,406	12.4%	8.7%	1.2%	-45.4%
15	Food products and beverages	4,772,321	3,678,727	7.8%	7.8%	1.6%	-22.9%
31	Electrical machinery	2,823,359	2,704,711	4.6%	5.7%	-1.6%	-4.2%
25	Rubber and plastics	3,115,326	2,309,366	5.1%	4.9%	1.5%	-25.9%
27	Basic metals	2,498,029	1,549,918	4.1%	3.3%	-5.9%	-38.0%
32	Radio, television and communication equip	2,096,757	1,377,270	3.4%	2.9%	3.2%	-34.3%
17	Textiles	1,693,461	1,324,141	2.8%	2.8%	2.3%	-21.8%

PRODUCT CODE	PRODUCTS DESCRIPTION	2021 (IN 1,000 US$)	2022 (IN 1,000 US$)	SHARE IN MANUFACTURED IMPORTS, 2021	SHARE IN MANUFACTURED IMPORTS, 2022	CAGR 2011-2021	CAGR 2021-2022
33	Medical, precision and optical instruments	1,558,599	1,210,892	2.6%	2.6%	3.7%	-22.3%
30	Office, accounting, and computing machinery	1,473,309	1,076,884	2.4%	2.3%	11.2%	-26.9%
28	Fabricated metal products	1,699,356	1,047,281	2.8%	2.2%	0.1%	-38.4%
18	Wearing apparel; dressing and dyeing	631,530	961,958	1.0%	2.0%	5.2%	52.3%
21	Paper and paper products	1,148,369	797,921	1.9%	1.7%	-3.2%	-30.5%
26	Other non-metallic mineral products	1,032,853	674,094	1.7%	1.4%	-3.1%	-34.7%
19	Tanning and dressing of leather products	802,001	585,952	1.3%	1.2%	4.5%	-26.9%
36	Manufacturing of furniture and manufacturing n.e.c.	1,051,195	511,168	1.7%	1.1%	2.3%	-51.4%
35	Transport equipment	654,047	463,553	1.1%	1.0%	-3.4%	-29.1%

Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified. Each product group represents at least 1% of the import structure of 2022. Imports values are available from 2011 onwards.

The war did not significantly change the ranking of the leading manufactured imports, but the share of coke & refined petroleum increased significantly. In 2022, this group of products represented 20.9 percent of total manufactured imports after rising in value by 30.6 percent between 2021 and 2022. This is related to the substantial damage this sector suffered from the war and the related high drop in local production levels. Domestic coke production fell by 59 percent in 2022 because of the shutdown of the largest coking plant next to the front line (GMK Center, 2023).[6]

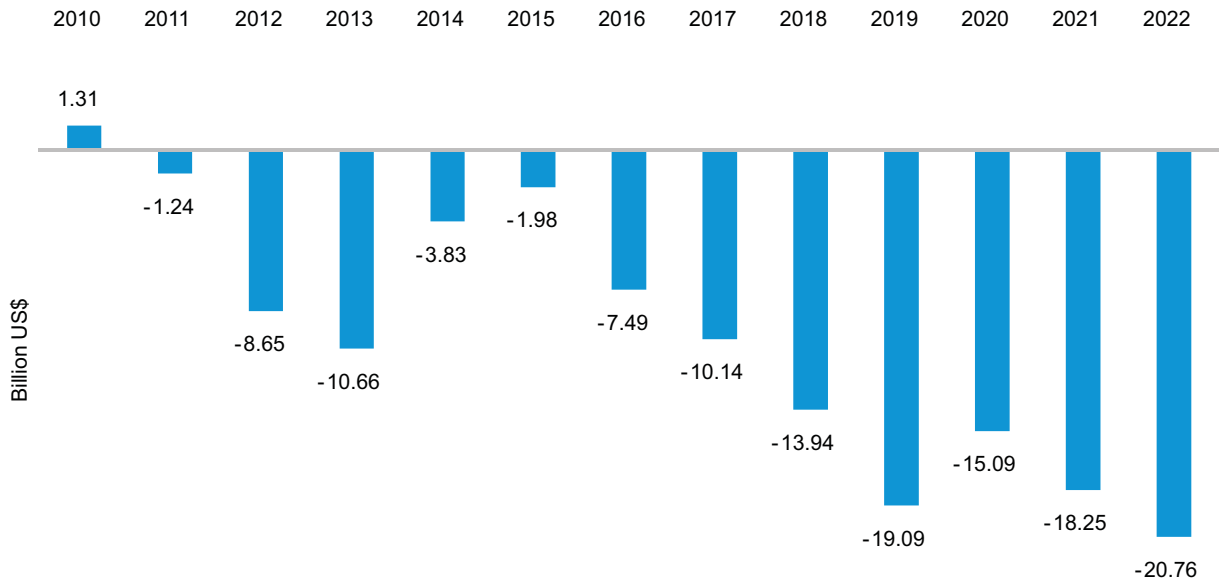
From all subsectors captured in **Table 1.5**, the ones where imports fell the most between 2021-2022 were furniture manufactures (-51.4 percent), machinery and equipment (-45.4 percent), fabricated metal products (-38.4 percent) and basic metals (-38.0 percent). The substantial drop in the last three is likely related to the country's general decline in industrial production.

MANUFACTURED TRADE BALANCE

If we analyse the exports and imports of manufactured goods, we can see that Ukraine's manufactured trade balance has consistently been in the red since 2011 (**Figure 1.18**). Moreover, this negative balance has increased significantly, from around US$ -1 billion in 2011 to US$ -18.3 billion in 2021 (pre-war year) and US$ -20.8 billion in 2022 (war year). In addition, Ukraine´s accumulated manufactured trade deficit over these 12 years exceeds US$ -130 billion, representing a non-negligible outflow of foreign exchange. While this means a challenge for an economy that needs to generate more income through exports to promote growth, it can also be an opportunity to identify import products that could be substituted by competitive domestic production.

FIGURE 1.18: UKRAINE´S TRADE BALANCE, 2010-2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



1.2.4 MANUFACTURED EXPORTS DIVERSIFICATION

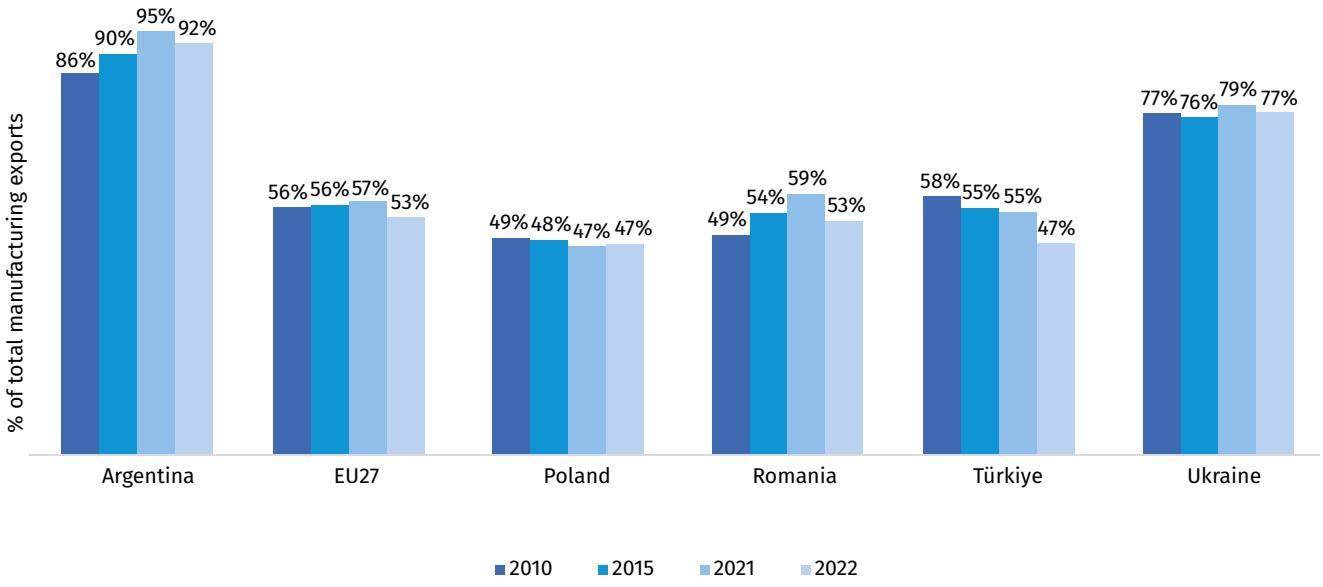
DIVERSIFICATION IN EXPORT PRODUCTS

In many low- and middle-income countries, especially resource-rich ones like Ukraine, the variety of productive activities undertaken is limited and economic activity is concentrated in a few subsectors. As a result, these countries export only a handful of different products and often only to a small number of markets. In this context, diversifying the country's productive and export structure can drive economic growth and development. Indeed, empirical studies have pointed to a positive relationship between industrial diversification and a country's income level, especially at earlier stages of economic development (Cadot, Carrère, & Strauss-Kahn, 2011) (Imbs & Wacziarg, 2003) (Kaulich, 2012).

The previous subsection showed that Ukraine's manufactured export basket is not overly diversified. As **Table 1.4** shows, it is concentrated in a few subsectors. **Figure 1.19** demonstrates that the top five most essential subsectors have accounted for nearly 80 percent of Ukraine's total manufactured exports, with a slight upward trend between 2010-2021. Only in Argentina was this share higher. Such a concentration implies the country's heightened vulnerability against external shocks.

FIGURE 1.19: SHARE OF TOP 5 SUBSECTORS IN TOTAL MANUFACTURED EXPORTS, UKRAINE AND COMPARATORS, 2010, 2015, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



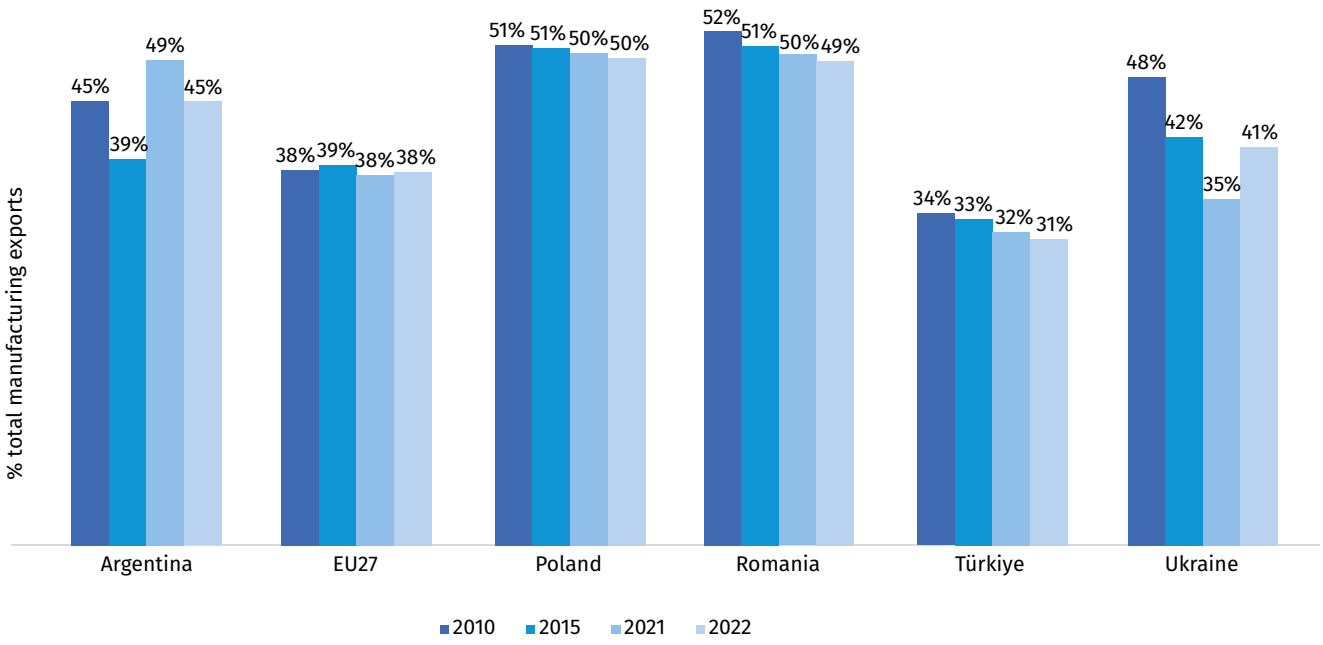
By comparison, in Poland, Romania, Türkiye and the EU, the share of the top five subsectors in total manufactured exports was much lower, below 60 percent in all four years. Poland and Türkiye have, moreover, managed to reduce their share by further diversifying their manufactured exports across subsectors from 2010-2022.

DIVERSIFICATION IN EXPORT MARKETS

If a country can sell its products to a broader set of export markets, it is less vulnerable to adverse shocks from a single trade partner country. **Figure 1.20** reveals that in 2010, Romania, Ukraine and Poland registered the highest level of dependency on fewer export destinations, with around one-half of their total manufactured exports going to just five foreign markets. However, only Ukraine managed to decrease this share significantly by 2021 (to 35 percent).

FIGURE 1.20: SHARE OF TOP 5 MARKETS FOR MANUFACTURING EXPORTS, UKRAINE AND COMPARATORS, 2010, 2015, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



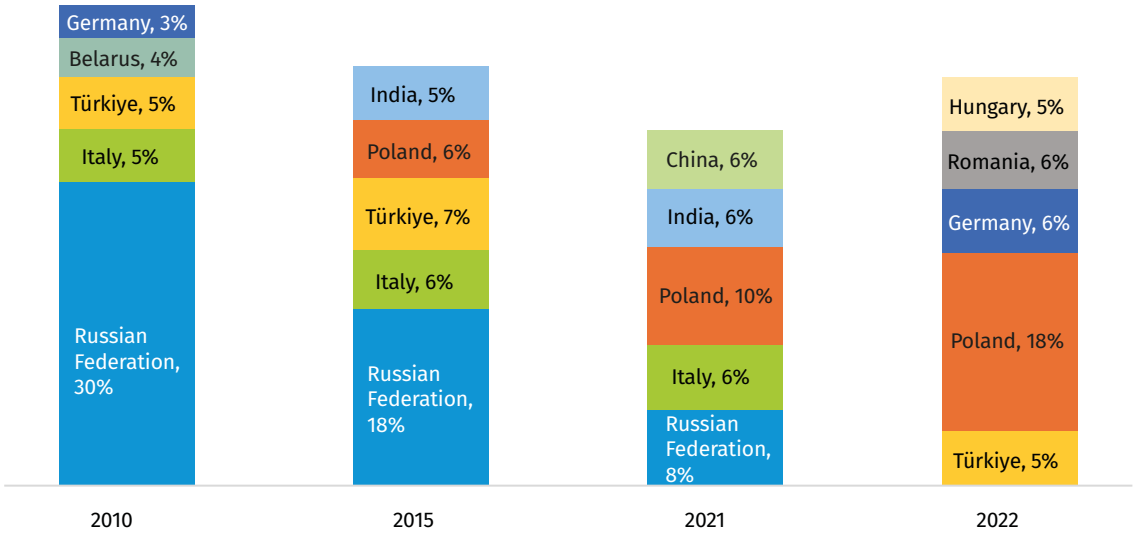
This trend was driven by a continuous decline in the importance of Russia as an export market since 2011, which was further accelerated by the conflict in Eastern Ukraine when military fighting and the confiscation of Ukrainian industrial assets led to a deindustrialization spiral in the region, including a sharp decline in manufactured exports from Luhansk and Donetsk provinces (Mykhnenko, 2020). Already in the run-up to this war, Russia had started to embargo imports from Ukraine in protest against Ukraine's intention to sign an Association Agreement with the EU (Popescu, 2013).

Before that, Ukraine had been heavily dependent on the Russian market, which in 2010 took in almost one-third of Ukraine's manufactured exports. However, by 2021, this share had dropped to 7.6 percent, and Russia lost its status as Ukraine's top export market to Poland. This reorientation of trade flows was propelled not only by the intensifying conflict with Russia but also by the entering into force of the EU-Ukraine Association Agreement in 2016 (Dnabrowski, Domínguez-Jiménez, & Zachmann, 2020). In the meantime, China and India had also emerged as essential buyers of Ukrainian manufactures, while Italy remained Ukraine's top export destination in Western Europe (**Figure 1.21**).

As expected, the war changed the geography of Ukraine's exports. Russia disappeared while China and India dropped from the top ranks. Instead, a large share of Ukraine's manufacturing exports is going to the EU. Poland has become Ukraine's leading trading partner, receiving 17.5 percent of Ukraine's shipments of manufactured goods, followed by Germany, Romania, Türkiye and Hungary, accounting for another roughly 5.5 percent (**Figure 1.21**).

FIGURE 1.21: SHARE (% OF TOTAL) OF UKRAINE'S TOP FIVE MANUFACTURING EXPORT MARKETS, 2010, 2015, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



Ukraine's strategy to achieve EU integration, and thus better access to EU and G7 markets, has the potential to support export diversification. However, the country´s recovery and modernization plan must align with core EU principles related to the rule of law, product quality and safety, the green transition, and digital transformation.

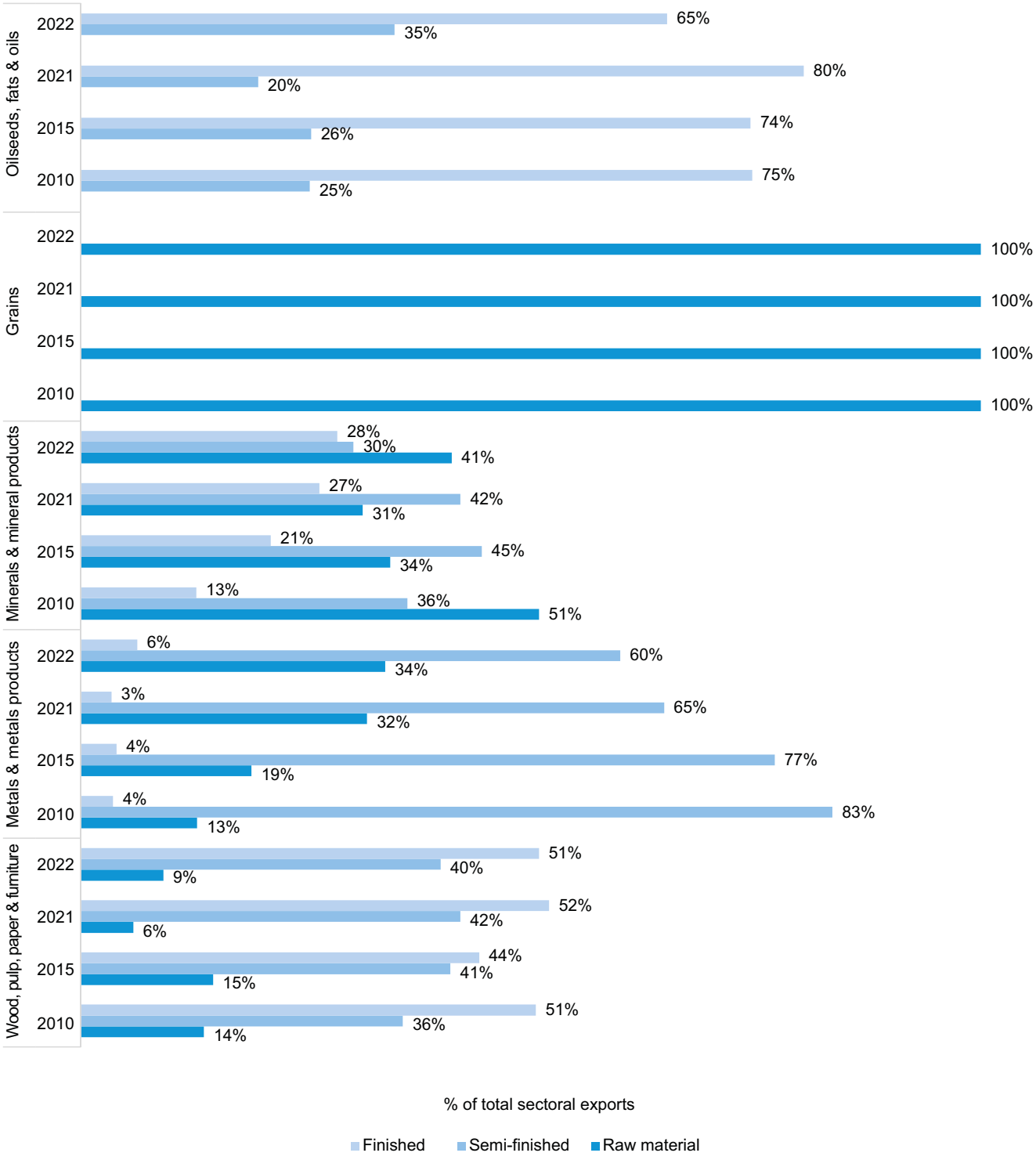
DEGREE OF PROCESSING OF RESOURCE-BASED EXPORTS

A key element of industrial development and structural change is the increasing capacity of a country to generate value added when producing goods and services. Value added can be incorporated by increasing the level of processing of a raw material or a primary product, or by improving quality and introducing product differentiation.

Considering the structural challenges that Ukraine has exhibited in the industrial production sphere during 2010-2021, and the accelerated deindustrialization process that is taking place because of the war, one of the transformation engines identified in the Ukraine Recovery Vision is the increase of value added, especially within priority sectors. Against this backdrop, **Figure 1.22** illustrates the composition of exports in six key subsectors according to their level of processing. The Multilateral Trade Negotiations (MTN) classification[7] is used for this analysis as it allows for the disaggregation of a specific sector into raw, semi-finished and finished products. Some major findings are highlighted in the following section.

FIGURE 1.22: UKRAINE´S SHARE OF RAW, SEMI-PROCESSED AND PROCESSED EXPORTED GOODS, SELECTED SUBSECTORS, 2010, 2015, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).



Wood, wood products and furniture: One of the priority sectors for industrial development, with significant export potential, it is also identified in Ukraine´s National Recovery Plan 2022 as one of the sectors to increase value addition. During 2010-2022, more than 50 percent of sectoral exports were finished products like furniture, around 40 percent were semi-finished products and 10 percent were unprocessed wood. This shows that the sector is vertically integrated and creates value added through processing within the country. Still, it has more opportunities to grow, based on the abundance of raw materials in the country and the development of cluster initiatives. However, high-quality standards and sustainability considerations should not be neglected (Ukrainian Stakeholders, 2023; UNIDO, 2020b).[8]

Metal and metal products: Metallurgy is another priority sector highlighted in Ukraine´s National Recovery Plan 2022. Ferrous metallurgy was the most affected industry by the war, and its decrease caused a dramatic drop in steel production (from 20 million tons in 2021 to just 4.5-5 million tons in 2022). This is critical because ferrous metallurgy is considered a high-tech industry and remains the basis of the production of construction materials (Ukrainian Stakeholders, 2023). From 2010-2022, the bulk of exports within the metal sector were semi-finished products. However, the share of these products decreased during these years (from 83 percent to 60 percent), while the share of raw materials exports increased (from 13 percent to 34 percent). This is thus one of the subsectors where a process of deindustrialization can be observed that already started before the war (2010-2021) and further accelerated during the war period (2021-2022; see **Figure 1.22**). Reversing this trend will be one of the primary challenges for the post-war recovery and should ideally be accompanied by efforts to decarbonize and green the industry (Saha, 2021).[9]

Minerals and mineral products: Ukraine is among the world's leading producers of several minerals and one of the most richly endowed European countries when it comes to rare earth and lithium reserves. While in 2010, raw materials accounted for more than one-half of subsectoral exports, in subsequent years, the composition of the export basket shifted towards mineral products with higher degrees of processing. By 2021, the shares of semi-finished and finished products had increased to 42 percent (up from 36 percent in 2010) and 27 percent (up from 13 percent in 2010), respectively. However, with mining and processing plants destroyed by military fighting, the subsector significantly reduced its exports (by around one-third). Raw materials became the main export item, with their share in subsectoral exports jumping from 31 percent in 2021 to 41 percent in 2022. This is also a priority sector according to the National Recovery Plan 2022.

Grains: Ukraine is well known for its agricultural potential due to the favourable soil and climate conditions for the cultivation of grains such as wheat, corn and barley. It is one of the world's leading exporters of grains (without any level of processing), and the competitiveness of the sector was influenced by several factors like market demand, global grain prices, government support policies, infrastructure, and transportation logistics. However, the war and a blockade of Black Sea ports are preventing 20 million tons of grain from reaching the international market. Through the grain deal agreed between Russia and Ukraine in July 2022, the latter activated its grain exports again, and world prices dropped approximately 20 percent. Still, the deal ended, and since then, Ukraine has been facing difficulties exporting these commodities (BBC, 2023). The decrease in grain exports between 2021-2022 was around 22.6 percent.

Oilseeds, fats and oils: This is one of the most essential agro-industrial sectors for Ukraine´s economy, where the processing industry creates significant value added. Prior to the war, the country was the world's top producer of sunflower meal, oil and seed, and the world's largest exporter of sunflower meal and oil. Other important oilseeds for the country are rapeseed and soybean (USDA, 2022). From 2010-2022, processed products dominated subsectoral exports, accounting for 74 percent of

export revenues on average. While the export value of processed oilseed products decreased by 17.3 percent in 2022, according to the Association for Extraction and Processing of Fat and Oil Products in Ukraine, from September 2022 to August 2023, Ukraine exported 5.6 million tons of sunflower oil, which is 25 percent more than in the previous season, despite the logistic disruption caused by the war. Notwithstanding the war's impact, the sector's potential remains, thanks to favourable agricultural and climate conditions, advanced farming practices and technology that local producers have adapted in previous years, and a growing global demand for edible oils from different industries.

In short, Ukraine has several subsectors that export processed goods, including value added. However, significant opportunities exist to increase value further and unlock the potential to deepen existing value chains within the different subsectors (Grygorenko & Schnitzer, 2022) (Movchan & Rogoff, 2022). Some of the country's critical resources are exported either as raw materials or semi-finished products, leaving it to other countries to benefit from the additional value created in the production of processed or final goods. Currently, as mentioned earlier in this section, strategies have been designed to promote the transformation of agricultural products (agroprocessing), support the recovery process of Ukraine and trigger the industrial development of the country (National Recovery Council, 2022).

1.2.5 INDUSTRIAL INNOVATION, TECHNOLOGY UPGRADING AND DIGITALIZATION

INDUSTRIAL INNOVATION AND TECHNOLOGY UPGRADING

Ukraine's economy depends mainly on a few simple agricultural and manufacturing activities with, in general, low technology intensity and level of sophistication (e.g. grains, mineral and metal products) that generate limited positive (productivity and knowledge) spillover effects in the broader economy. Manufacturing activities categorized as MHT industries play a relatively minor role in the country's productive and export structure (e.g. machinery and equipment, chemical products, motor vehicles and other transport equipment). As seen in **Table 1.1**, MHT industries contributed slightly more than one-quarter to total MVA in 2021, which has implications for the stability of economic growth, potential for positive spillovers and innovation, and skills development.

Analysing the technology intensity of Ukraine's manufactured exports reveals that the contribution of MHT industries to total manufactured exports declined from 30.1 percent in 2010 to 20.8 percent in 2021 – which is even less than their share in MVA, hinting at a lack of international competitiveness. At the end of 2022, although their share slightly increased to 21.1 percent, the export value of MHT products decreased by 36.2 percent compared to 2021.

Figure 1.23 illustrates the composition of Ukraine's MHT manufactured exports and their share in total manufacturing exports in 2021 and 2022. It shows that chemicals and chemical products, machinery and equipment, and electrical machinery are the most critical MHT industries in Ukraine's export basket. While export values decreased across all MHT industries in 2022, the war hit the chemicals industry particularly hard. Since this sector is essential to Ukraine´s economy, several actions will be required to promote its recovery and improvement. The main challenges are the obsolete and worn-out equipment that cannot be restored after stopping its operation and the loss of personnel (Ukrainian Stakeholders, 2023).

FIGURE 1.23: UKRAINE´S SHARE OF MEDIUM- AND HIGH-TECHNOLOGY INDUSTRIES IN TOTAL MANUFACTURING EXPORTS, 2021 AND 2022

Source: UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (accessed September 2023).

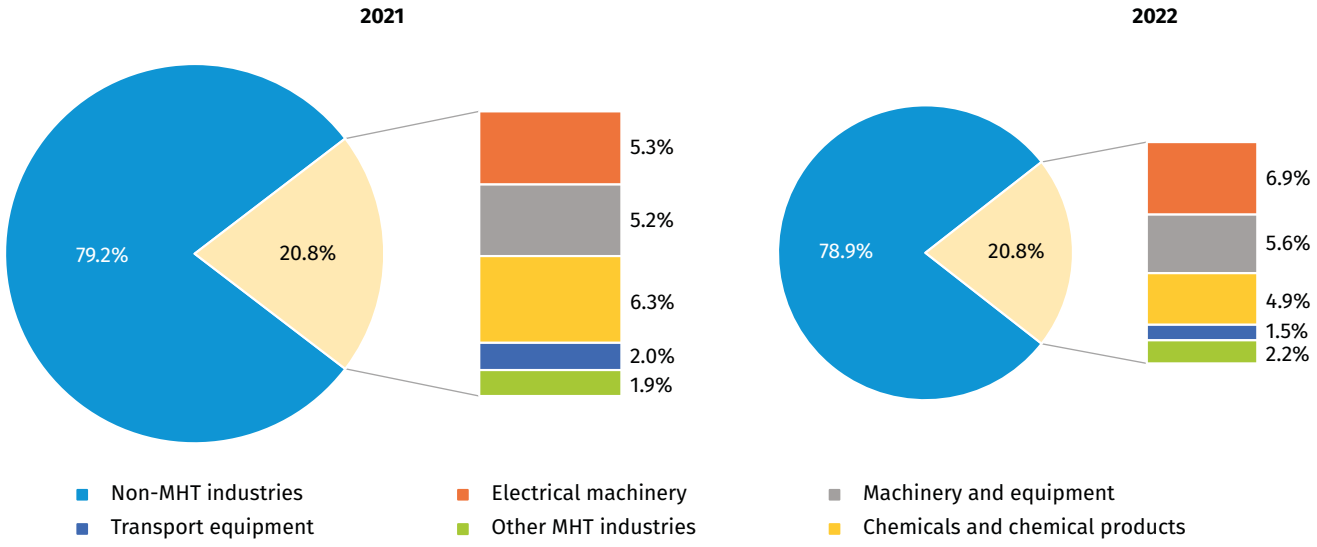
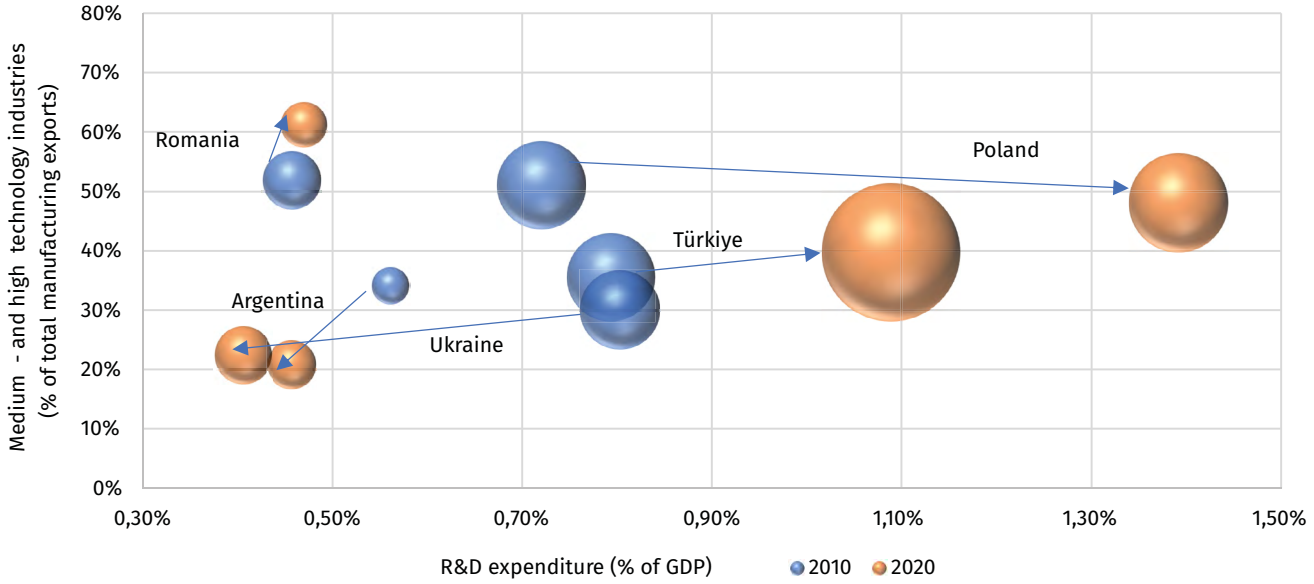


Figure 1.24 combines the analysis of the technology intensity of manufactured exports, an outcome indicator, with two input indicators, the national expenditure on research and development (R&D) as a share of GDP and the number of patent applications by residents, which both serve as proxies to understand innovation efforts in Ukraine and comparator countries. This analysis is critical, considering that innovation is a prerequisite to promote technological upgrading.

FIGURE 1.24: INNOVATION EFFORTS AND MEDIUM- AND HIGH-TECHNOLOGY MANUFACTURING EXPORTS, UKRAINE AND COMPARATORS, 2010-2020

Source: UNIDO elaboration, based on UNCTAD, *UN COMTRADE Database* through World Bank, *World Integrated Trade Solutions* database (manufacturing exports) and World Bank, *World Development Indicators* database (R&D expenditure) (accessed September 2023.



Note: GDP = gross domestic product; R&D = research and development. Bubble size represents the number of patent applications by residents.

The MHT industries' share in total manufactured exports for 2022 was 57 percent in Romania, 49 percent in Poland, 37 percent in Turkey, 26 percent in Argentina, and 21 percent in Ukraine. According to data availability in the international databases, the MHT exports for Ukraine in 2010 correspond to 2011, and R&D for Argentina in 2020 corresponds to 2019.

The fact that the bubbles for Romania and Türkiye are "moving" upwards and to the right in **Figure 1.24** shows that these two countries have increased both the technological component of their manufactured exports and their R&D expenditure between 2010 and 2020. In Türkiye, the number of patent applications by residents has also risen, which is captured by the increase in the size of its bubble, indicating that innovation was one of the drivers of its industrial development and sophistication.

By contrast, all three indicators followed a downward trend for Ukraine between 2010 and 2020. Specifically, R&D expenditure in total GDP dropped from 0.8 percent in 2010 to 0.4 percent in 2020, and the number of patent applications by residents decreased from 2,556 to 1,361 between these two years. This has important policy implications. To promote technological upgrading, one of the government's top priorities for the recovery is for both the public and private sectors to take decisive actions to boost innovation in the country. The

war, however, has hindered this turnaround. Many scientists fled their homes and relocated within Ukraine or abroad. It is estimated that approximately 10 percent of researchers have left the country since the beginning of the war. Others have joined the army or were killed in the fighting (Ganguli & Waldinger, 2023). This has already brought visible effects on scientific outputs: research papers produced by Ukrainian scientists declined by about 10 percent (Ganguli & Waldinger, 2023). Future repercussions of this brain drain might be even more dramatic. **Box 1.2** illustrates innovation efforts and perceptions in the country in the context of the war.

BOX 1.2: INNOVATION BY MANUFACTURING COMPANIES IN THE CONTEXT OF THE WAR

Source: UNIDO consultations with Ukrainian stakeholders.

According to a study by the Institute for Economic Research and Policy Consulting on innovation among manufacturing companies in Ukraine, 18 percent of firms reported not having innovation activity before or during the war.[10] Most often, innovation activities were carried out by firms in the pharmaceutical and chemical industries, as well as in metallurgy, and machine building. The more internationalized a company is, the more likely it is to have an innovation focus.

For 77 percent of respondents, innovation is not relevant at all in the context of the war. Innovation has remained relevant for 23 percent, primarily large exporting companies, including 19 percent that increased spending on innovation during the war. For example, one company reinvested up to 90 percent of its income in R&D. Another company established an R&D centre to create innovative technological solutions and provide the industry with fundamentally new production methods.

For 42 percent of respondents, the reasons for reducing spending on innovation are financial: raw material prices have risen significantly; logistics costs have increased; and, against the backdrop of a significant slump in demand, business struggles to understand market trends. Moreover, public innovation policy is ineffective and absent.

Measures that can stimulate innovation include long-term sectoral development programmes, fiscal incentives, improved communication formats with innovators, the creation of design bureaus and government support for innovation based on a system of incentives for business.

DIGITALIZATION

One megatrend that will increasingly and inevitably shape Ukraine's industrial development is digitalization, both in the form of the growing deployment of industry 4.0 technologies by businesses, both domestic and foreign, and the proliferation of digital government (or e-government or e-governance) approaches and services. While some have recognized that Ukraine's digital economy has been a bright spot before the war, the full-scale invasion of Ukraine has caused severe disruptions to Internet connectivity (OECD, 2022a).

Before the war, Ukraine had made great strides in Internet coverage. Access increased significantly from 2010-2019 in the country and across oblasts. However, the improvement has been uneven across territories, with Kyiv City registering the highest level of access to broadband services in the country (84 percent of households), followed by Dnipropetrovsk and Zakarpattia (79 percent and 76 percent, respectively). In contrast, Rivne showed the lowest level of Internet penetration (only 49 percent of citizens) (OECD, 2022a). This suggests that there is room for improvement regarding secure and reliable connectivity for all, which is a precondition to advance towards a truly digital economy.

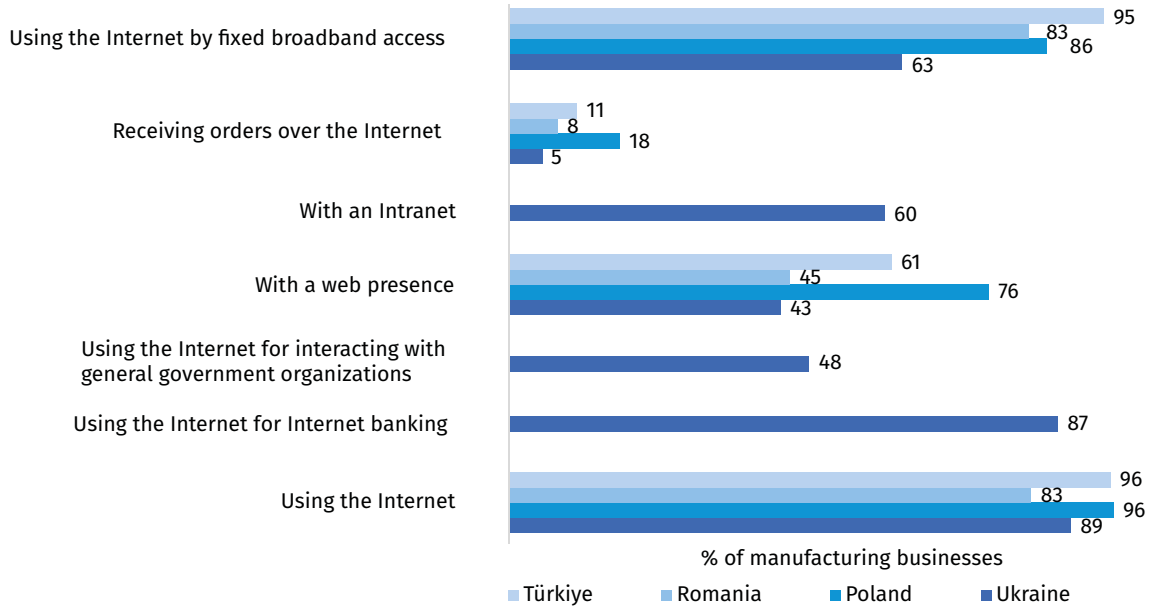
In line with this, **Figure 1.25** shows a mixed performance for Ukraine regarding manufacturing firms' Internet services access and usage. In 2019, around 90 percent of Ukrainian manufacturing enterprises used the Internet in their business activities, higher than in Romania and close to Türkiye and Poland. This percentage was somewhat lower, but at least 60 percent, for other forms of digitalization, like businesses accessing the Internet via fixed broadband, using Internet banking, or even having an intranet. By contrast, few Ukrainian manufacturing businesses, especially when compared to their Polish counterparts, receive orders over the Internet, have a web presence, and use the Internet to interact with government organizations.

Meanwhile, UNIDO's *2020 Industrial Development Report assesses* countries according to their level of engagement with advanced digital production (ADP) technologies applied to manufacturing and categorizes Ukraine as a "latecomer (as producer)."

Looking beyond the application of digital technologies in the manufacturing sector, Cisco's Digital Readiness Index[11] aims to holistically measure a country's digital preparedness and disposition based on seven different criteria: basic needs, business and government investment, ease of doing business, human capital, start-up environment, technology adoption, and technology infrastructure. In 2021, the index ranked Ukraine 79th, after Poland (33rd), Romania (50th), Türkiye (56th), and Argentina (70th). Among the seven components of the index, Ukraine's performance was best in human capital (reflecting the availability of skilled labour to support digital innovation), technology adoption (related to the demand for digital products/services), and technology infrastructure (which enables digital activities and connection to consumers). This suggests that to improve its digital readiness, Ukraine must primarily increase business and government investment in innovation and technology and enhance the business environment for digital products and services (CISCO, 2021).

FIGURE 1.25: MANUFACTURING BUSINESSES' INTERNET SERVICES USAGE, UKRAINE AND COMPARATORS, 2019

Source: UNCTAD, *UNCTADstat* database (accessed September 2023).



This context and the war motivated and accelerated Ukraine's efforts to advance in the digital economy, and the government has made it a top priority to turn Ukraine into a world-leading country that provides digital services for its citizens and businesses. The "Ukraine Plan" to implement the Ukraine Facility[12] establishes digital transformation as one of the core areas for mainstreaming. The focus will be on building secure and efficient digital infrastructure, providing digital skills and developing innovations, supporting the digitalization of businesses, and completing the digitization of public services (Ukraine Government, Sep 2023). The second point is of particular interest, since in UNIDO consultations with Ukrainian stakeholders, owners of large manufacturing companies emphasised the need for upskilling and reskilling strategies, such as ongoing training to upskill their workforce, investing in start-ups to acquire new technologies and talent, and partnering with the academic ecosystem to develop digital skills.

With Ukraine's Ministry of Digital Transformation leading and supporting the process, by December 2022, Ukraine offered more than 70 government services online and provided access to 14 digital documents through the Diia portal.[13] Ukraine has become the first EU country with a valid digital ID, and where it is possible to experience fast business registration (it takes seconds to become an entrepreneur and 30 minutes to create a limited liability company) (Ukraine Now, 2023).

Underpinning and bolstering Ukraine's aspiration to become a digital country is the recent successful development of its IT sector. According to the IT Ukraine Association, in 2021 the country was ranked 11th in the IT competitiveness rankings among European middle-income countries, and the IT sector took over first place in the export of services, generating more than 4 percent of Ukraine's GDP (Grygorenko & Schnitzer, 2022). Over the last few years, the IT service industry has increased its exports considerably, generating $6.8 billion in export revenue in 2021, which represented 10 percent of the country's total exports (OECD, 2022a). In addition, the industry increased its number of specialists by more than 50 percent and in 2021, more than 5,000 IT companies (including startups) were active in the labour market. This demonstrates the IT sector's potential and progress during the pre-war period – despite some challenges, especially for start-ups, when it comes to attracting foreign investment due to insufficient protection of property rights (Grygorenko and Schnitzer, 2022).

However, the war has caused severe disruption to the IT industry, and 43 percent of the country's IT specialists wanted to or have considered moving abroad. Twenty percent of IT specialists have actually moved abroad since the beginning of the full-scale war, while around 3 percent of workers have been mobilized to the military or the territorial defense force (Grygorenko & Schnitzer, 2022). The war has also pressured the government to seek EU membership and thus access to the EU Digital Single Market (DSM), which requires alignment with international regulations and standards (OECD, 2022a).

Considering these challenges, more financial resources are required to support the Ukraine Plan's implementation, ensure proper digital infrastructure and the development of relevant digital skills, and strengthen incentives for businesses to intensify their digitalization efforts. This strongly suggests that targeted support for a broader pick-up of Industry 4.0 technologies would benefit the manufacturing sector. More broadly, Ukraine will also be required to ensure favourable conditions for protecting property rights through the rule of law, stopping the brain drain, and attracting IT specialists to return to Ukraine.

1.2.6 INVESTMENT AND FINANCE

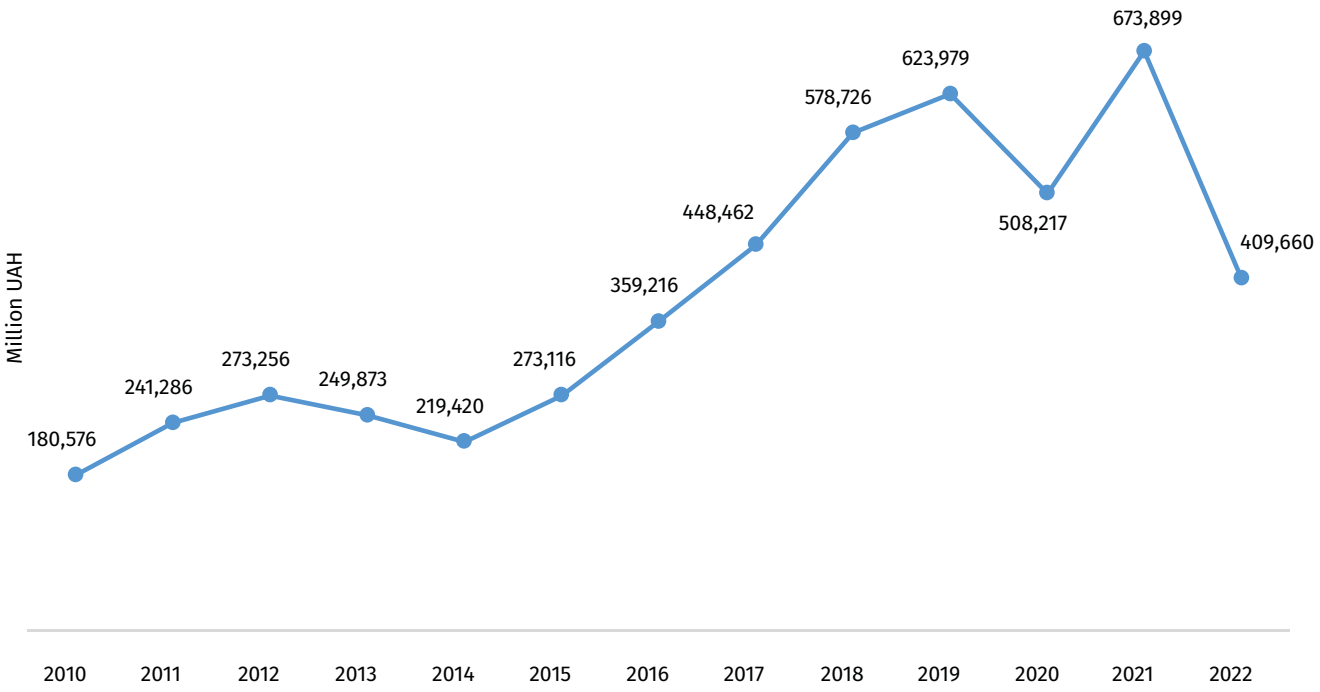
CAPITAL INVESTMENT

Without investment, industrial development is not possible. Capital accumulation, i.e. the dedication of financial resources to productive investment, is a crucial driver of an economy's long-term growth. Capital investment involves businesses acquiring permanent fixed assets such as plants, machinery and equipment. Its level can also indicate enterprises' expectations of the business outlook, as companies will invest if they have confidence in the country's business environment.

Figure 1.26 illustrates the level of capital investment in Ukraine for 2010-2021 and shows an increasing trend, especially after the 2014 Euromaidan protest when the country embarked on a recovery period amidst structural reforms. Another significant uptick occurred in 2021 when the Ukrainian economy recovered from the COVID-19 shock. However, this was followed by a dramatic drop in 2022 (-39.2 percent). The disruption of productive activities by the war forced businesses to prioritize using their financial resources to cover day-to-day activities.

FIGURE 1.26: CAPITAL INVESTMENT IN UKRAINE, 2010-2022

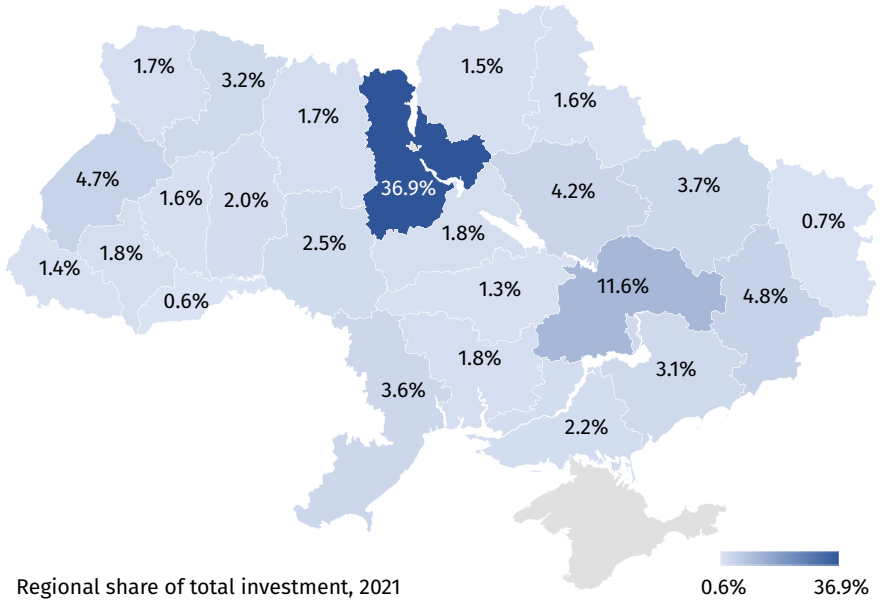
Source: The State Statistics Service of Ukraine (accessed September 2023).



At the regional level, capital investment was concentrated in Kyiv (36.9 percent),[14] Dnipropetrovsk (11.6 percent), Donetsk (4.8 percent), Lviv (4.7 percent), Poltava (4.2 percent) and Kharkiv (3.7 percent) (**Figure 1.27**). These six regions also account for 65.9 percent of businesses in the country (814,900). Importantly, most of these regions are located in the country's southeast, which was later the most affected by the war.

FIGURE 1.27. UKRAINE´S CAPITAL INVESTMENT, BY REGION, 2021

Source: The State Statistics Service of Ukraine (accessed September 2023).

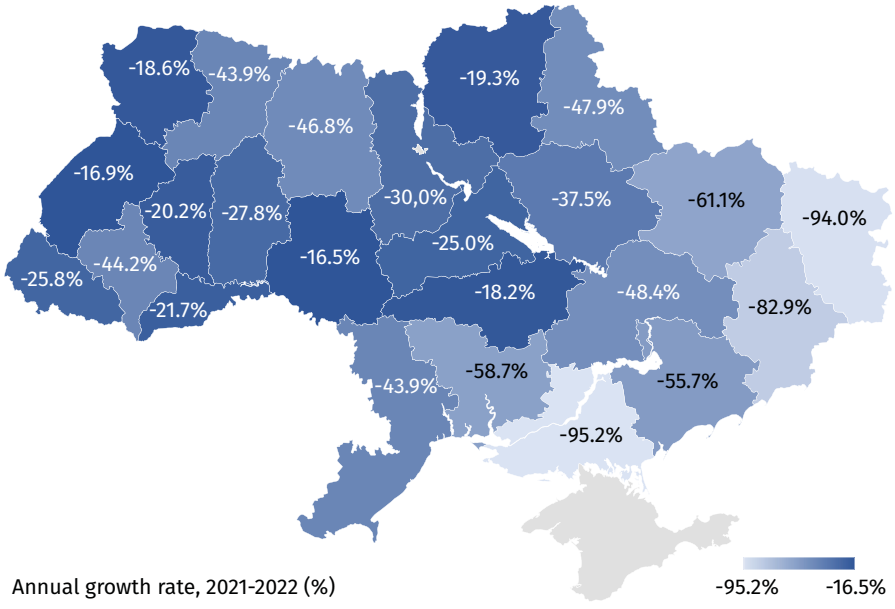


Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

While capital investment decreased in all regions between 2021-2022, it dropped the most in Kherson (-95.2 percent), Luhansk (-94.0 percent), Donetsk (-82.9 percent), Kharkiv (-61.1 percent), Mykolayiv (-58.7 percent) and Dnipropetrovsk regions (-48.4 percent) (**Figure 1.28**). These regions lost many enterprises because of relocation or destruction, and the war crushed investor sentiment.

FIGURE 1.28: UKRAINE´S CAPITAL INVESTMENT GROWTH, BY REGION, 2021-2022

Source: The State Statistics Service of Ukraine (accessed September 2023).



Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

It will be crucial for Ukraine to promote and incentivize companies to reactivate their investment efforts to support reconstruction efforts and tackle more structural challenges like technological upgrading and innovation to develop the priority sectors identified in the National Recovery Plan 2022.

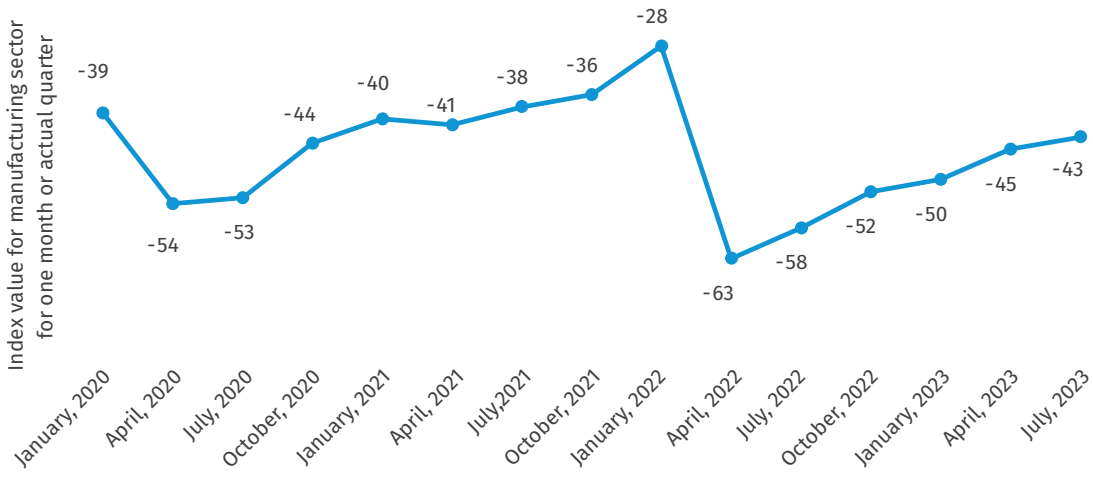
However, corporate investment decisions are influenced by many factors, including the level of confidence in the country's business environment, financial resource availability and expectations of the business outlook. This calls for a holistic strategy that addresses the promotion and improvement of these elements. **Box 1.3** presents current business sentiment about the future development of the country's productive sector and business situation.

BOX 1.3: INSIGHTS FROM BUSINESS CONFIDENCE SURVEYS IN UKRAINE, 2020-2023

The results from a regular business confidence survey conducted by the State Statistics Service of Ukraine (UkrStat) shed light on how business sentiment and expectations have oscillated in recent years. In the manufacturing sector, business confidence, based on enterprises' assessment of their current order-books, improved in 2021 after the COVID-19 shock receded. However, the onset of the war disrupted production and business confidence, which can be seen in the dip between January and April 2022 depicted in **Figure B1.3.1.** It is interesting to see the constant recovery after the trough in April 2022. A similar picture emerges from businesses' responses to their expectations for the near future. In the third quarter of 2022, 30 percent of survey participants expected industrial production to decrease over the coming three months, and only 23 percent expected an increase. In the third quarter of 2023, these percentages flipped (26 percent expected a rise and 17 percent a decrease), returning to the pre-war levels of 2021. Such a brighter assessment of order books and future production can bring back business confidence and the intention and motivation of the business community to invest in productive activities.

FIGURE B1.3.1: ASSESSMENT OF CURRENT ORDER-BOOKS ON THE INDUSTRIAL PRODUCTION FOR MANUFACTURING

Source: UkrStat Business Confidence Survey 2023, State Statistics Service of Ukraine (accessed September 2023).



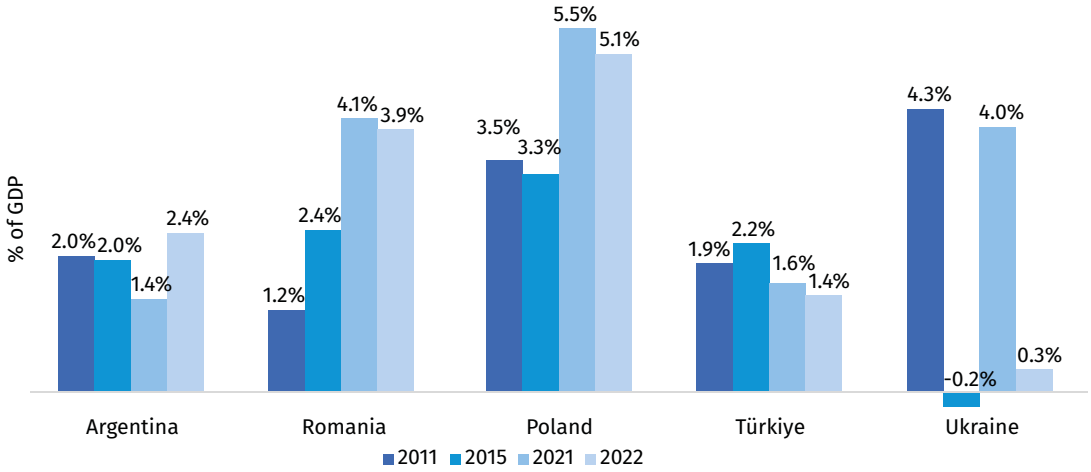
FOREIGN DIRECT INVESTMENT (FDI)

While mobilizing and accumulating domestic capital is essential, there are countries for whom the inflow of FDI has historically been a critical driver of industrial growth. The ability of an economy to attract FDI depends on a variety of factors, including macroeconomic as well as political stability, endowment with natural resources, availability of cheap or skilled labour, size and dynamism of the domestic market, legal and regulatory framework, a supportive and reliable policy environment, and quality of physical infrastructure (World Bank, 2014) (World Bank, 2018).

Figure 1.29 illustrates the level of FDI as a percentage of GDP for Ukraine and the comparator countries, showing that for specific years in the pre-war period, Ukraine registered the highest shares of FDI (around 4 percent in 2011 and 2021), together with Poland and Romania. However, FDI inflows were quite sensitive to political unrest and conflict. In 2015, after the Euromaidan protests, Ukraine experienced a significant decrease in FDI. Following these years, the country embarked on a path of structural reforms to promote FDI, among other elements (Dnabrowski, Domínguez-Jiménez, & Zachmann, 2020), but with limited success. Their volatility over the years was such that the overall level of FDI inflows has been judged "small and insufficient" (Klimkin & Mikloš, 2022; Movchan & Rogoff, 2022), especially since 2014.

FIGURE 1.29: NET INFLOWS OF FDI AS SHARE OF GDP, UKRAINE AND COMPARATORS, 2011, 2015, 2021 AND 2022

Source: World Bank, *World Development Indicators* database (accessed September 2023).



According to UNCTAD's *World Investment Report 2022*, after negative net inflows in 2020 due to the COVID-19 pandemic, macroeconomic difficulties and geopolitical tensions, FDI flows to Ukraine increased to US$ 6.5 billion in 2021. That year, the inbound FDI stock stood at about US$ 62 billion. Multinational companies hold assets in steel, ICT, pharmaceuticals and agricultural commodities (UNCTAD, 2022). Of this amount, one-third originated from Cyprus, but investment from Germany, the Netherlands and Russia was also sizable. However, (Movchan & Rogoff, 2022) caution that the productive nature of FDI inflows from especially Cyprus and the Netherlands can be questioned as they partly include round-tripping, which is often linked to tax evasion.

In 2022, FDI fell abruptly again after the full-scale invasion of Ukraine, causing business climate deterioration, insecurity, economic and political uncertainty, supply-chain disruptions, and infrastructure destruction (UNCTAD, 2022). That year, FDI amounted to just a 0.3 percent share of GDP, the lowest percentage among the countries in this analysis.

Attracting FDI into the country is probably one of the significant challenges that Ukraine currently faces, as reconstructing all of the productive infrastructure destroyed during the attacks will not be possible with domestic capital alone. According to the World Bank's Rapid Damage and Needs Assessment for Ukraine, the infrastructure sectors that suffer war-related damage and are vital to recovering from promoting Ukraine's industrial development are: (1) the energy sector, as Ukraine's integrated energy system, including power generation and transmission infrastructure, was severely damage; (2) transport sector, urban transport infrastructure and rolling stock, and communal roads were highly destroyed; (3) telecommunications and digital sector, which was highly affected but has proven to be resilient; (4) water supply and sanitation sector (WSS), was damaged but the ongoing power outages and intermittent electricity supply have significantly affected these services; and (5) municipal services, which experienced disruption of the entire solid waste management service network (World Bank, 2023).

However, it is crucial to recognize that the main issues affecting FDI in Ukraine are not just related to the war but have to do with longer-term problems associated with a poor business environment, weak institutions and widespread corruption. Indeed, these specific elements are highlighted in Ukraine's Recovery Visions as areas that require improvement. An initiative currently deployed to promote industrial development and contribute to economic recovery through FDI is the revision of the amendments to the Law "On State Support of Investment Projects with Significant Investments and Extension of its Effect" (Ukrainian Stakeholders, 2023).

During UNIDO consultations, Ukrainian stakeholders mentioned relevant elements to consider when promoting FDI and investment more generally, such as (1) a favourable microclimate for entrepreneurs as something more important than the inflow of foreign investments, especially for SMEs; (2) avoiding the closure of trade missions at embassies since this would prevent the establishment of cooperation with foreign partners (investors); and (3) the most important investments should also focus on developing competencies of the workforce (Ukrainian Stakeholders, 2023).

In this context, it is important to note that the government, as part of the National Recovery Plan 2022, has established an industrial investment menu to plan the development of the processing and related industries for 2023-2032. The document identifies 614 projects (with a total investment amount required of US$ 425 billion) and the expected number of jobs that could be created (931,000). These projects are classified by industrial subsector (metallurgy & metalworking, agriculture, energy, machinery, mining, logistics, furniture & woodworking), and the menu identifies the specific regions for implementation.

Finally, to attract quality FDI, policy measures to improve the business environment, the establishment of a clear investment law, and the identification and advertising of attractive sectoral opportunities for foreign investment will play a significant role (see also Grygorenko & Schnitzer, 2022; Movchan & Rogoff, 2022).

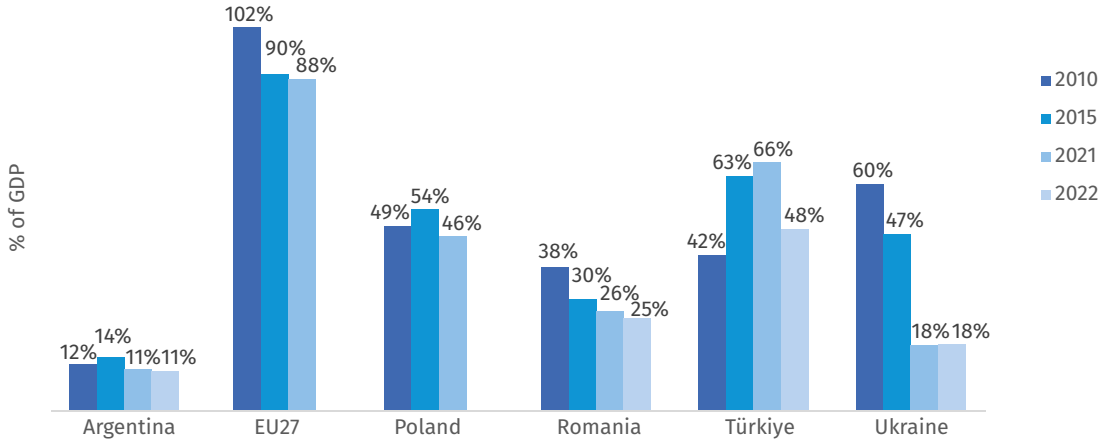
PRIVATE-SECTOR ACCESS TO CREDIT

For enterprises to be able to invest, access to finance is crucial. SMEs often struggle to obtain funds to perform and significantly expand their productive activities. In lower- and middle-income countries, the banking sector is the most important source of external finance. To understand how effective the banking system is in channeling funds to the private sector, the next section examines a standard indicator for financial deepening: the ratio of domestic bank lending to the private sector to GDP.

Figure 1.30 shows that in 2010, this ratio (60 percent) was considerably higher in Ukraine than in the comparator countries. However, what followed was a continuous decline. This contrasts with Türkiye, where domestic credit to the private sector as a share of GDP grew rapidly until 2021 before dropping in 2022. In Poland, the percentage remained at roughly the 50 percent mark throughout 2010-2021. By 2021, the level of credit accessed by the private sector in Ukraine – now corresponding to only 18 percent of GDP – was significantly lower than in peer countries and a far cry from the EU average.

FIGURE 1.30: DOMESTIC CREDIT TO THE PRIVATE SECTOR BY BANKS, SHARE OF GDP, UKRAINE AND COMPARATORS, 2010, 2015, 2021 AND 2022

Source: World Bank, *World Development Indicators* database (accessed September 2023).



The trend toward credit tightening long predates the difficulties brought to the banking sector by the full-scale invasion of Ukraine. The banking system has been quite prone to crisis over the last decades. Especially in the early years of the transition after the dissolution of the Soviet Union, it was characterized by weak institutions, including a lack of regulatory enforcement and low corporate governance standards, which encouraged moral hazard and related-party lending and led to non-performing loans, fraud and even bank looting. Moreover, until 2014, the banking system was highly fragmented, with many banks in operation. Against this backdrop, many banks were hit hard by the global financial crisis of 2008-2009. They struggled to recover before being struck again in 2014 by the economic fallout triggered by armed conflict with Russia. Many private Ukrainian banks became insolvent, fraudulent entities were forced to shut down, and many foreign-owned banks chose to leave the country amidst persistent uncertainty. The banking sector's consolidation also meant considerably downsizing its total balance sheet. While the banking sector overall has become healthier since, it still suffers from weak institutions (including supervision) and comparatively high levels of toxic debt. Moreover, state-owned banks have significantly increased their market share (Barisitz & Fungáčová, 2015; Repko & Soltysiak, 2018).

In this context, the most pressing challenges related to the availability of financial resources that stakeholders identified during UNIDO consultations are the following:

- Lack of financial support for business scaling, as financial support is mainly related to refinancing of past debts;
- Need for debt write-offs and restructuring by banks, e.g. inability to repay debts for participation in projects of Mariupol metallurgical plants, which were destroyed;
- Financing the cost of the latest business equipment and its maintenance;
- Need for state financial support for the purchase of high-tech expert equipment (particularly in the food industry) to reduce the time required to obtain permits and quality certificates;
- Need to reduce bank discount rates;
- Limited grant support for large businesses for the construction of alternative energy facilities;
- Financing of utilities and water treatment for manufacturing;
- Limited grant support for the certification of products for export;
- Lack of insurance programmes for the supply of products to Ukraine.

Overall, improving financing is a precondition to reviving and sustaining the manufacturing sector in Ukraine. Increasing the scale of credit in the economy will be necessary to promote domestic investment and dynamize the population's consumption level, thereby reactivating demand.

Ukraine's government has deployed some policy initiatives at national, municipal and oblast levels to support access to finance to promote the recovery, expansion and sophistication of the industrial sector. These are summarized in **Box 1.4**.

BOX 1.4: POLICY INITIATIVES TO SUPPORT ACCESS TO FINANCE

Source: UNIDO consultations with Ukrainian stakeholders.

- **"Affordable loans 5-7-9% programme"**, under which the state compensates business entities for a part of the loan burden. This particularly applies to businesses in the manufacturing industry. Since the beginning of 2023, banks have granted 17,600 loans. Of the most frequent users of the programme, 14 percent are enterprises from the manufacturing industry. In September 2023, the Cabinet of Ministers further improved the mechanisms of state support for business under the „Affordable Loans 5-7-9%" programme, including by lifting the maximum eligible amount for individual firms to UAH 150 million (for businesses that have suffered destruction and operate in the areas that are no longer under the temporary military control of the Russian Federation).
- **Grant programme (up to UAH 8 million) for entrepreneurship development** provides for grant repayment within three years from the date of grant disbursement. The manufacturing sector is a priority.
- **Diia.Business project** is a joint initiative by the Ministry of Digital Transformation, the Ministry of Economy, and the Entrepreneurship and Export Development Office. As part of this project, microgrants of the equivalent of UAH 125,000 (€4,000) are available from 13 May 2022 through the Diia portal, which, also offers a digital marketplace of financial opportunities for businesses.
- **The Ukraine Facility** is a new four-year programme of the European Union that will offer €50 billion in grants and loans between 2024 and 2027. It includes €8 billion of budgetary guarantees for investments, which will allow an additional €20 billion to mobilize.

1.3 SOCIAL PERFORMANCE

This section analyses the social dimension of industrial development in Ukraine. A set of indicators are examined and compared with benchmark countries. Wherever possible and meaningful, the macro-level analysis for the country as a whole are complemented by regional analysis to shed light on differences across oblasts or municipalities. Relevant insights from UNIDO's consultations with Ukrainian stakeholders are reported, to better comprehend the repercussions of the conflict on manufacturing employment. This task was made challenging due to limited up-to-date data availability.

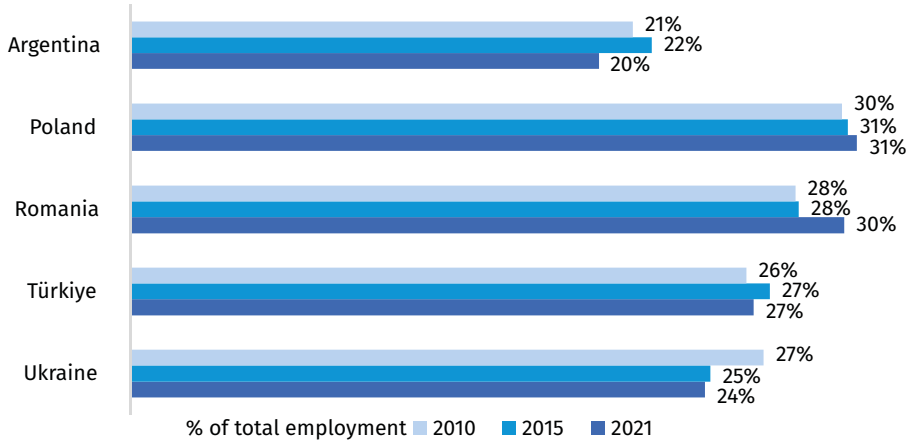
1.3.1 MANUFACTURING EMPLOYMENT AND WAGES

CONTRIBUTION OF MANUFACTURING TO TOTAL EMPLOYMENT

The importance of the manufacturing sector can also be seen in its potential to create good job opportunities. The share of manufacturing in total employment is a critical indicator to track an economy's structural transformation. **Figure 1.31** presents values of this indicator for Ukraine and comparator countries from 2010 to 2021. Data from 2010 reveals that manufacturing employment accounted for approximately 26.9 percent of total employment in Ukraine, positioning the country favourably relative to peer countries such as Türkiye and Argentina. Nonetheless, it is essential to highlight that Ukraine has notably declined this share over the years, exhibiting a negative CAGR of -1 percent from 2010 to 2021. This contrasts with the marginal increases observed in comparable nations, with Argentina being the sole exception.

FIGURE 1.31: SHARE OF INDUSTRY EMPLOYMENT, UKRAINE AND COMPARATORS, 2010, 2015 AND 2021

Source: World Bank, *World Development Indicators* database (accessed September 2023).



In 2022, employment in Ukraine witnessed a significant drop, plummeting to 15.5 percent below pre-war levels, equivalent to a staggering loss of 2.4 million jobs (ILO, 2022b). The principal factor contributing to this decline is the nation's diminishing population. The conflict sparked a mass exodus of refugees and accelerated population decline. As of the end of May 2022, the conflict had displaced approximately 13 million individuals, including 6.8 million refugees who sought sanctuary in neighbouring countries (UNHCR, 2022). Furthermore, direct losses at the front lines have disproportionately affected the working-age population.

No data is available specifically for manufacturing employment in 2022 and 2023 to assess the impact of the war on this sector. However, **Box 1.5** provides insights on the expected changes in employment at industrial enterprises during 2020-2023, according to the Business Confidence Survey 2023 conducted in Ukraine.

The importance of a substantial share of manufacturing employment cannot be overstated for Ukraine, as this sector is renowned for its productivity and capacity to provide high-quality employment opportunities. Going forward, allocating resources for vocational and technical training programmes will be imperative to enhance the skills of the manufacturing workforce, ensuring alignment with the demands of modern industry. Concurrently, supporting research and development initiatives within the manufacturing sector can foster increased productivity and competitiveness, motivating companies to embrace cutting-edge technologies and innovative processes (OECD, 2022c).

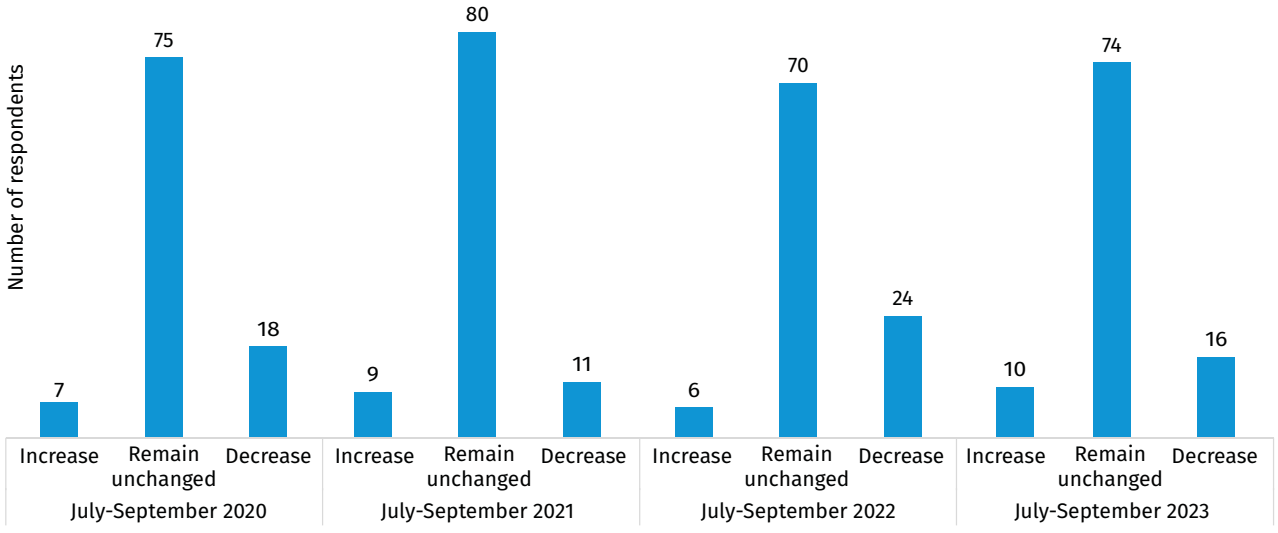
BOX 1.5: BUSINESS EXPECTATIONS ON EMPLOYMENT IN UKRAINE'S INDUSTRIAL SECTOR, 2020-2023

The business confidence survey by UkrStat also asks respondents about their expectations regarding employment creation. Looking at the responses by industrial enterprises for the third quarter of each of the four years from 2020-2023 reveals that respondents held dim prospects for job creation throughout this period. Interestingly, though, the share of respondents expecting an increase in employment over the following three years was highest in Q3 2023, when Ukraine was in the middle of its second year of war. At 10 percent, it was four percentage points higher than one year earlier, when the war had recently begun, and one percentage point above Q3 2021, thus before the war. Conversely, the share of businesses expecting a decrease in industrial employment was lower in Q3 2023 than in Q3 2022 (but higher than in Q3 2021).

This suggests that enterprises' expectations regarding employment and business confidence are better for 2023, where signs of recovery in industrial activity are registered **Figure B1.5.1**).

FIGURE B1.5.1: EXPECTED CHANGES IN EMPLOYMENT AT INDUSTRIAL ENTERPRISES OVER THREE MONTHS, 2020, 2021, 2022 AND 2023

Source: Business Confidence Survey 2023.



EMPLOYMENT IN MANUFACTURING SUBSECTORS

Tracking the distribution of employment across the different manufacturing subsectors allows us to identify which specific industries are driving employment growth and which may be declining. Economic diversification is often seen as a sign of a healthy and resilient economy because it reduces dependence on a few industries in production and job creation. **Table 1.6** shows Ukraine's manufacturing subsector employment for Ukraine in 2021 and its CAGR from 2010-2021. Food and beverages, machinery and equipment, basic metals, chemicals, and non-metallic mineral products are the top five subsectors (in decreasing order), contributing the most to manufacturing employment in 2021. However, employment in those subsectors declined between 2010 and 2021, with basic metals seeing the largest decrease (7 percent), followed by machinery and equipment (3 percent). It can be expected that these subsectors will face further job shedding during wartime, with a particular focus on the food and beverages and basic metals sectors.

This anticipated decline is attributed primarily to the adverse effects of the ongoing conflict on the agriculture sector, which is a vital source of food processing. Furthermore, the metallurgical sector is also negatively impacted due to the destruction of assets and disruptions in electricity availability (World Bank, 2023).

On the upside, some manufacturing subsectors created new jobs from 2010-2021. The office, accounting, and computing machinery subsector recorded the highest CAGR (20 percent) during this period, followed by the motor vehicles, trailers, and semi-trailers subsector (CAGR of 5 percent) and the wood products industry (CAGR of 1 percent). This suggests diversification and the move towards more productive and innovative sectors. Efforts to develop innovative industrial skills and encourage R&D within different manufacturing subsectors can increase productivity and competitiveness, making it easier for companies to adopt innovative technologies and processes (OECD, 2022c).

TABLE 1.6: MANUFACTURING SUBSECTOR EMPLOYMENT AND AVERAGE WAGES IN UKRAINE, 2010-2021

Source: UNIDO, *INDSTAT* database (accessed September 2023).

ISIC CODE/ MANUFACTURING SUBSECTOR	EMPLOYMENT		ANNUAL AVERAGE WAGE	
	2021 (Number)	CAGR 2010-2021	2021 (US$)	CAGR 2010-2021
15 Food and beverages	323,772	-2.2%	5,142	4.7%
29 Machinery and equipment n.e.c.	186,724	-2.9%	5,325	4.6%
27 Basic metals	116,975	-7.1%	7,847	4.3%
24 Chemicals and chemical products	90,077	-2.0%	7,188	6.1%
26 Non-metallic mineral products	82,134	-3.6%	5,597	6.5%
28 Fabricated metal products	79,219	-1.2%	5,020	6.2%
35 Other transport equipment	70,347	-6.5%	5,596	3.9%
34 Motor vehicles, trailers, semi-trailers	55,855	5.3%	5,569	6.5%
36 Furniture; manufacturing n.e.c.	53,341	-0.4%	3,916	6.0%
25 Rubber and plastics products	52,437	-1.3%	4,134	3.8%
20 Wood products (excluding furniture)	47,215	0.8%	3,695	5.5%

ISIC CODE/ MANUFACTURING SUBSECTOR	EMPLOYMENT		ANNUAL AVERAGE WAGE	
	2021 (Number)	CAGR 2010-2021	2021 (US$)	CAGR 2010-2021
31 Electrical machinery and apparatus	45,295	-6.9%	4,884	4.4%
18 Wearing apparel, fur	44,995	-2.8%	3,203	5.5%
21 Paper and paper products	28,753	-0.1%	5,450	5.0%
30 Office, accounting and computing machinery	26,568	19.8%	5,527	0.8%
19 Leather, leather products and footwear	18,808	-1.1%	3,844	5.9%
17 Textiles	16,857	-3.8%	3,583	4.3%
22 Printing and publishing	16,767	-11.7%	4,395	3.7%
23 Coke, refined petroleum products, nuclear fuel	13,138	-9.1%	7,954	3.9%
16 Tobacco products	3,013	-2.0%	14,514	0.5%

Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified.

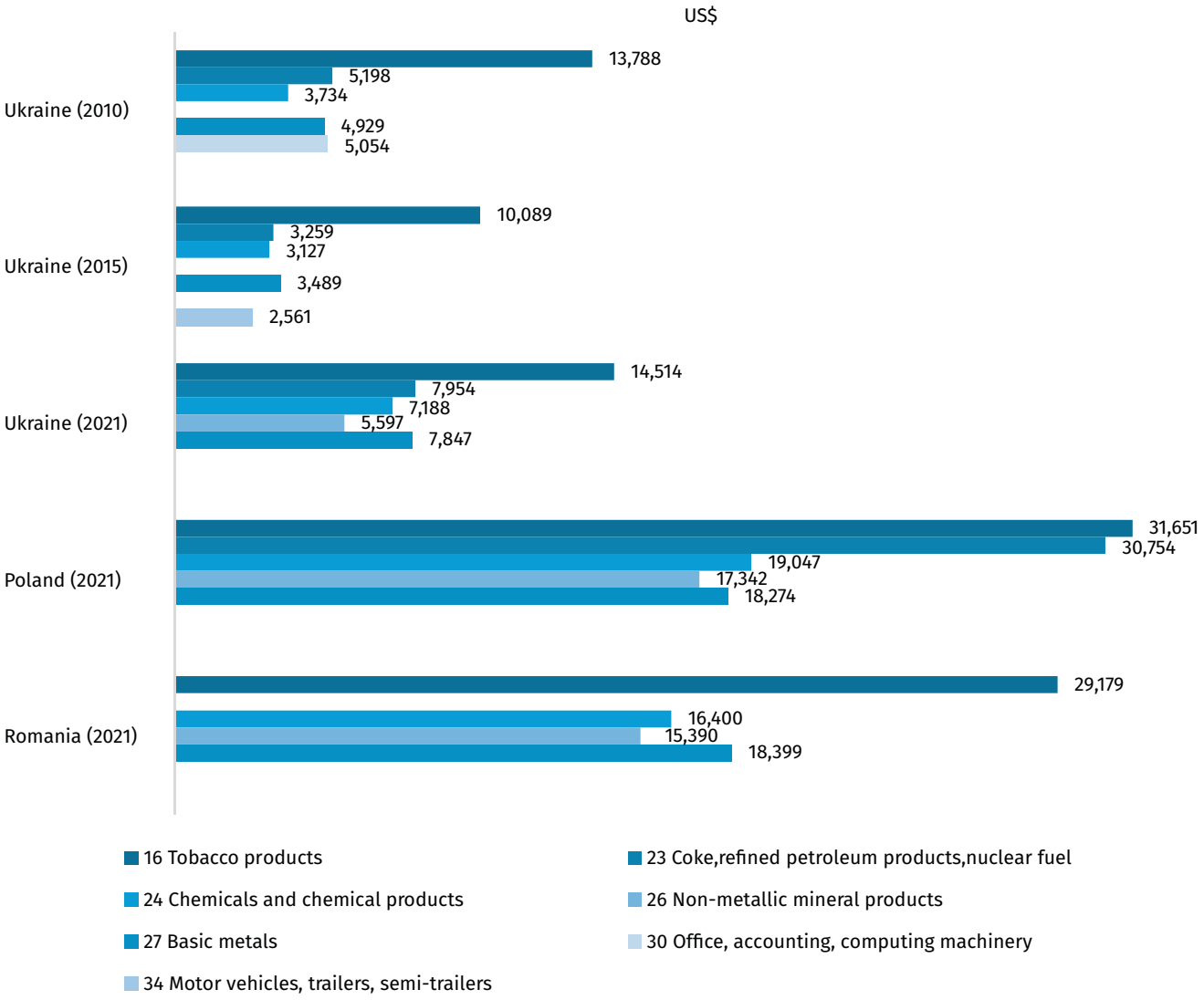
WAGES IN MANUFACTURING SUBSECTORS

To better understand the social dimension of industrial development, an assessment of the average wages paid in the different manufacturing subsectors is warranted. This offers valuable insights into the living standards of manufacturing workers and the divergent earnings structures across various industries. Average subsectoral wages are a powerful indicator for comprehending the intricate dynamics of the labour market, uncovering wage disparities and pinpointing potential imbalances in labour supply and demand within specific manufacturing subsectors. Moreover, subsectoral wage data offers a window into income inequality within the manufacturing sector, revealing whether specific industries exhibit significant wage differentials. Finally, a certain degree of correlation between wage levels and labour productivity can be expected.

Table 1.6 reports the average annual wages for all subsectors of Ukraine's manufacturing industry, and their CAGR for 2010-2021. **Figure 1.32** illustrates the average wages of the top five manufacturing subsectors that offered the highest compensation in Ukraine from 2010 to 2021. Note that this ranking has not changed much over time, with just two subsectors (office and computing machinery on the one hand and motor vehicles on the other hand) dropping out over time. In 2021, average wages were the highest in the tobacco, coke, refined petroleum, basic metals, chemicals, and non-metallic minerals subsectors. All increased their average wages between 2010 and 2021, although unsteadily (with a dip mid-decade) and at different rates. Among them, the chemicals and the non-metallic minerals subsectors are the ones where average wages have increased the most from 2010-2021 (with CAGRs more than 6 percent). Thus, while employment has decreased in most subsectors, average wages have followed the opposite trend. However, as **Figure 1.32** reveals, even the best-paying manufacturing subsectors have average wages far below workers in Romania and Poland, two of the EU benchmark countries. The cross-country wage gap is between 50 percent and 70 percent in these five subsectors.

FIGURE 1.32: TOP FIVE MANUFACTURING SUBSECTORS, UKRAINE AND COMPARATOR COUNTRIES, PAYING THE HIGHEST AVERAGE WAGES, 2010, 2015 AND 2021

Source: UNIDO, *INDSTAT* database (accessed September 2023).



1.3.2 YOUTH AND FEMALE EMPLOYMENT

FEMALE EMPLOYMENT IN TOTAL EMPLOYMENT AND INDUSTRY

Two crucial indicators for gauging gender diversity in the workforce are the share of female employment in total employment and the share of female employment in industry. These percentages offer valuable insights into gender disparities and employment trends.

Figure 1.33 shows female employment as a proportion of total employment in Ukraine and comparators from 2010-2021. In 2010, more than one-half of the total workforce in Ukraine were women, indicating a significant level of gender equality across various industries. In fact, that year Ukraine's performance surpassed the EU average and that of other comparator countries. However, from 2010-2021, the female share in total employment decreased from 50.5 percent to 47.8 percent. Despite this decline, Ukraine maintained a higher female employment share than EU countries.

More specifically, **Figure 1.34** illustrates the share of females in industrial sector employment, showing that during 2010-2021, around 30 percent of the Ukrainian industry workforce comprised women (albeit with a slight downward trend over the years). This represents a higher proportion than in all benchmark countries except for Romania. Moreover, additional data not presented here shows that, of all Ukrainian women in employment, 13.6 percent worked in industry in 2021 (down from 16.7 percent in 2010). This is slightly higher than in the EU, but lower than in Romania, Poland and Türkiye, indicating that industrial employment is still a male domain in Ukraine.

FIGURE 1.33: SHARE OF FEMALE EMPLOYMENT, UKRAINE AND COMPARATORS, 2010, 2015 AND 2021

Source: World Bank, *World Development Indicators* database (accessed September 2023).

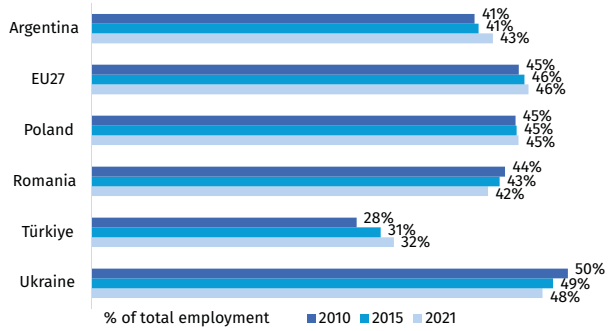
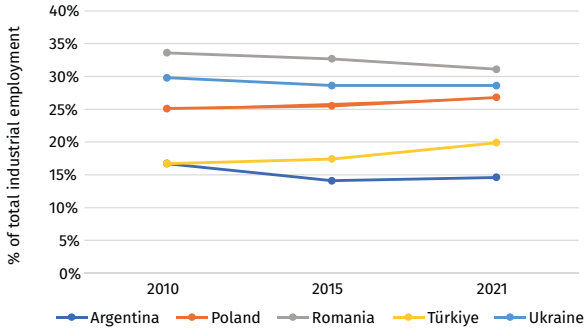


FIGURE 1.34: SHARE OF WOMEN IN INDUSTRIAL EMPLOYMENT, UKRAINE AND COMPARATORS, 2010, 2015 AND 2021

Source: ILO, *ILOSTAT* database (accessed September 2023).



While these findings emphasize women's significant contributions to the workforce in Ukraine, they also reveal that there is scope for increasing female participation in the industrial workforce. Unfortunately, the ongoing conflict that started in 2022 has had a disproportionate impact on women and children. Among those who sought assistance from the State Employment Service due to unemployment, most were women (61 percent in December 2022 and 68 percent in January 2023) (World Bank, 2023). Given this situation, it is crucial to prioritize policies that uphold gender equality, promote women's economic empowerment to engage in a broader spectrum of more productive industrial sectors and address any lingering gender disparities. Acknowledging the significance of gender equality in the workplace is vital for cultivating a more inclusive and fairer workforce and economy.

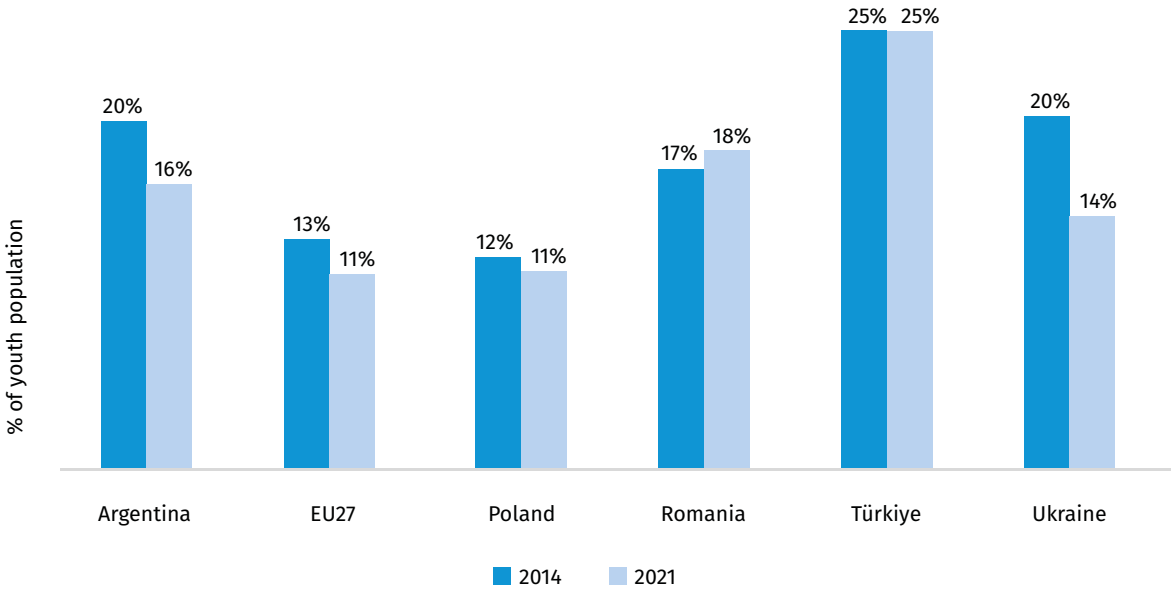
SHARE OF YOUTH NOT IN EMPLOYMENT, EDUCATION OR TRAINING

The transition from leaving the education system to entering the workforce is often tricky. A lack of work experience and demonstrated practical skills make many employers hesitate to hire young labourers. It's no surprise, then, that high unemployment rates among youth are a widespread problem across the globe.

One commonly used indicator to measure the young generation's participation in economic life is the share of youth not in employment, education or training (NEET). **Figure 1.35** provides insights into the NEET rate for Ukraine and comparator countries between 2014 and 2021. In 2014, Ukraine's NEET rate exceeded that of most comparators, except Türkiye. However, there was a very positive trend within Ukraine, as the percentage of young people not currently employed, enrolled in formal education, or participating in vocational training decreased from 20.0 percent in 2014 to 14.3 percent in 2021.

FIGURE 1.35: SHARE OF YOUTH NOT IN EMPLOYMENT, EDUCATION OR TRAINING, UKRAINE AND COMPARATORS, 2014 AND 2021

Source: World Bank, *World Development Indicators* database; State Statistics Service of Ukraine (accessed September 2023).



Despite this, the ongoing conflict is anticipated to harm education in Ukraine, estimated to result in a decline in Harmonized Learning Outcome scores from 481 points to 420 points (per the World Bank's 2023 report). According to the same report, as of February 2023, at least 2,772 educational institutions have suffered partial damage and 454 have been destroyed. This amounts to approximately 10 percent of all educational institutions across all levels in Ukraine. The eastern part of Ukraine has borne the brunt of this damage, with 64 percent of educational institutions in Donetska Oblast and 38 percent in Kharkivska Oblast either partially damaged or destroyed.

Initiatives such as enhancing access to education and vocational training, offering career guidance and counseling, creating job opportunities, and empowering youth with innovative industrial entrepreneurial skills are vital to reducing the NEET rate. Lowering the NEET rate is not only crucial for the well-being of young people but also plays a significant role in building productive capacities necessary for long-term economic growth and social development.

1.3.3 EDUCATION AND SKILLS

GOVERNMENT EXPENDITURE ON EDUCATION

Education serves as a fundamental catalyst for both growth and development within societies. A well-educated workforce is characterized by enhanced skills, productivity and innovation capacity, and is pivotal in driving economic progress. One of the cornerstones of ensuring the quality of education is adequate funding. Government investment in the education sector carries the potential to recruit proficient educators, procure modern teaching materials and equipment, and create an enriched learning environment. Quality education equips individuals with the technical and soft skills required to thrive in a competitive and dynamically evolving job market.

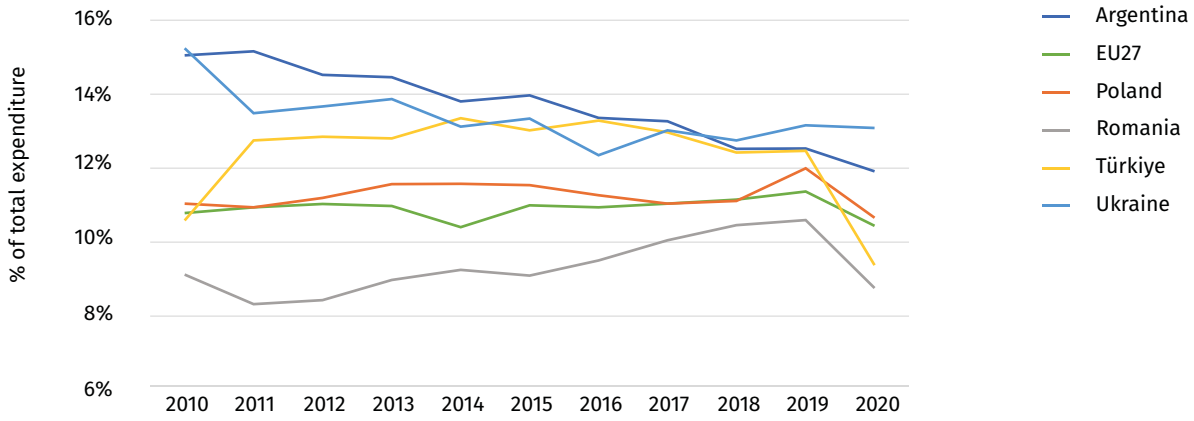
The share of education in a government's total expenditure is a metric that mirrors the government's financial commitment to bolstering the education system and serves as a litmus test for assessing the priority accorded to education within a nation's fiscal agenda. This indicator offers valuable insights into how much the government prioritizes investment in education and skills development.

Figure 1.36 traces the trajectory of the government's allocation of funds to education within the budgets of Ukraine and comparator countries from 2010-2020. Ukraine has consistently earmarked a substantial portion – in fact, exceeding the EU average – of its total expenditure to support education. Notably, in 2010 Ukraine demonstrated a considerably higher allocation of its budget towards education. Nevertheless, there was a marked decline in this allocation, with it diminishing from 15.2 percent to 13.5 percent between 2010 and 2020. Still, it surpassed its peer countries between 2018 and 2020, underscoring Ukraine's commitment to reinforcing its education system. However, the war has not left the education system unscathed. The conflict has diverted the Ukrainian government's attention and resources from the education sector.

Moreover, according to the World Bank, the war has caused at least US$4.4 billion in damage to educational institutions throughout Ukraine. Consequently, additional efforts on the part of the government to ensure safe access to education and maintain the quality of the educational process are imperative. The estimated cost for guaranteeing secure access to education in 2023 is US$466.8 million (World Bank, 2023).

FIGURE 1.36: SHARE OF GOVERNMENT EDUCATION EXPENDITURES, UKRAINE AND COMPARATORS, 2010-2020

Source: World Bank, *World Development Indicators* database (accessed September 2023).



STUDENTS IN VOCATIONAL TRAINING

The enrollment of students in vocational training programmes can play a pivotal role in addressing critical skill gaps, enhancing employability prospects and fostering economic development, especially in the industrial sector where technical skills are needed. These programmes offer a practical avenue for students to acquire innovative skills and knowledge directly applicable to specific industries or occupations, making them a valuable asset in the workforce.

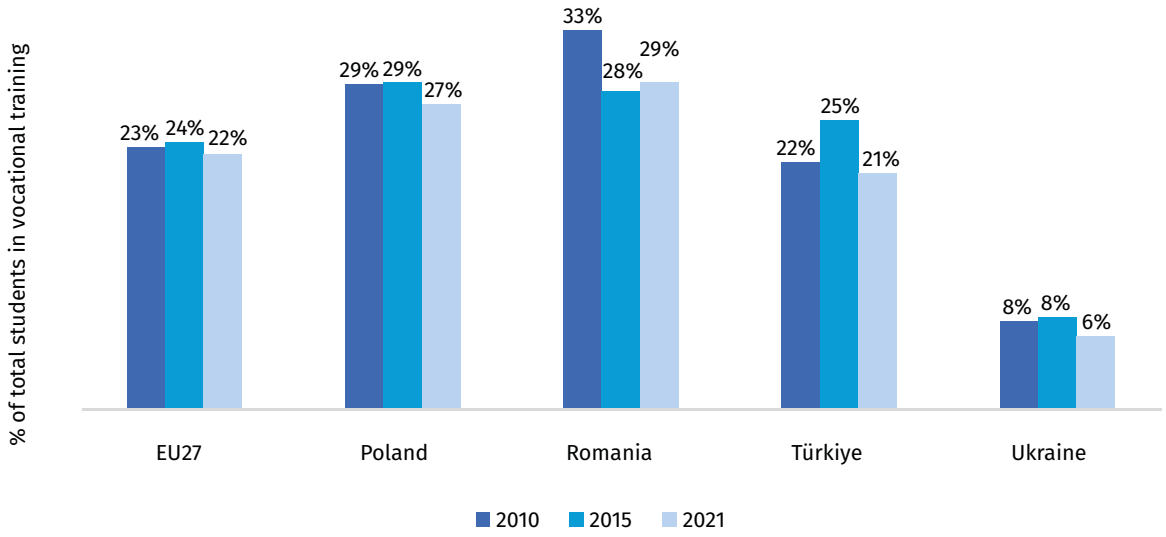
The share of students in vocational training represents the proportion of students within an education system who have chosen vocational or technical training pathways over traditional academic or general education programmes. Vocational training programmes are meticulously designed to provide students with hands-on skills and practical knowledge tailored to the demands of particular careers or industries.

Figure 1.37 illustrates the share of secondary students enrolled in vocational programmes in Ukraine and comparators from 2010 to 2021. Notably, Ukraine faces a substantial need for improvement in vocational training enrollment, as it exhibits a significantly lower share of students participating in such programmes compared to the EU average as well as its peer countries. On top of this, the share of Ukrainian students engaged in vocational training declined from 7.7 percent in 2010 to 6.5 percent in 2021. In total numbers, enrollment figures dropped from 241,706 students in 2010 to 177,070 students in 2018.

Ukraine could benefit from a concerted effort to promote and expand vocational training opportunities for its students to bolster its workforce's skill set and enhance economic prospects. Closing the gap between its current enrollment levels and those of its European peers could help meet the evolving demands of the job market, empower students with valuable skills, and contribute to the nation's structural change.

FIGURE 1.37: SHARE OF STUDENTS IN VOCATIONAL TRAINING, UKRAINE AND COMPARATORS, 2010, 2015 AND 2021

Source: UNESCO, *UIS.Stat* database (accessed September 2023).



Due to the impact of the war, domestic businesses are facing a lack of knowledge, expertise and a shortage of skilled personnel. In fact, according to UNIDO consultations with Ukrainian stakeholders, there is a severe shortage of qualified design engineers, technological engineers in MHT industries, project managers, machine-tool workers and workers with average qualifications, mainly for operational tasks.

To revive and support the manufacturing sector in Ukraine amid the war, the government needs to work for safe access to learning and ensure the quality of the educational process (World Bank, 2023). More specifically, it will have to address the inconsistency of the state training system with the demand needs (particularly for skilled workers in mechanical engineering), the low efficiency of dual education (there is no guarantee of employment for specialists trained on the job), and the lack of cooperation between educational institutions and business in recruiting qualified personnel (Ukrainian Stakeholders, 2023).

1.4 ENVIRONMENTAL PERFORMANCE

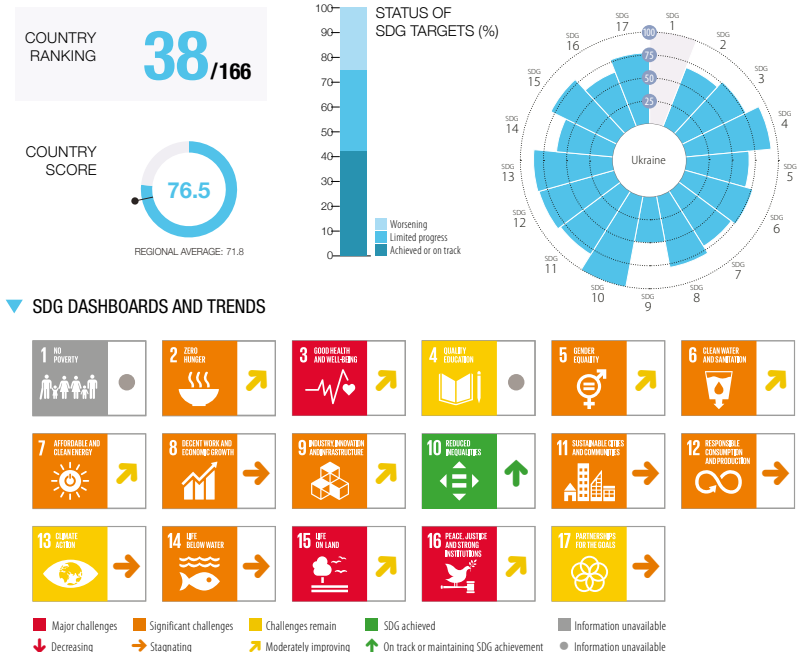
This section analyses the environmental footprint of the industrial/manufacturing sector in Ukraine, compared with benchmark countries. It combines a set of indicators that shed light on different dimensions of environmental performance. More specifically, it considers input indicators related to resources like water, raw materials and energy that are used in production processes. It also highlights output indicators related to emissions and waste generation and management.

Wherever possible, the analysis is, on the one hand, disaggregated to the regional level to capture differences across oblasts or municipalities and, on the other hand, complemented by qualitative information to understand the impact of the war on the environmental sphere.

To provide a general overview of how Ukraine is performing in terms of Sustainable Development Goals (SDGs) that are related to environmental aspects, **Figure 1.38** shows that, overall, Ukraine ranks 38th among 166 countries in the SDG index, with its score of 76.5 being above the regional average (71.8). It is essential to highlight that Ukraine performs particularly well on three SDGs: SDG 4 (Quality Education), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Change); the latter two are directly related to environmental issues, although challenges remain. The specific scores remain stagnant (United Nations, 2023).

FIGURE 1.38: UKRAINE'S PERFORMANCE ON THE SUSTAINABLE DEVELOPMENT GOALS (SDGS) DASHBOARD

Source: Sachs, et al, 2023, p. 484.



This data for Ukraine reflects the situation before February 2022. Therefore, it is expected that quite a different picture of SDG performance will emerge after the impacts of the full-scale invasion of Ukraine are fully captured. However, now more than ever, it will be critical for Ukraine to continue pursuing industrial development while aspiring to build back better and greener To achieve this, approaches such as decarbonization, circular economy, and resource and material efficiency will be crucial to incorporate.

1.4.1 WATER USE AND SUPPLY

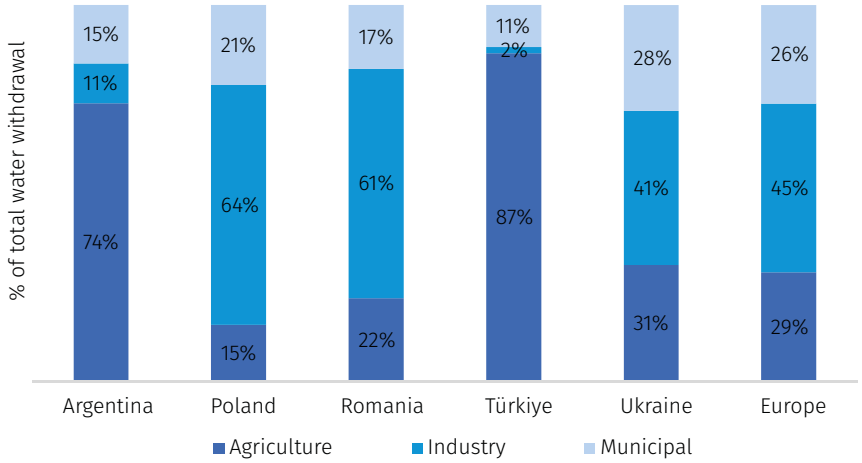
SECTORAL WATER USE

Water can be used for widely different purposes, and its management is crucial in ensuring the reproduction of life. When it comes to industrial development, one potential use is for production purposes in various industries, such as mining and quarrying, manufacturing, electricity, and construction, among others. The water withdrawal level per sector is a valuable indicator for understanding how water usage is distributed across economic sectors, thereby hinting at areas with scope for efficiency improvements.

Figure 1.39 indicates that the industrial sector was the main contributor to the total water withdrawal for Ukraine, Poland and Romania in 2020. In Ukraine, it accounted for 40.9 percent, followed by agriculture (31.0 percent) and the municipal sector (28.1 percent). The figure indicates that the industrial sector is the main source of water stress levels in these countries.

FIGURE 1.39: LEVEL OF WATER WITHDRAWAL, BY SECTOR, UKRAINE AND COMPARATORS, 2020

Source: FAO, *AQUASTAT* database (accessed September 2023).



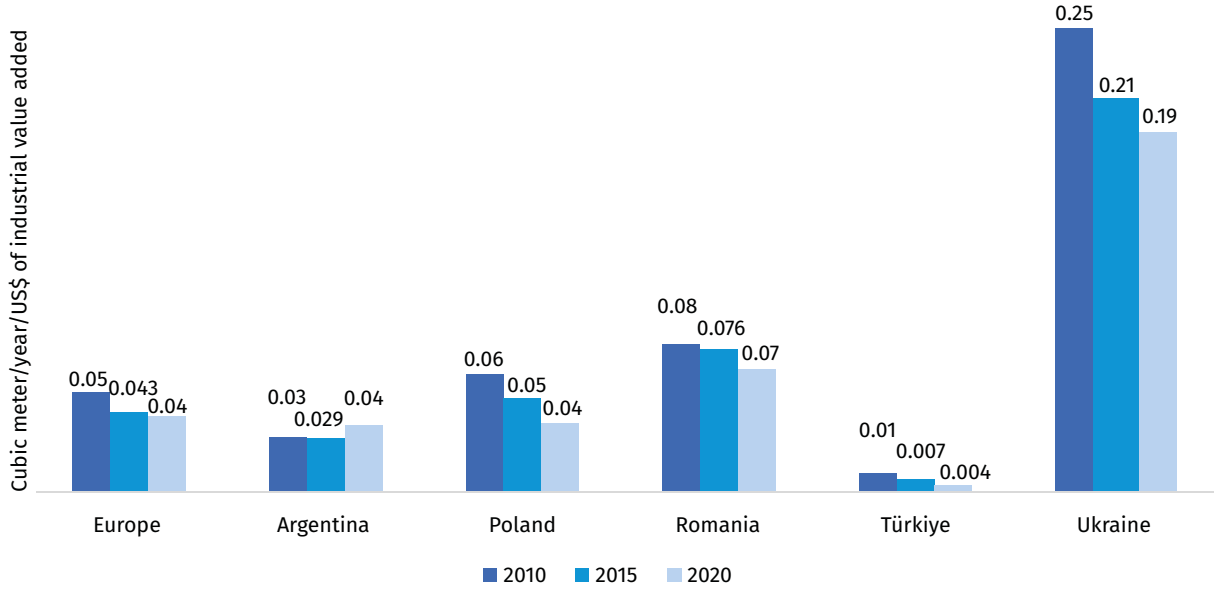
Note: Europe's level of water withdrawal corresponds to that of all European countries.

INDUSTRIAL WATER USE INTENSITY

Calculating the amount of water required to generate one dollar of industrial value added provides a glimpse of the water-use intensity in a country's industrial sector. This indicator is, therefore, a measure of the sector's efficiency in using this resource. Decoupling industrial water use from industrial value added offers an opportunity to capture more monetary value as well as reduce water stress. Increasing water use efficiency is one of the targets under SDG 6. **Figure 1.40** shows that Ukraine has the highest intensity of industrial water use compared to the benchmark counties. Even after having decreased from 0.3 to 0.2 m^3/year/US$ between 2010-2020, the 2020 level is still 3, 5 and 51 times higher than in Romania, Poland and Türkiye, respectively.

FIGURE 1.40: INDUSTRIAL WATER USE INTENSITY, UKRAINE AND COMPARATORS, 2010, 2015 AND 2020

Source: UNIDO elaboration based on Food and Agriculture Organization (FAO), *AQUASTAT* database (industrial water withdrawal) and World Bank, *World Development Indicators* database (industry value added) (accessed September 2023).



Note: Europe's average industrial water use intensity corresponds to that of all European countries.

The growing water demand, combined with the effects of climate change, means a real risk of water shortage. Moreover, the war has imposed additional challenges to water availability for production as there are notable damages and losses in the irrigation and water resources sector. For example, agricultural production, the foundation of Ukraine's food industry, has been highly affected due to the damage to irrigation canals and on-farm infrastructure. Destruction of hydrological facilities at large reservoirs and main irrigation canals has created losses of water resources (World Bank, 2023). Therefore, improving its water use efficiency will help Ukraine's industry become less vulnerable and more resilient.

The destruction of the Kakhovka dam in southeastern Ukraine could create a water crisis that has the potential to last for generations. In addition, ammunition and military equipment dumped into the rivers and streams have released heavy metals and other toxins, while strikes on oil depots and industrial facilities have further poisoned water supplies (The Telegraph, 2023).

1.4.2 MATERIAL EXTRACTION AND CONSUMPTION

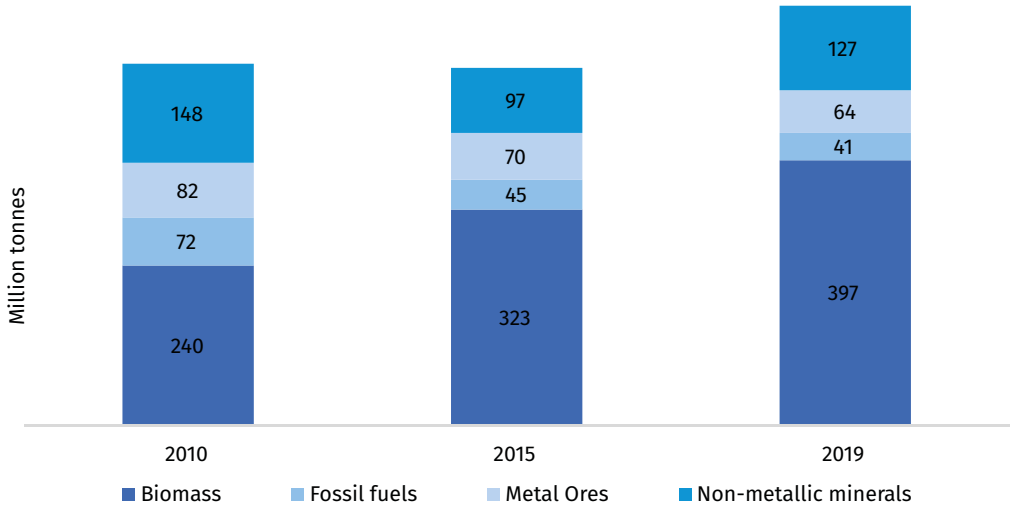
MATERIAL EXTRACTION

Raw materials are essential in production, as they are the basis of manufacturing activities. Part of an economy's success is related to how it manages natural resources and materials. By using materials more productively, both the extraction of virgin resources and waste generation can be reduced. This helps to limit the harmful side of economic activities, including the depletion of natural resources and environmental pollution. Achieving sustainable management and efficient use of natural resources and materials is one of the most important goals for the sustainable development of the industrial sector (SDG 12).

Ukraine is richly endowed with natural resources that, if managed well, can benefit the economy. Over the last decade, domestic extraction increased by a CAGR of 1.7 percent, growing from 542.1 million tons in 2010 to 629.4 million tons in 2019 (**Figure 1.41**). In all three the years presented in the figure, biomass accounted for the largest share in overall material extraction, followed by non-metallic minerals, metal ores, and fossil fuels. Moreover, biomass is the only material group that increased its share between 2010-2019 (from 44.2 percent to 63.1 percent), suggesting that more agricultural activity is occurring. Putting Ukraine's material extraction into a global comparison, with 14.3 tons per capita, Ukraine ranked 149 out of 217 countries in 2019, 9.6 percent above the world average of 13.0 tons per capita.

FIGURE 1.41: UKRAINE'S MATERIAL EXTRACTION, BY MATERIAL GROUP, 2010, 2015 AND 2019

Source: Vienna University of Economics and Business, *MaterialFlows.Net* database (accessed September 2023).



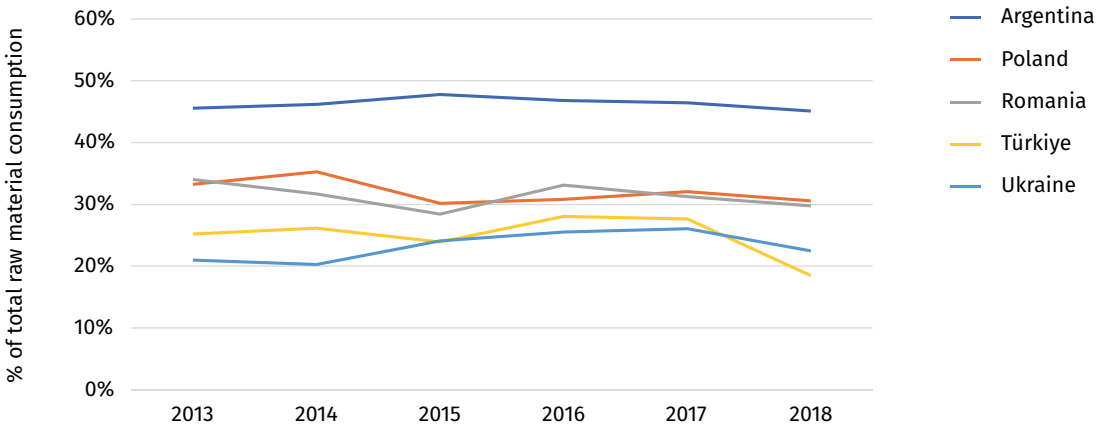
Within the biomass material group, crop residues (mainly from straw) were the dominant material subgroup, with 56.5 percent, followed by crops at 36.5 percent, particularly cereals, wheat, vegetables and sugar. Looking at the second largest material group, non-metallic minerals, construction was the dominant subgroup (mainly sand, gravel, crushed rock and limestone). It will be crucial for Ukrainian stakeholders, both public and private, to investigate how to increase material productivity and decouple material extraction from economic growth. This has received extra urgency due to the war, which has brought severe damage to the agricultural land that has been mined or occupied.

MATERIAL CONSUMPTION IN MANUFACTURING

Ukraine's material extraction per capita is above the world average. Still, this information needs to be complemented with an analysis of the manufacturing sector's contribution to the economy's raw material consumption (RMC). These two pieces of information will help to better understand policies to promote material use efficiency in this sector, which should be a priority. **Figure 1.42** shows that the manufacturing sector in Ukraine represented 21.0 percent and 22.5 percent of total RMC in 2013 and 2018, respectively, which are the lowest percentages compared to benchmark countries (except for Türkiye in 2018). Although the share in Ukraine increased slightly over these five years, it is not too different from that of the other countries, except for Argentina. Within manufacturing, the subsectors most responsible for RMC in 2018 were the food (65.7 percent) and fabricated metals (22.8 percent).

FIGURE 1.42: SHARE OF MANUFACTURING RAW MATERIAL CONSUMPTION (RMC), UKRAINE AND COMPARATORS, 2013-2018

Source: Vienna University of Economics and Business, Hotspot Analysis Tool for Sustainable Consumption and Production (accessed September 2023).

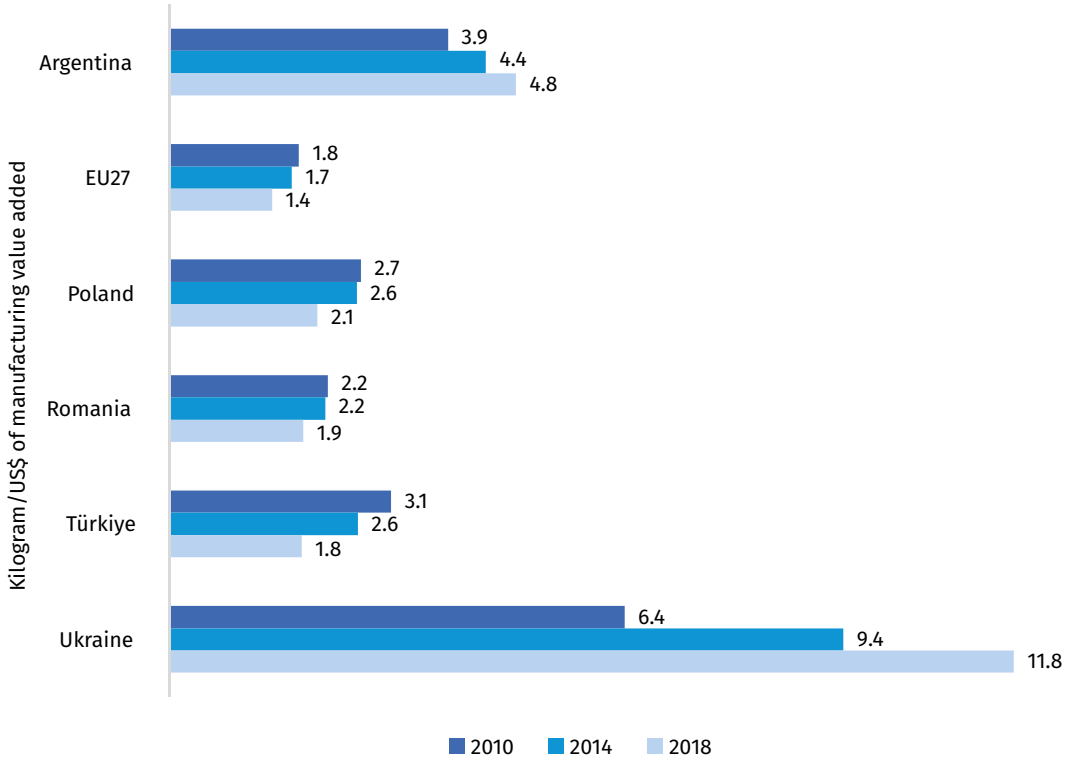


MANUFACTURING MATERIAL CONSUMPTION INTENSITY

Correlating input (namely RMC) with output (namely MVA), **Figure 1.43** indicates that Ukraine has the highest manufacturing RMC intensity relative to comparators; in 2018, it required 11.8 kg of raw materials to generate US$ 1 of value added. In addition, besides Argentina, Ukraine is the only country where manufacturing RMC intensity increased between 2013 and 2018. This is due in part to the decline in Ukraine's MVA over this period (from US$ 15.8 billion in 2010 to US$ 11.9 billion in 2018 at constant 2015 prices). In any case, Ukraine's manufacturing RMC intensity is about 5-6 times higher than that of Romania, Poland, Türkiye and the EU average.

FIGURE 1.43: RAW MATERIAL CONSUMPTION (RMC) INTENSITY, UKRAINE AND COMPARATORS, 2010, 2014 AND 2018

Source: UNIDO, based on Hotspot Analysis Tool for Sustainable Consumption and Production, Vienna University of Economics and Business (raw material consumption) and World Bank, *World Development Indicators* database (MVA) (accessed September 2023).



With such low material efficiency, policymakers should prioritize implementing measures that promote the careful use of materials and their recirculation into the economy, thereby extending their second-life use. As part of an agenda for sustainable industrial development, improving material efficiency can lead to triple dividends: reducing dependence on the supply of raw materials (mainly when imported), lowering environmental pressures, and making the industry more competitive (European Environment Agency, 2016).

1.4.3 ENERGY GENERATION AND ENERGY-USE INTENSITY

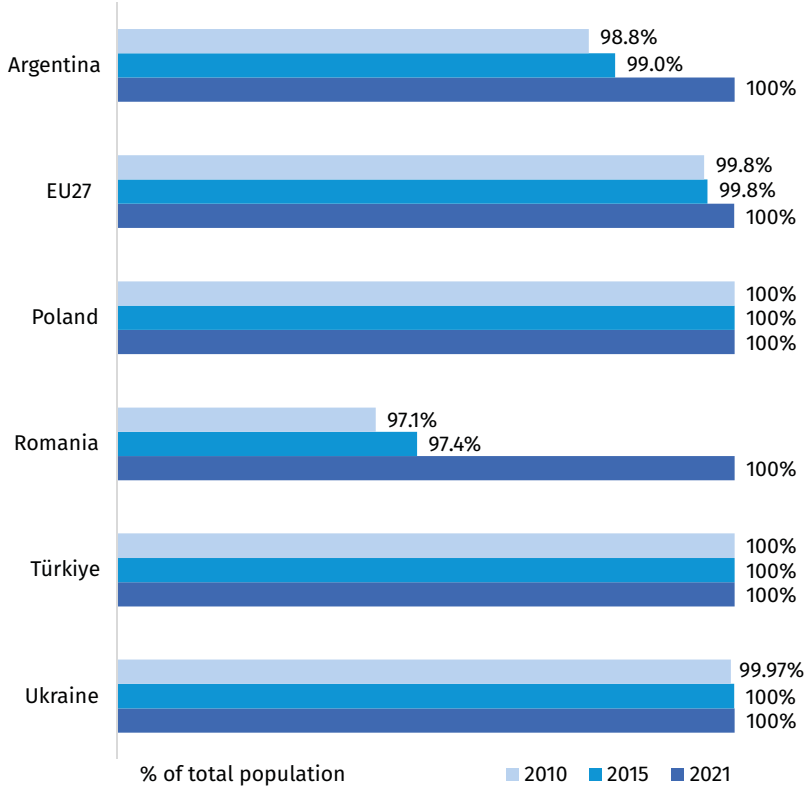
ACCESS TO ELECTRICITY

Access to electricity is at the core of any country's economic and social development. As expressed through SDG 7, the main goal is to ensure access to affordable, reliable, sustainable and modern energy for all. This is an essential element for the reproduction of life and the development of productive activities.

The energy sector has played a crucial role in Ukraine's economic growth and national security. The energy supply sector contributes 7-8 percent to GDP, and the entire population has access to electricity, as illustrated in **Figure 1.44** (World Bank, 2023).

FIGURE 1.44: ACCESS TO ELECTRICITY, BY SHARE OF TOTAL POPULATION, UKRAINE AND COMPARATORS, 2010, 2015 AND 2021

Source: World Bank, *World Development Indicators* database (accessed September 2023).



However, between February and September 2022, the energy sector suffered significant war-related damage and intensified attacks on energy infrastructure continued afterward. Multiple artillery attacks and cyberattacks have impacted Ukraine's integrated energy system, including power generation, transmission infrastructure, and distribution with power generation being the most impaired segment (World Bank, 2023).

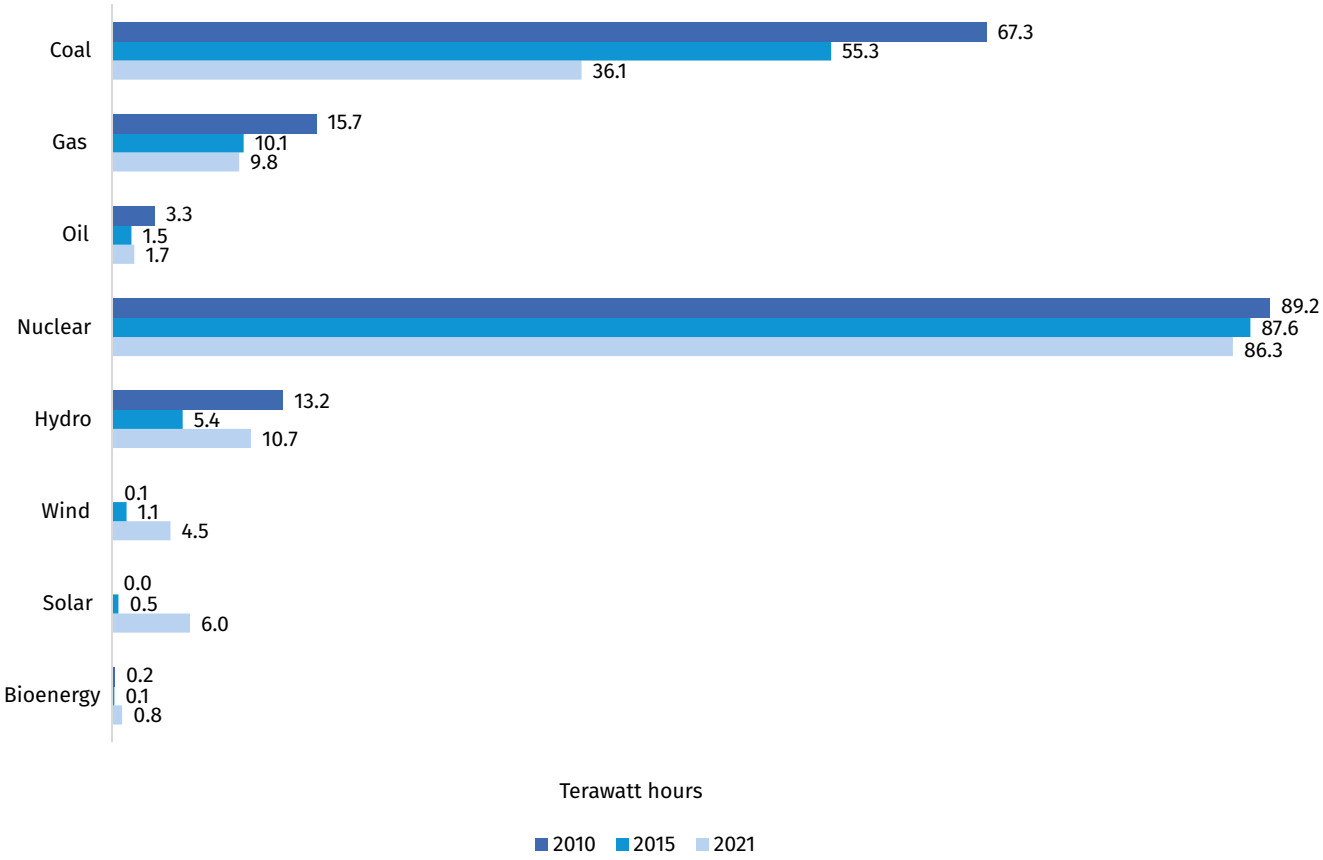
As a result, 12 million people have been left with no or limited access to electricity. According to estimates based on information from UkrEnergo, the average Ukrainian household had to endure five cumulative weeks without electricity service until the end of December 2022 (UNDP, 2023). The total electricity consumption in the country decreased by 31.5 percent in 2022: industry consumption declined by 45 percent and households by 16 percent (Kolisnichenko, 2023)

ELECTRICITY PRODUCTION CAPACITY

Ukraine has enormous potential for power generation, as the country is well endowed with a variety of resources, from oil, coal and gas to renewables. In 2021, nuclear energy represented 55.4 percent of total electricity production, followed by coal (23.2 percent), hydro (6.9 percent), gas (6.3 percent), solar (3.8 percent), wind (2.9 percent), oil (1.1 percent) and bioenergy (0.5 percent) (**Figure 1.45**). This shows the diversity of sources for electricity generation despite the high reliance on nuclear energy.

FIGURE 1.45: UKRAINE'S ELECTRICITY PRODUCTION BY SOURCE, 2010, 2015 AND 2021

Source: IEA (accessed September 2023).



Interestingly, electricity produced from nuclear, coal, gas, oil and hydropower decreased between 2010-2020, whereas solar, wind and bioenergy increased (**Figure 1.45**). This can be taken as a first sign of an incipient transformation towards an energy mix where renewables play a bigger role. **Box 1.6** shares insights about the market structure of the energy sector in Ukraine, as well as about the primary sources of energy available in the country and their potential.

BOX 1.6. MARKET STRUCTURE OF THE ENERGY SECTOR IN UKRAINE

Source: (IEA, 2021) and (CSIS, 2022).

Ukraine's electricity sector comprises separate generation, wholesale market, transmission system operation, distribution and supply entities. Between 2000 and mid-2019, the wholesale electricity market operated under a single-buyer model, with state-owned company Energorynok as the only wholesale trader. In July 2019, to meet the commitments to implement the EU Third Energy Package, Ukraine successfully switched from a single-buyer model to one with a more competitive power market structure. Most thermal generation plants have been partially or fully privatized, with the private company DTEK controlling the bulk of the market. UkrEnergo, Ukraine's state-owned national electricity company, owns and operates the United Energy System of Ukraine (UES), including transmission networks and interconnections with neighbouring countries. The distribution system was also unbundled into distribution system operators (DSOs) and electricity supply companies. Since 1995, most DSOs and electricity supply companies have been owned by private investors (domestic and foreign). Primary sources of energy available in Ukraine are as follows:

Nuclear: Nuclear energy represented around 54 percent of Ukraine's electricity production in 2019. The net nuclear capacity in Ukraine is 13.1GW, representing only 28 percent of the country´s installed electrical capacity. However, insufficient transmission capacity limits the output of some of the four nuclear plants. All plants are owned and operated by Energoatom.

Coal: The country has approximately 300 mines. Many profitable ones have been privatized or transferred to concessions (predominantly by DTEK); state-controlled companies own the remaining mines. Most of Ukraine's mines are in the Donbass region, which has been severely affected by the recent political instability and hostilities.

Hydro: The nine large hydropower stations on the Dnieper and Dniester rivers (total installed capacity of 5.9 GW) are all operated by state-owned UkrHydroEnergo. "Hydro generation is important for the electricity system stability since it provides peak-load supplies, regulates the frequency and capacity of the system, and offers the emergency reserves that outdated fossil-fueled power plants cannot guarantee." (IEA, 2021).

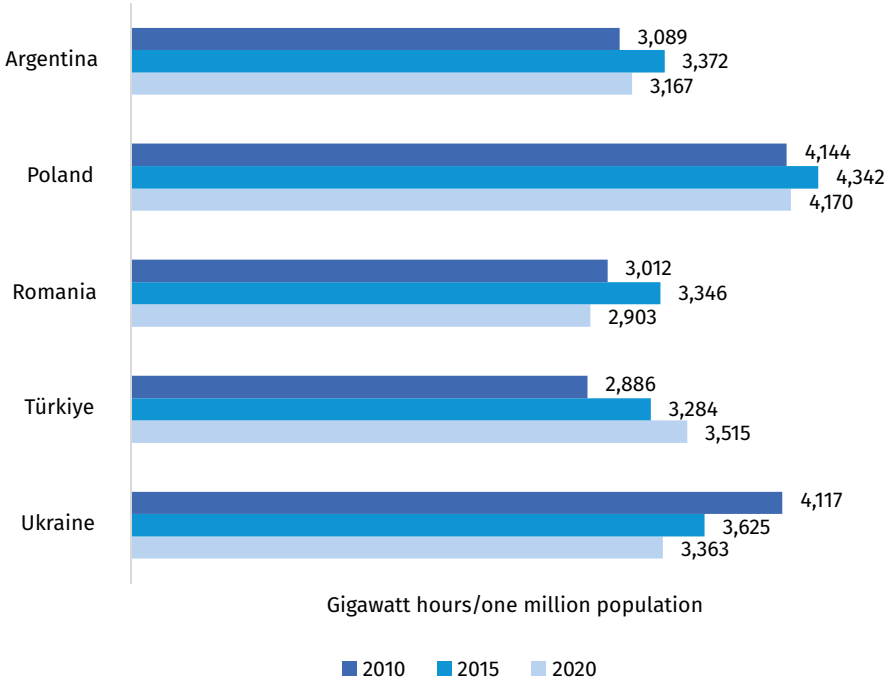
Oil and gas: The state-owned NJSC NaftoGaz was, until 2020, vertically integrated and engaged in the entire cycle of gas and oil exploration operations in the country. However, to meet the EU Third Energy Package requirements, Ukraine unbundled Naftogaz by transferring the Gas Transmission System Operator of Ukraine (GTSOU) from NaftoGaz to the state-owned Main Gas Pipelines of Ukraine. GTSOU manages the gas transmission trunk lines, but Naftogaz continues to operate the gas storage facilities since unbundling. NaftoGaz and its 11 subsidiaries hold the largest share of all oil and natural gas produced in Ukraine.

Renewables: Ukraine experienced a significant increase in renewable energy generation from 2018-2019. Hydro, solar, wind and biomass are the primary sources of renewable energy generation, although the increase has been driven by wind and solar, with biomass arising in more recent years. Ukraine´s total wind power potential is between 16 and 24 GW. Before the war, companies planned to invest in wind capacity generation, and 91 turbines were added in 2021. In terms of solar development, the southern and southwestern regions of the country boast the highest potential due to the solar irradiance level. Biomass also constitutes a promising source, considering the country's agricultural resources.

In general, the electricity production capacity of Ukraine was among the highest in 2010, compared with the benchmark countries (4.117 GWh per one million inhabitants) (**Figure 1.46**). However, the capacity decreased continuously until 2020 to 3,363 GWh. The impact of the war further aggravated this downward trend. Power generation capacity fell from 37.6 GW at the beginning of 2022 to 18.3 GW by April 2023, mainly due to the limited reserve generation capacity, the low maneuvering capacities, and the dire conditions of the transmission network capacity (UNDP, 2023).

FIGURE 1.46. ELECTRICITY PRODUCTION PER MILLION POPULATION, UKRAINE AND COMPARATORS, 2010, 2015 AND 2020

Source: World Bank, *World Development Indicators* database (accessed September 2023).



Based on UkrEnergo data, electricity production (all sources) between January and April 2023 was 32.5 percent lower than in the same period in 2021 due to missile attacks on energy infrastructure and a drop in electricity consumption (UNDP, 2023). However, electricity generation increased by 9.7 percent in the first quarter of 2023 compared to the fourth quarter of 2022. This suggests that the situation in the power system has been temporarily stabilized due to the efforts of Ukrainian power engineers and the support of international partners. The improvement of the energy production capacity and the partial restoration of electricity transmission and distribution networks ameliorated the operational security of the power system and reduced the risk of shortages (UNDP, 2023).

The industrialization process that the country is keen to promote will need to be powered, ideally through an expansion of renewable energy. Even though there are signs of restoration, government efforts will be crucial to enhance energy generation capacity and the entire integrated energy system. Specific programmes are designated in the National Recovery Plan 2022 to achieve this. Moreover, in April 2023, the government approved the National Energy Strategy, aligned to the SDGs, which defines as objectives and priorities the following:

- **Energy security and independence.** The goal is to increase the power generation capacity to transform from an energy shortage to a net excess energy supply ready for export.
- **Green transition and decentralization.** Developing carbon-neutral generation capacities and further harmonizing with the EU markets will provide affordable, reliable and modern energy.

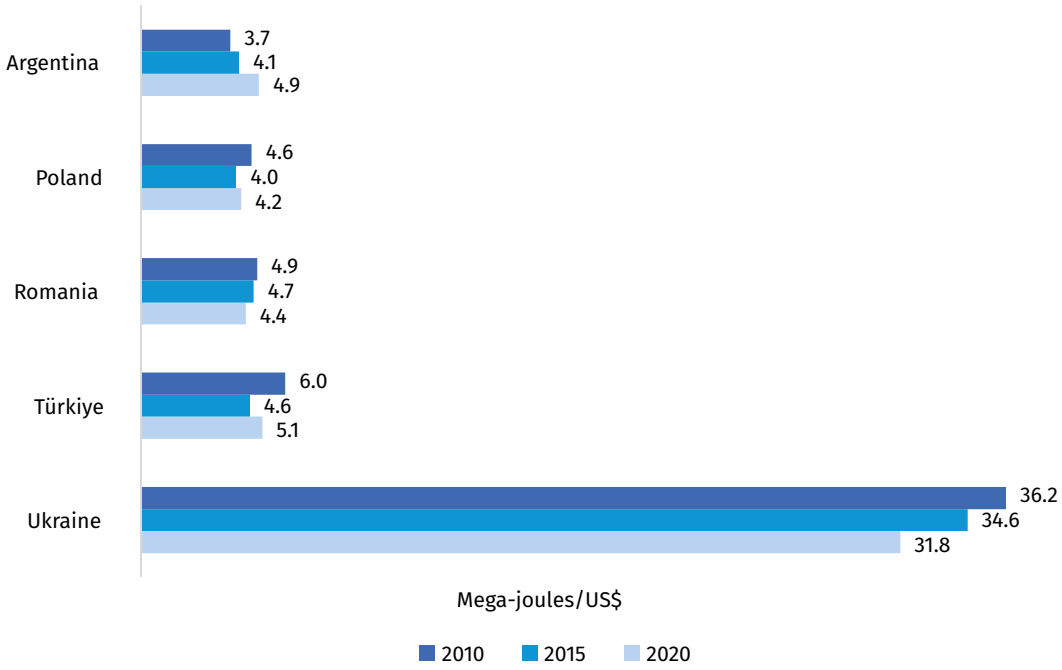
INDUSTRIAL ENERGY USE INTENSITY

Industry is one of the main sectors responsible for Total Final Energy Consumption (TFEC) in Ukraine, accounting for 33.7 percent of TFEC in 2010 and 33.4 percent in 2020. Within industry, the subsector that has contributed the most to the TFEC was the manufacture of basic metals (83.4 percent in 2020). Analysing industrial energy-use intensity is vital to understanding a country's energy efficiency level benchmarks.

Figure 1.47 indicates that Ukraine's industry energy-use intensity is around 6-7 times the level seen in comparator countries. Ukraine's industry needed 36.2 MJ of energy to generate 1 US$ of industrial value added in 2010. By 2020, this figure had decreased by around 12 percent (to 31.8 MJ/US$) but was still far more than the intensity of industry energy use elsewhere. Initiatives to promote energy efficiency could help Ukraine's industry to embark on a trajectory of more sustainable development, with a potential bonus in the form of a boost in competitiveness. Moving away from high energy-intensive industries towards lower energy-intensive ones would also improve the balance.

FIGURE 1.47: ENERGY USED PER UNIT OF INDUSTRIAL VALUE ADDED, UKRAINE AND COMPARATORS, 2010, 2015 AND 2020

Source: UNIDO elaboration, based on IEA (industry energy used) and World Bank, *World Development Indicators* database (industry value added) (accessed September 2023).



According to the International Energy Agency's (IEA) profile of Ukraine, the country has significant untapped energy efficiency potential, and the industrial sector shows the greatest opportunity. Should industrial energy-use intensity decline to the EU average, energy savings could be enormous (IEA, 2021).

RENEWABLE ENERGY

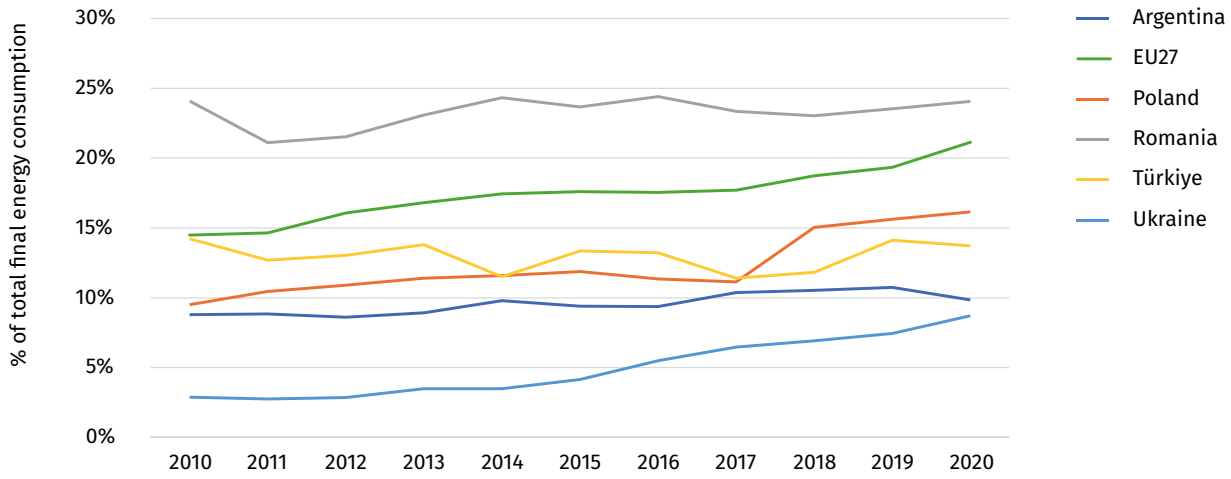
Energy efficiency measures can contribute to a green industrialization process. In addition, promoting renewables over other sources can support climate neutrality, reduce environmental damage caused by fossil-fuel extraction and utilization, and increase resilience by lowering reliance on fossil fuels.

As shown earlier in this section, Ukraine´s energy production relies heavily on fossil fuels, which accounted for approximately 86 percent of total use in 2021. Renewable sources together represented 14 percent in 2021, more than three times their share in 2010 (when it stood at 4.4 percent). Most of the increment came from expansions in solar and wind power. Due to the high potential that the country has for hydro, solar and wind power, renewables could constitute the building blocks of Ukraine's future energy system, contributing to nearly 80 percent of total energy generation by 2050 (UNECE, 2023).

In line with this, **Figure 1.48** shows the share of renewable energy consumption in TFEC,[15] where Ukraine has the lowest share but the most impressive upward trend. More precisely, renewables increased their share in Ukraine's total energy consumption from 2.9 percent in 2010 to 8.7 percent in 2020. This has helped reduce the gap with countries like Türkiye and Argentina and fall in line with the EU trend towards more reliance on renewables. Still, there is some catching up to do vis-à-vis the frontrunners, especially Romania and the EU more broadly, where renewables in 2020 represented 24.1 percent and 21.1 percent, respectively, in TFEC.

FIGURE 1.48: RENEWABLE ENERGY CONSUMPTION, UKRAINE AND COMPARATORS, 2010-2020

Source: World Bank, *World Development Indicators* database (accessed September 2023).



Moreover, war has not spared the renewable energy sector, as important energy infrastructure has been destroyed. By 30 April 2023, the war strongly affected up to 40 percent of renewable energy facilities, mainly in Ukraine's southern and southeastern regions. Solar and wind power generation decreased by one-third. In general, the available generation capacity from renewable sources fell from 8.2 GW at the end of 2021 to 6.3 GW by 30 April 2023 (UNDP, 2023).

At the same time, the challenges generated by the war constitute an opportunity for Ukraine to rethink its energy-sector priorities and come up with a road map to focus, as a first step, on repairing the damage done to the power grid and other energy infrastructure to ensure energy access for all. The second step would be to expand energy production capacity and continue efforts to increase renewable energy participation. This aligns with the need to build back better and greener, while ensuring Ukraine´s energy access, security and independence.

To fully exploit the potential of renewable energy, the country will need to count on substantial financial support from both public and private partners, attract domestic and foreign investment, improve Ukraine´s renewable policy framework, modernize the grid, and have greater storage and export capacity to manage variable generation across the system (CSIS, 2022).

1.4.4 CLEANER PRODUCTION – CO_2 EMISSIONS

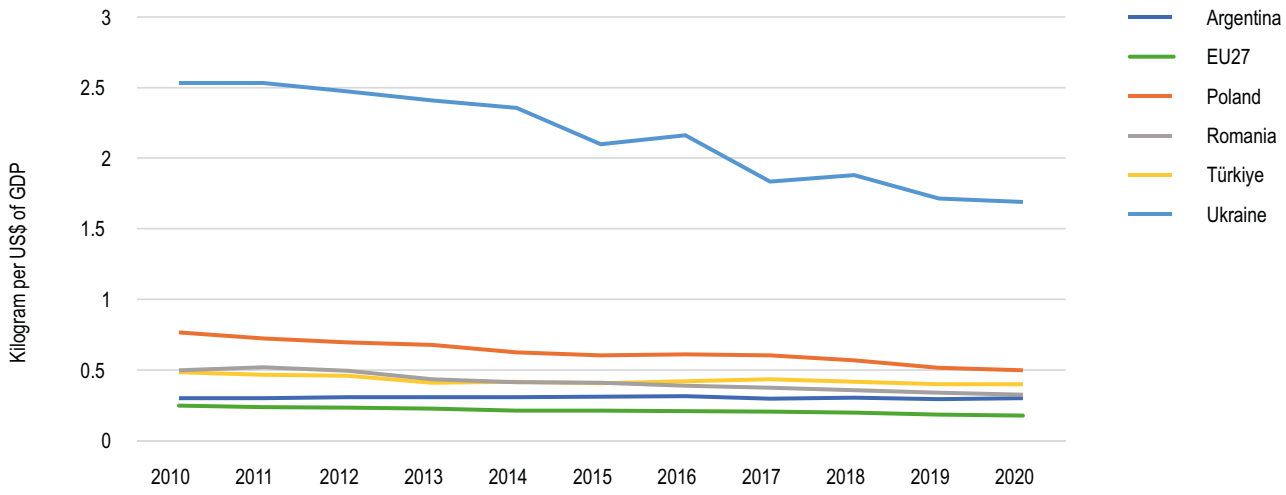
CO_2 EMISSIONS OF THE ECONOMY

Promoting green industrialization by introducing sound environmental practices and moving towards cleaner manufacturing production enables countries to decouple pollution from manufacturing/economic growth and contribute to climate action. SDG 13 calls for urgent action as the planet already feels the impact of climate change, rising temperatures, droughts, natural disasters and biodiversity loss.

The emissions intensity of an economy – the CO_2 emissions generated in a country for each US$ 1 of GDP – indicates how polluting or, conversely, how sustainable current production patterns are. High values indicate the need for more efforts and investment in climate-change mitigation measures. Figure 1.49 presents evidence that, for every US$ 1 of GDP, Ukraine emits much more CO_2 than its comparator countries and the EU. Despite a decline from 2.5 kg to 1.7 kg of CO_2 emissions per US$ 1 of output between 2010-2020, Ukraine's emissions intensity is three to four times higher than that of Poland and Romania'. Moreover, behind this decreasing trend is not only the decarbonization of industry; it is also related to stagnant economic activity, especially after 2014 (with the Euromaidan protests and intensifying tensions with Russia, see **Figure 1.2**).

FIGURE 1.49: CO_2 EMISSIONS INTENSITY, UKRAINE AND COMPARATORS, 2010-2020

Source: World Bank, *World Development Indicators* database (accessed September 2023).

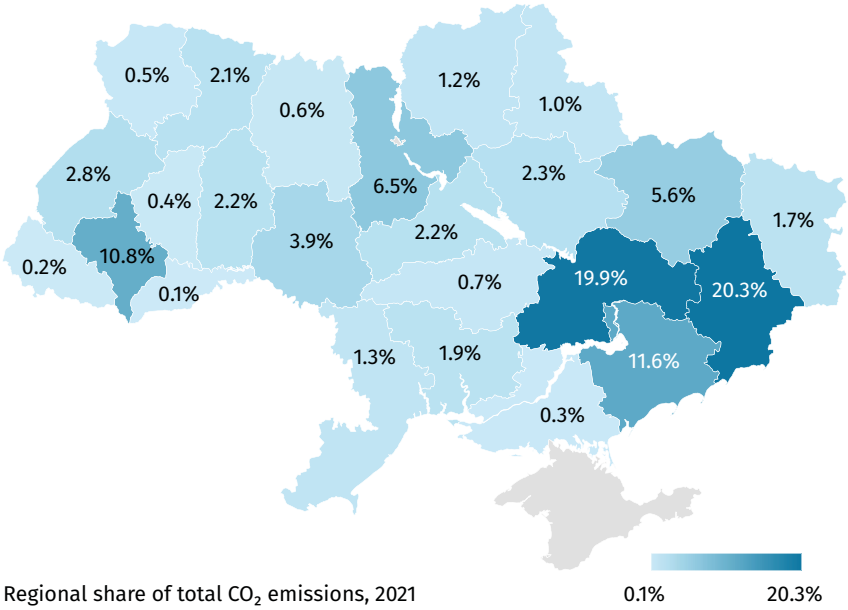


Considering that, worldwide, most of the CO_2 emissions come from using fossil fuels to generate energy, it will be necessary for Ukraine to expand the use of renewable sources to produce electricity. The war has led to a dramatic decrease of 43.7 percent in 2022 as Ukraine's CO_2 emissions declined from 111 million tons in 2021 to 63 million tons in 2022.

Figure 1.50 illustrates that five regions throughout Ukraine were responsible for more than two-thirds of the country's CO_2 emissions in 2021: Donetsk (20.3 percent), Dnipropetrovsk (19.9 percent), Zaporizhzhya (11.6 percent), Ivano-Frankivsk (10.8 percent) and Kharkiv (5.6 percent). Most are in the country's southeast, where significant manufacturing activity took place before the war, and are territories that were among the most affected by the fighting.

FIGURE 1.50: UKRAINE'S CO_2 EMISSIONS, BY REGION, 2021

Source: State Statistics Service of Ukraine (accessed September 2023).



Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

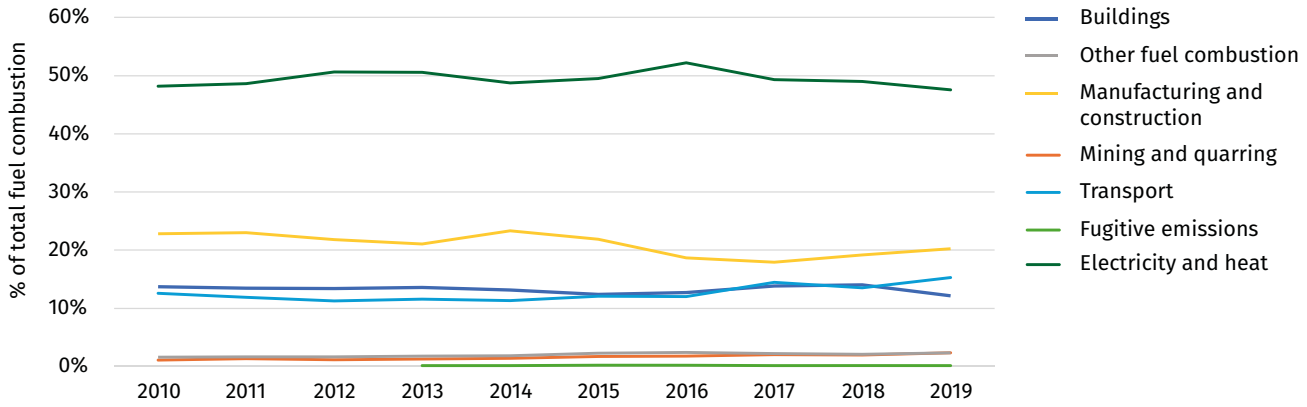
After the full-scale invasion of Ukraine, regions where CO_2 emissions dropped the most include Luhansk (-98 percent), Donetsk (-80 percent), Mykolayiv (-76 percent), Chernihiv (-57 percent) and Kherson (-88 percent). The three first regions are part of the territories where many enterprises were destroyed or relocated westwards. In these cases, the reduction of CO_2 emissions is mainly attributable to the decline in production.

CO_2 EMISSIONS, BY SECTOR, USING FUEL COMBUSTION

In Ukraine, the electricity and heat sector has contributed most CO_2 emissions in the economy, through fuel combustion – on average accounting for 49.4 percent during 2010-2019 – followed by the manufacturing and construction (20.2 percent), transport (15.3 percent) and building (12.1 percent) sectors. The country needs to change its sources of energy generation to decarbonize these sectors (**Figure 1.51**). A comparison with peer countries reveals that the share of the manufacturing and construction sector in total CO_2 emissions was higher in Ukraine (20.2 percent) than in Romania (17.4 percent) and Türkiye (16.9 percent), and significantly above the EU average (13.3 percent). In other words, whereas in the benchmark countries the sector's contribution to pollution is in line with its contribution to output (**Figure 1.8**), in Ukraine, its share in CO_2 emissions exceeded its share in GDP. This is the flip side of the above-average intensity of Ukraine's industry's emissions.

FIGURE 1.51: UKRAINE'S CO_2 EMISSIONS BY SECTOR, 2010-2019

Source: IEA (accessed September 2023).

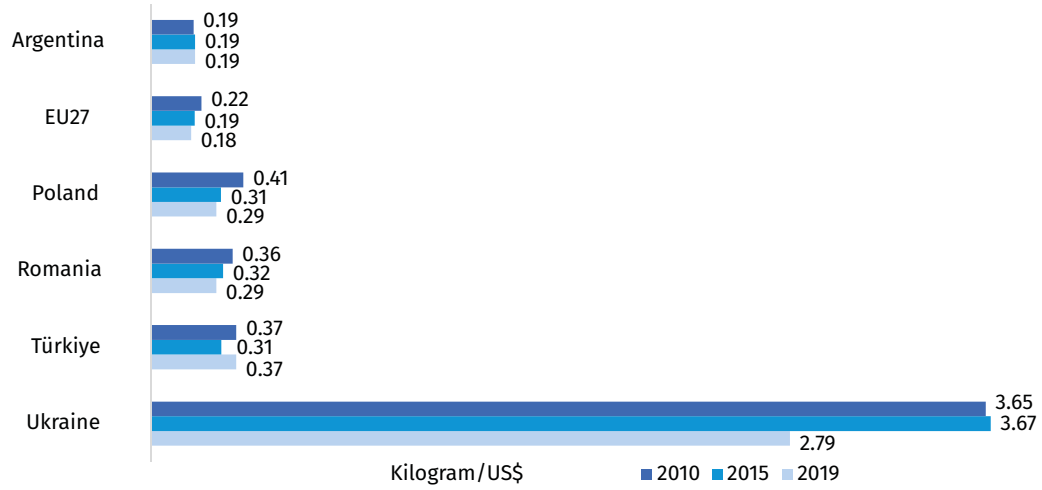


MANUFACTURING CO_2 EMISSIONS INTENSITY

Zooming in on the manufacturing sector more specifically, **Figure 1.52** confirms that Ukraine has recorded the highest intensity of CO_2 emissions in all the years. It shows that for every US$ 1 of MVA generated, CO_2 emissions in Ukraine are 15 times higher than the EU average. In 2019, manufacturing CO_2 emissions in Ukraine reached 2.8 kg per US$ 1 of MVA, one-fifth less than in 2010 but still much more than elsewhere.

FIGURE 1.52. MANUFACTURING CO_2 EMISSIONS INTENSITY, UKRAINE AND COMPARATORS, 2010, 2015 AND 2019

Source: UNIDO, based on OECD (manufacturing CO_2 emission) and World Bank, *World Development Indicators* database (MVA) (accessed September 2023).



In this context, the Government of Ukraine will have to implement initiatives to address the decarbonization of manufacturing while reconstructing the sector. The Strategy of Environmental Safety and Adaptation to Climate Change until 2030 outlines strategic goals where the need to address industrial pollution is clearly stated. The introduction and diffusion of clean technologies and lower-carbon industrial processes will play a key role herein. Moreover, the National Recovery Plan 2022 also establishes a programme to support a zero-carbon energy transition in line with the EU strategy.

1.4.5 WASTE GENERATION AND MANAGEMENT

MUNICIPAL SOLID WASTE GENERATION

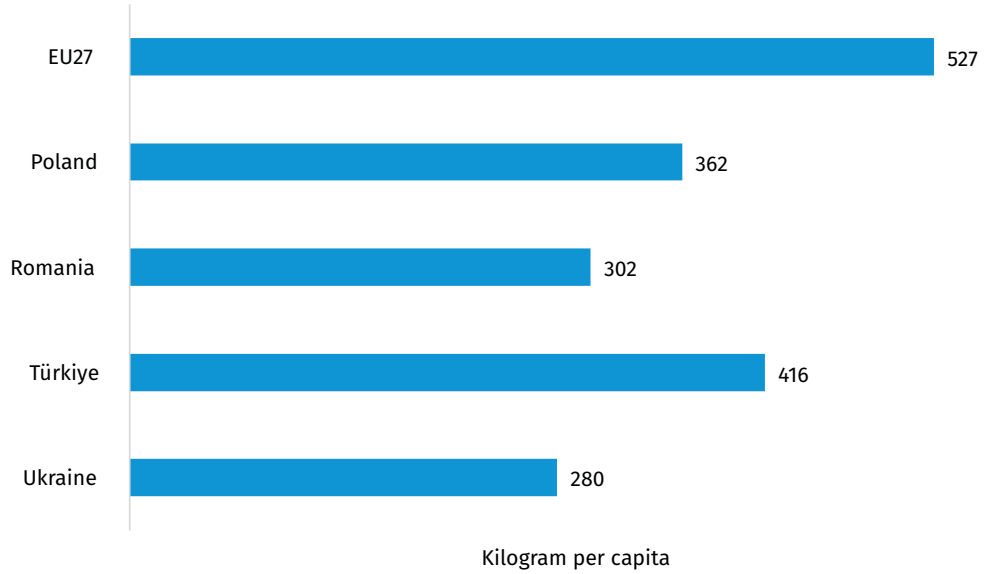
Waste management and reduction are critical to promoting sustainable industrial development and environmental safety. The circular economy is a paradigm that aims to contribute to these. One of its principles is to eliminate waste from production processes or at least minimize it. However, wherever waste is generated, it should be possible to recycle it and recover materials that, converted to new resources, could be reintroduced into the production cycle. This is at the centre of the new production and consumption models that countries are promoting to address the current environmental challenges related to resource and material depletion, pollution and loss of biodiversity, but that also have significant economic and social benefits. In line with this, SDGs 11 and 12 are about making cities and human settlements inclusive, safe, resilient and sustainable, as well as ensuring sustainable consumption and production patterns.

According to Kovalenko et al. (2022), of the total annual amount of waste generated in Ukraine (462 million tons of waste), 79.5 percent is from the extractive industry, 6 percent from metallurgy, 2.5 percent solid waste, and 1.6 percent agricultural waste. Solid waste is one of the most difficult to manage, especially in countries like Ukraine, where most waste is taken to landfills (most of them unauthorized), and the value that can be recovered gets wasted.

Figure 1.53 shows the level of municipal solid waste (MSW) generation per capita to be lower in Ukraine (280 kg) than in benchmark countries and the EU (527 kg) in 2021. Despite this, solid-waste generation in Ukraine is one of the leading threats to environmental safety. The volume of waste generation, including chemicals and hazardous substances, has grown in the country, and unauthorized landfills are significantly expanding (DLF, 2021).

FIGURE 1.53: MUNICIPAL SOLID WASTE (MSW) GENERATION PER CAPITA, UKRAINE AND SELECTED COMPARATORS, 2021

Source: National Waste Management Strategy until 2030 for Ukraine (2019) and *Eurostat* for other countries (2021).



Note: Ukraine's data is for 2019, while the rest is for 2021.

MUNICIPAL SOLID WASTE COMPOSITION

The composition of MSW is a relevant determinant of a country's necessary waste-management system. It defines requirements for collection and disposal systems and measures in MSW management. A more diversified composition implies that more segregated collection methods exist. Therefore, more complex treatment options are possible, too. This indicator is also useful when MSW recycling is to be implemented.

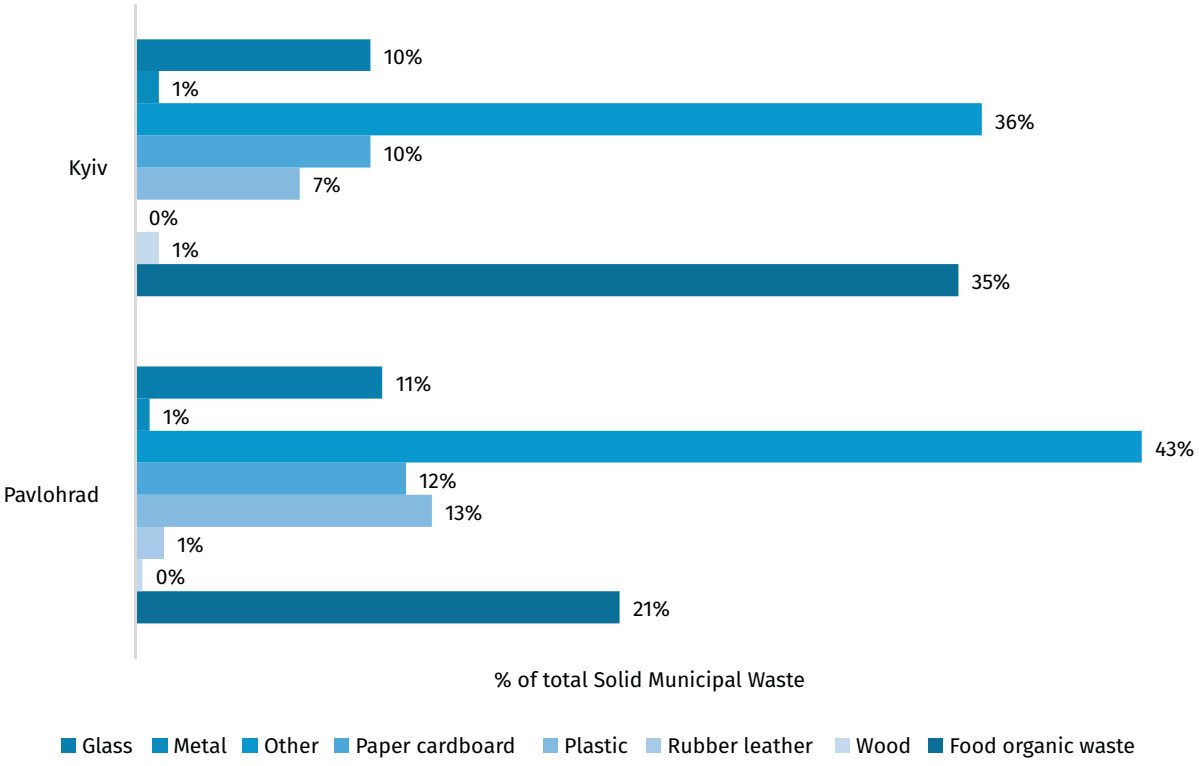
Data availability for Ukraine only allows analyse of the composition of MSW for just two cities, Kyiv and Pavlohrad. **Figure 1.54** shows that in Kyiv, other waste (unsegregated) was the leading group, representing 36 percent in 2019, followed by organic waste (35 percent), glass (10 percent), paper cardboard (10 percent), and plastic (7 percent).

This implies that in terms of treatment options, the biggest opportunity for waste valorization (converting waste to more useful materials) is to implement waste-to-energy with unsegregated waste and composting techniques with organic waste. Therefore, the MSW composition limits the value that recycling can recover. The same applies to Pavlohrad, which has a similar MSW composition.

When this composition is compared with EU countries, these countries (especially the developed ones) tend to have less organic waste and a wider variety of waste than can be recycled. The recycling rate for EU countries was 31 percent in 2021. According to the State Statistics Service of Ukraine, in 2019 only 0.14 percent of waste was recycled (DLF, 2021). Collection, segregation and treatment techniques will have to improve in the country to increase the potential to recover more MSW value.

FIGURE 1.54: MUNICIPAL SOLID WASTE (MSW) COMPOSITION OF KYIV AND PAVLOHRAD, 2019

Source: World Bank *What a Waste Global* database (accessed September 2023).



MUNICIPAL SOLID WASTE (MSW) MANAGEMENT

In light of the challenges that waste generation and management implies for Ukraine, in 2017 the government approved the National Waste Management Strategy until 2030. The strategy's primary goal is to reform and improve the waste-management system considering EU approaches. Among other things, this strategy foresaw the establishment of regional waste disposal centres, the adoption of circular economy principles and laws for its enforcement (e.g. extended manufacturer´s liability), and the introduction of the 5-step waste management hierarchy introduced in the EU to promote waste prevention rather than waste disposal (DLF, 2021). At the same time, the National Waste Management Plan until 2030 was created to implement the strategy, but households and legal entities usually violate several points. Regulations governing waste management have also been developed. However, they do not consider updated definitions of industrial and household waste, imposing a real challenge to establishing an effective waste-management process (Kovalenko, et al., 2022). As a complement, the Strategy of Environmental Safety and Adaptation to Climate Change until 2030 outlines the creation of a legal and economic framework for implementing a waste-management system (EU/UNDP, 2021).

Despite these initiatives, Ukraine's waste-management system faced challenges even before the war, when its coverage rate was only 79 percent. The war caused significant damage to the solid waste management sector and disrupted the entire waste-management service network. Damage was estimated to be the largest in the Luhansk, Donetsk, Kharkiv, Kherson and Zaporizhzhya regions (World Bank, 2023). This has critical implications considering that just to initiate recovery and reconstruction, debris removal and demolition will have to occur, directly linked to the solid-waste sector capacity.

In this context, the National Recovery Plan 2022 for Ukraine contemplates implementing a programme to rebuild a clean and safe environment, where one of the specific projects will focus on the restoration and development of waste-management infrastructure. For all the initiatives to increase effectiveness, it will be essential for the government to attract investment and mobilize financial resources. (National Recovery Council, 2022).

1.4.6 FOREST AREA

FOREST AREA AND NET CHANGE RATE

SDG 15 recognizes how important it is to protect, restore and promote the sustainable use of terrestrial ecosystems to manage forests sustainably, combat desertification, and to halt and reverse land degradation and biodiversity loss. Protecting its forest area is highly relevant for Ukraine, considering it is an agro-industrial country with low woodland coverage. Forests comprised only 16.7 percent of Ukraine´s national territory in 2020 (slightly up from 16.5 percent in 2010). By contrast, in the EU forests occupied 40 percent of the land surface in 2020, i.e. 2.4 times more than in Ukraine.

Due to the low share of forest area and the high level of erosion caused by the plowing of agricultural lands, protective afforestation is crucial. Thanks to various afforestation projects in eroded agricultural land, Ukraine's forest area has marginally increased yearly (ATIBT, 2021). **Figure 1.55** shows the net change rate of forest area for Ukraine and comparators between 2010-2020. Except for Argentina, Ukraine and the other countries (including the EU) increased their forest area during the period; however, Ukraine registered the lowest increment (0.2 percent).

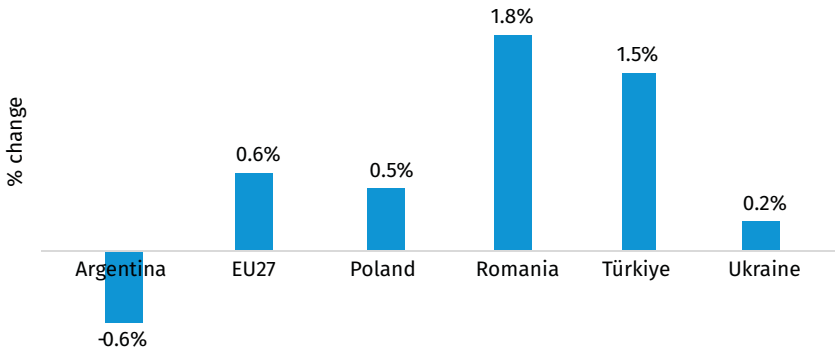
In this already vulnerable context, the war had severe repercussions. Around 30 percent of all protected areas of Ukraine suffered from military actions, and forests have been destroyed by fires from shelling, many being littered with destroyed or abandoned military vehicles (OECD, 2022b). In addition, deforestation is accelerating compared with the pre-war period for at least two reasons: as a result of the destruction of the energy system, a larger number of people are stockpiling firewood for the winter, and military forces are also logging forests. Finally, productive forests, mainly agricultural land, have been occupied or destroyed (UWEC, 2022).

While environmental damage from the war is evident, its magnitude is difficult to measure. To tackle this challenge, the National Council for Recovery, with the support of a working group on environmental safety, identified five priority areas for action: (1) reforming public environmental administration; (2) climate-change mitigation and adaptation policy; (3)) environmental safety and effective waste management; (4) sustainable use of natural resources; and (5) conservation of natural ecosystems, preservation of biological diversity, and restoration and development of protected areas (OECD, 2022b).

In addition, it will be necessary for Ukraine to establish a clear regulatory framework that will foster the sustainable management of the country's forest area while promoting industrial activity related to the wood and food sectors, which have considerable economic potential.

FIGURE 1.55: FOREST AREA NET CHANGE RATE, UKRAINE AND COMPARATORS, 2010-2020

Source: World Bank, *World Development Indicators* database (accessed September 2023).



1.5 KEY FINDINGS AND IMPLICATIONS FOR INDUSTRIAL POLICY

A mix of achievements and challenges has marked Ukraine's history. Despite all the political instability, economic stagnation, corruption and armed conflict, its economy has good opportunities to grow. The country possesses fertile land, significant natural resources (grains, oilseeds, metals), good climate conditions and a strategic geographical location at the crossroads of Europe and Asia. More importantly, it has critical assets based on its entrepreneurial culture and skilled labour force that, through the years, have demonstrated resilience and willingness to transform the country.

Currently, many of these opportunities are overshadowed by the catastrophe of war and the fact that the country has gone through a process of deindustrialization over the last few years that has influenced the deceleration of the economy. The latter has been prompted by several factors, such as the lack of a systemic industrial policy to guide the development of the sector in the long run; the overreliance on commodities motivated by high prices and international demand (e.g. iron, steel, cereals); the political conflict faced in 2014 and the COVID-19 pandemic that disrupted the production processes, especially for manufacturing industries where global supply chains were highly affected; as well as the systematic loss of skillful workforce due to political/military conflicts and the low levels of investment required to trigger innovation, technological upgrading, equipment modernization and productivity.

The development of a vibrant industrial sector will be vital for Ukraine to reactivate the economy, recover from the war and embark on a process of inclusive and sustainable growth, considering the capacity of this sector to create benefits further discussed in this section.

The primary key findings and policy implications are presented below based on the macro analysis conducted in this block.

DEINDUSTRIALIZATION IN UKRAINE IS A RECURRING CHALLENGE

Historically, Ukraine has faced challenges that have threatened the economy and triggered a deindustrialization process that started before the war. This points to the need to reignite a process of structural transformation towards more greener manufacturing.

During 2010-2021, Ukraine's GDP per capita has practically remained unchanged. While the service sector dominates the economy (60.3 percent of GDP in 2021), agriculture (12.4 percent) and manufacturing (12.0 percent) are also relevant to promote economic growth. However, compared to 2012, by 2021 manufacturing value added had declined in terms of its share in GDP and absolute values (both at constant and current prices), manifesting a deindustrialization trend.

In this context, the war had a further dramatic impact on the country's economy, with GDP per capita slumping by almost a fifth (-18.3 percent) in 2022 and manufacturing output dropping by 43.2 percent compared to 2021. Among the significant consequences of the war that most affected the manufacturing performance are (1) the destruction of industrial facilities and energy infrastructure, which impaired production capacity; (2) a drop in domestic market demand; (3) labour shortages due to mobilization and the departure of population abroad; (4) disruption of supply chains; (5) an increase in the logistics cost of export processes; and (6) a significant shortage of capital.

POLICY IMPLICATIONS

This calls for policy actions to promote industrial development and the recovery of the economy by triggering a structural transformation towards more manufacturing to reap the positive externalities associated with an expansion of this sector, including innovation and productivity growth, knowledge spillovers, skills development, employment creation, forward and backward linkage generation, and technological upgrading. As experience elsewhere has shown, success will require the government's close coordination and cooperation with and targeted support to the private sector.

Loss of manufacturing employment even before the war is also a result of Ukraine's deindustrialization, which calls for urgent actions to promote quality job creation.

In 2010, manufacturing jobs accounted for 26.9 percent of total employment in Ukraine, positioning the country favourably compared to some peer countries. However, by 2021, this share had declined to 24.5 percent. The war exacerbated this downward trajectory, and in 2022, manufacturing's contribution to employment plummeted to 15.5 percent, equivalent to a staggering loss of 2.4 million jobs. The principal factor behind this decline is the nation's diminishing population. The conflict has sparked a mass exodus of refugees and accelerated the overall shrinking of the population. As of May 2022, the conflict had displaced approximately 13 million individuals, including 6.8 million refugees who sought sanctuary in neighbouring countries. Among those who left the country or relocated internally are highly skilled workers and professionals.

Within manufacturing, the top five subsectors in terms of workforce size are food and beverages, machinery and equipment, basic metals, chemicals, and non-metallic mineral products. However, employment in all these subsectors declined between 2010 and 2021, with basic metals significantly decreasing. This was insufficiently compensated by job creation in other subsectors, most notably in the office, accounting, and computing machinery; motor vehicles; and wood products industries. It can be expected that food and beverages will face further job shedding during wartime, attributed to the adverse effects of the ongoing conflict on the agriculture sector, which is a vital source of food processing.

POLICY IMPLICATIONS

In this context, it will be crucial for Ukraine to implement an industrial policy to promote quality job creation in more labour-intensive sectors that simultaneously have good potential for value addition and differentiation, including food processing, wood products and the construction industries. Going forward, allocating resources for vocational and technical training programmes will be imperative to enhance the skills of the manufacturing workforce while ensuring alignment with the demands of the industry. To improve the odds, oblasts and municipalities should participate in policy action, mainly by providing financial support to regional vocational and technical education institutions. Support programmes to bring back brains will also need to be considered.

THE NEED FOR DIVERSIFICATION AND COMPETITIVENESS TO CRAFT A RESILIENT ECONOMY

Manufacturing activity is highly concentrated in a few (mostly resource-based) subsectors and a handful of regions only. This has meant a heightened economic vulnerability against shocks in these subsectors and locations. Deepening the structural transformation by improving existing medium-

and high-tech (MHT) subsectors and diversifying into new ones while also rebalancing the regional distribution of manufacturing production will provide more sources of sustainable growth.

The high concentration of manufacturing activity in a few oblasts (Kyiv, Dnipropetrovsk, Donetsk, Zaporizhzhya and Kharkiv) has increased the country´s economic vulnerability. Together, they accounted for 60.5 percent of national MVA in 2021. Since most of them are in the east and southeast parts of the territory, where the war created the most damage, manufacturing production ended up suffering severely.

In addition, the manufacturing sector in Ukraine relies heavily on five main subsectors: food and beverages, basic metals, machinery and equipment, chemicals, and non-metallic mineral products. This has made economic progress strongly dependent on the performance of these subsectors, making them susceptible to internal and external shocks affecting these subsectors. The fact that among these five subsectors, three are resource-based (food and beverages, basic metals, and non-metallic mineral products) enhances vulnerability even further as these subsectors are typically more exposed to price fluctuations, climate conditions and dramatic changes in international demand, among challenges.

In this scenario, the war provoked a slump in overall manufacturing production by 20 percent. However, the impact of the war was not felt equally in all subsectors. Among the most severely impacted ones, with drops in production of 60 percent or more, were industries producing coke and refined petroleum products, basic metals, other non-metallic mineral products, chemicals, as well as machinery and equipment. The basic metal industry is also where industrial assets were almost destroyed. This means that four of Ukraine‘s five main manufacturing subsectors were harmed significantly.

POLICY IMPLICATIONS

Based on government strategic decisions, regions located close to the front line (Dnipropetrovsk, Donetsk, Zaporizhia, Luhansk, Mykolaiv, Odesa, Sumy, Kharkiv, Kherson and Chernihiv) will require support to promote industrial development. The government should allocate resources to local budgets, which will help to strengthen regional capabilities. Nevertheless, rebalancing the distribution of productive activities more evenly across Ukraine’s regions will help lower vulnerability, increase resilience, and make industrialization more (regionally) inclusive. With the relocation of enterprises to the country’s northwest, this process has already started but needs to be potentiated. To achieve this, regional and municipal governments should take on a more active role in promoting productive development in their jurisdictions. Despite growing attention toward governance decentralization, neither private sector actors nor policymakers view municipalities as playing a significant role in industrial development. Overcoming this will probably require an increased awareness of the importance of local authorities and the strengthening of necessary governance and policy capabilities at municipality and oblast levels. Implementing commercial diplomacy between big business, municipal and state authorities can be another important puzzle. Such efforts can build on the “smart specialization strategies” (which set out an industrial and innovation framework that shows how public policies can influence the economic, scientific and technological specialization of a region) and the „Community Passport“ for the development of industrial infrastructure – which contain information about existing industrial markets and priority industries and which are sent to international investors and partners – that some Ukrainian regions started to develop since 2015.

POLICY IMPLICATIONS

As for the subsectoral rebalancing, it will be strategic to deepen the structural transformation process by improving the existing MHT sectors and diversifying towards new MHT industries, considering the positive externalities they can generate. At the same time, the revitalization of resource-based subsectors like food processing – where Ukraine has comparative advantages and which are vital for other policy objectives such as food security, employment generation and value-added creation – should not be neglected. Through innovation and the adoption of advanced digital ("industry 4.0") technologies, the food sector and other promising natural resource-based industries (e.g. wood products and furniture) can also increase processing, sophistication and product differentiation.

Finally, accelerating the recovery of the production infrastructure is crucial to advancing the diversification and sophistication of production. For example, it looks advisable to bet on a network of small oil refineries to increase the self-supply of basic inputs for production in critical moments and to provide government assistance in creating mini-production complexes and setting up a network of mini-metallurgical plants. These mini-plant projects bring several advantages related to less capital expenditures, less power consumption, less area for the establishment of plants, less demand for skilled labour and less time needed for design and construction, among others.

Mirroring the country's productive structure, Ukraine's manufacturing exports are also concentrated in a relatively small number of subsectors/product groups and markets. This low degree of export diversification has affected the economy's resilience, indicating the need to establish an integral diversification strategy aligned with EU principles.

Ukraine's manufactured export basket is not highly diversified. It is dominated by a few product groups, with the top five making up nearly 80 percent of export revenues between 2010-2021. What is more, their dominance has even slightly increased over the years. In 2021, the ranking of manufactured exports was topped by basic metals, food and beverages, chemicals, electrical machinery, and machinery and equipment. The first two alone accounted for 61.6 percent of total manufactured exports. However, the war decimated the export of basic metals (which plummeted by -62.2 percent between 2021 and 2022).

Ukrainian exporters of manufacturers, moreover, have been heavily dependent on just a few foreign markets. In 2010, around half of the total manufactured exports went to just five markets (Russia, Türkiye, Italy, Belarus and Germany). On the upside, by 2021 Ukraine had managed to decrease the share of the top five export destinations in total trade to 35 percent. Moreover, the ranking changed significantly as shipments to Russia shrank to 7.5 percent, giving space to other export destinations such as Poland, China and India. With the onset of the war in 2022, Russia disappeared from Ukraine's export market map.

POLICY IMPLICATIONS

For the country to embark on a more profound process of industrial development, reduce vulnerability to external shocks and increase resilience, it will be critical to establish an export diversification strategy that increases the number of products traded and opens new markets while intensifying trade relations with existing partners.

POLICY IMPLICATIONS

The strategy to achieve EU integration and better access to the EU and G7 markets has the potential to support export diversification. However, Ukraine´s recovery and modernization plan must align with core EU principles related to the rule of law, product quality and safety, the green transition, and digital transformation.

Overall, the trade competitiveness of Ukraine's manufactures has decreased in international markets. However, while the war intensified this challenge, some regions increased their exports. It is crucial to improve the manufactured export capacity and competitiveness by facilitating market access and strengthening product quality and compliance with market requirements and international standards, among other elements.

The share of manufactures total merchandize exports has decreased from 84 percent in 2010 to 65 percent in 2021. Over the same period, Ukraine's manufactured export capacity – measured as export value per capita – has been limited and stagnant. In 2022, the war made the manufacturing sector's contribution to total goods exports decline to 60 percent. Ukraine fell even further behind the EU (as a regional benchmark) in its manufactured export capacity.

It is worth noting, though, that this pattern does not apply to all regions. Whereas heavily damaged industries in the southeastern regions of Donetsk, Luhansk, Kherson, Mykolayiv, Kharkiv and Dnipropetrovsk saw a significant decline in their exports, other regions (including Cherkasy, Odesa, Chernivtsi, Vinnytsya, Zakarpattya, Ternopyl, Rivne and Lviv) reported an increase in their exports. This reflects the resilience of industry but also the relocation of enterprises from eastern to western regions.

POLICY IMPLICATIONS

Solid and coordinated efforts from both public and private sectors are required for Ukraine to repair its competitiveness and strengthen its capacity to export manufactures faster. The prospect of EU integration and access to the EU and G7 markets will probably promote this. However, several challenges will need to be addressed, in particular ensuring the harmonization of Ukrainian and EU legislation (adaptation of and compliance with standards and regulations on product quality and safety); accelerating industry decarbonization, especially for export-oriented industries; strengthening conformity assessment services, related to product testing and certification, reducing obstacles for business in obtaining permits; access to trade finance; modernization of infrastructure; upgrading of firms' technical and technological base; expansion of cross-border business ties and economic policy networks; and the creation of joint transnational industrial companies that manufacture products with high added value.

TECHNOLOGICAL UPGRADING, INNOVATION, DIGITALIZATION AND INVESTMENT AS KEY DRIVERS OF INDUSTRIAL GROWTH

Ukraine's industry has been lagging regarding technological upgrading and innovation. The brain drain triggered by the war has imposed additional challenges. Policy measures to facilitate the development, adoption and diffusion of modern technology and the transfer and absorption of foreign techno-

logy will be crucial to spur much-needed productivity growth and spillovers. Creating awareness about the benefits of innovation and strengthening the institutional set-up – especially the cooperation between business and research bodies such as universities, technical colleges and research institutes – will help producers advance on the technology ladder and create value addition.

Manufacturing activities considered medium- and high-tech (MHT) play a relatively minor role in the country's productive and export structure. In 2021, they contributed only a bit more than one-quarter to overall MVA and roughly one-fifth to total manufactured exports. Chemicals, machinery, motor vehicles and other transport equipment are Ukraine's most important MHT industries. From these, chemicals were the most affected by the war due to the loss of personnel and worn-out equipment that cannot be restored after stopping its operation.

When analysing the role of innovation, a crucial requirement for technology upgrading, it is clear that even before the war, Ukraine did not prioritize it. R&D expenditure in total GDP dropped from 0.8 percent in 2010 to 0.4 percent in 2020, so Ukraine fell behind a range of peer countries (let alone the EU). The war has brought several new challenges in this area as scientists fled their homes and relocated within Ukraine or abroad. It is estimated that approximately 10 percent of researchers have left the country since the beginning of the war. Others have joined the army or were killed in the fighting. Future repercussions of this brain drain might be even more dramatic.

POLICY IMPLICATIONS

All these developments have important policy implications since the overreliance on resource-based and low-technology sectors limits the scope for productivity growth and increases economic vulnerability. Currently, efforts to promote innovation are underwhelming compared to peer countries. It is, therefore, to be welcomed that the government has defined the promotion of technological upgrading and the increase in the value addition in the manufactured export basket as among its top priorities for recovery. For this, both public and private sector actors will have to take action to boost innovation in the country – for example, through reinvestment of profits in business upgrading; the unification of innovative efforts of the government, research institutes, universities and big business; or the creation of R&D centres to promote innovative developments and competitive technological solutions. Against the backdrop of the findings of a recent survey among firms (where 77 percent of respondents deemed innovation is not relevant in the context of the war), one crucial step will be to create awareness about the importance and benefits of innovation as key for the reindustrialization and recovery of the country.

For Ukraine to advance in the digital economy and re-shape its industrial development, it will be crucial to guarantee Internet coverage and access to e-government services, and improve its digital readiness and the development of the IT sector.

Before the war, Ukraine had made great strides in terms of Internet coverage and the development of the IT sector. Between 2010-2019, Internet access increased significantly across oblasts, even though the improvement was uneven across territories. Beyond the application of digital technologies in the manufacturing sector, Ukraine's digital readiness was based on the level of human capital, technology adoption, and technology infrastructure available in the country, while business and government investment in innovation and technology and business environment for digital products and services were among the areas that required improvement.

In terms of IT sector performance during the pre-war period, the industry led in the export of services,

generating more than 4 percent of Ukraine's GDP in 2021. The industry increased its number of specialists by more than 50 percent, and more than 5,000 IT companies, including startups, were active in the labour market. However, the invasion caused severe damage, especially to Internet connectivity and the loss of IT specialists due to migration and military services.

Policy implications: Based on these challenges, more financial resources are required to support re-establishing a proper digital infrastructure, develop digital skills and increase business digitalization efforts. It will also be necessary to provide incentives to stop the brain drain and attract IT specialists to return to Ukraine.

Massive capital investment and FDI will be required to support industrial development and Ukraine's recovery process. Improving the investment climate and business confidence will be vital to attracting and mobilizing new resources.

During 2010-2021, capital investment in Ukraine was trending upward. However, this was followed by a dramatic drop in 2022 (-39.2 percent), where the disruption of productive activities by the war forced businesses to prioritize using their financial resources to cover their day-to-day activities. More generally, corporate investment decisions are influenced by many factors, including the business outlook and the level of trust in the country's business environment. In Ukraine, business confidence among manufacturers improved in 2021 after the COVID-19 shock receded but had decreased by April 2022 due to the war. Interestingly, however, after April 2022, business confidence improved steadily until July 2023, indicating a brighter outlook that can bring back business confidence and the intention and motivation to invest in productive activities.

FDI inflows into Ukraine followed a slightly different trajectory. Measured as a ratio to GDP, they decreased from 4.3 percent in 2011 to 3.8 percent in 2019. In subsequent years, FDI was even more highly affected, first by the COVID-19 pandemic and then by the war. At current levels, FDI inflows are insufficient to support the recovery process.

POLICY IMPLICATIONS

The mass destruction of companies' assets and industrial infrastructure will require massive flows of investment – foreign and domestic – to allow Ukraine's economy to build back better. A future industrial policy must incorporate interventions aimed at mobilizing both types of investment, recognizing that these are preconditions to support the industrialization process. It should combine measures that encourage domestic investment in short-term projects ("quick wins") and measures with a longer time-horizon that spur investment in strategic areas with the potential for scaling up production. Public-private partnerships might be needed to reconstruct specific damaged infrastructure since the required scale of investment as well as the risks are high. Specifically, private actors will want insurance against military risks. More broadly, incentives will be necessary to motivate businesses to align their capital investment with government priorities.

INCLUSIVE INDUSTRIAL DEVELOPMENT TO CREATE MORE AND BETTER OPPORTUNITIES FOR ALL

The manufacturing sector in Ukraine needs to be built back better and more inclusively.

The female labour-force participation rate is relatively high in Ukraine. Although the share of women in total employment declined by 2.7 percentage points between 2010 and 2021, currently standing at 47.8 percent, it is still above the EU average, indicating a significant level of gender equality in Ukraine's overall labour market.

However, the industrial sector is still a male-dominated domain. In 2021, only 29 percent of all industrial jobs were occupied by women. This indicates the scope for increasing female participation in the industrial workforce. Unfortunately, the ongoing conflict has had a severe impact on women's prospects for employment and skills development. Moreover, a large majority of those who fled the country were women (and children).

Youth is another group that often struggles to get a foothold in the labour market. Before the war, a positive trend for this demographic could be observed, as the rate of youth not in employment, education or training (NEET) decreased by almost one-third between 2014-2021. However, the war is not sparing educational institutions, and it is anticipated that there will be a decline in the number and employability of youth entering the workforce.

POLICY IMPLICATIONS

Given this situation, the industrial development process must be built upon inclusiveness, ensuring equal opportunities for all, including women, youth and even MSMEs that usually face disadvantageous conditions in the development process. This will require the design and implementation of specific programmes to promote the economic empowerment of women and youth. In particular, tailored initiatives are vital to enhance their access to education, vocational training and skills development that focuses on innovative industrial entrepreneurial skills.

RESOURCE EFFICIENCY AND CLEANER PRODUCTION TO BUILD BACK BETTER AND GREENER

The material intensity of manufacturing processes in Ukraine is high and a drag on the sector's competitiveness, indicating the need to improve resource efficiency significantly.

Manufacturing activities in Ukraine are highly material-intensive. On average, Ukraine's manufacturing sector requires five-six times more raw material inputs than its peers in the EU to generate one US$ MVA. Moreover, Ukraine's manufacturing sector's raw material consumption intensity has increased even further in recent years.

POLICY IMPLICATIONS

With such low material efficiency, policymakers should prioritize implementing measures that promote the careful use of materials and their recirculation into the economy, thereby extending their second life use. As part of an agenda for sustainable industrial development, improving material efficiency can lead to triple dividends: reducing dependence on the supply of raw materials, lowering environmental pressures and making industry more competitive.

A decline in energy production capacity and high energy-use intensity of the industrial sector have created challenges for competitiveness and sustainable development. Ensuring energy security and independence and implementing energy efficiency initiatives are of strategic importance to develop a resilient and greener industrial sector.

Thanks to its endowment with different resources – ranging from oil, coal and gas to renewables – Ukraine has enormous potential for power generation. At the moment, electricity production is dominated by nuclear power, which generates more than half of the total, followed by coal (23.2 percent), hydro (6.9 percent), gas (6.3 percent), solar (3.8 percent) and wind (2.9 percent). However, Ukraine's electricity production capacity has decreased continuously over the last decade. This trend has been further aggravated by the war, which in particular impaired the reserve generation capacity, the maneuvering capacities and the transmission network capacity. Recent data offers a bright spot, though: In the first quarter of 2023, electricity generation was almost 10 percent higher than in the fourth quarter of 2022. This suggests that the situation in the power system has been temporarily stabilized due to the efforts of Ukrainian power engineers and the support of international partners. Improvements in energy production capacity and the partial restoration of electricity transmission and distribution networks has ameliorated the operational security of the power system and reduced the risk of shortages.

However, Ukraine's industry still has a long way to go regarding energy efficiency. In 2020, it needed six-seven times more energy to generate 1 US$ of industrial value added than its comparator countries.

POLICY IMPLICATIONS

For the industrialization process that the country is keen to promote, Ukraine will need to enhance its power generation capacity, ideally through an expansion of renewable energy, ensure energy security and independence, and develop carbon-neutral generation capacities. Complementary initiatives to promote energy efficiency at a company level can help Ukraine's industry to embark on a more sustainable development trajectory, with a potential bonus of a boost in competitiveness. Moving away from high energy-intensive industries towards lower energy-intensive ones would also improve the balance.

The destruction of energy infrastructure has disrupted industrial production. At the same time, it opens up opportunities to move decisively into renewables while supporting the build back better and greener agenda.

Ukraine´s energy production heavily relies on fossil fuels, which accounted for approximately 86 percent in 2021. However, the country has great potential to generate energy from renewable sources. In 2021, these sources represented 14 percent, more than three times their share in 2010. Most of the increment came from expansions in solar and wind power. Due to the high potential that the country has for hydro, solar and wind power, renewables could constitute the building blocks of Ukraine's future energy system, with estimates of contributing nearly 80 percent of total energy generation by 2050.

The war has strongly damaged and destroyed important energy infrastructure, severely affecting renewable energy facilities. By April 2023, up to 40 percent of renewable energy facilities were highly damaged by the war, mainly in Ukraine's southern and southeastern regions. Solar and wind power generation decreased by one-third. In general, the available generation capacity from renewable sources fell from 8.2 GW at the end of 2021 to 6.3 GW by 30 April 2023.

POLICY IMPLICATIONS

All the challenges generated by the war constitute an opportunity for Ukraine to rethink its energy-sector priorities and to come up with a road map to focus, initially, on repairing the damage done to the power grid and other energy infrastructure to ensure energy access for all. A second step would be expanding energy production capacity and continuing efforts to increase renewable energy participation. The promotion of distributed renewable energy resources and small-scale power plants will be important to meet consumers' needs and make the energy system more flexible and less vulnerable. Moreover, it will be strategic to repurpose Ukraine's Gas Transport System towards creating a Central European Hydrogen Corridor to transport green hydrogen from potential supply areas within Ukraine through Slovakia and the Czech Republic to the EU market. All these initiatives align with the need to build back better and greener for the future, while ensuring Ukraine´s energy access, security and independence.

Waste generation and inadequate management are outstanding debts to society and the environment. Promoting circular economy strategies to minimize waste and improve recycling can generate more value for Ukraine's economy.

Municipal solid waste (MSW) generation per capita is lower in Ukraine than in comparator countries and the EU. Despite this, waste generation is one of the leading threats to environmental safety. The volume of waste generation, including chemicals and hazardous substances, has grown in Ukraine, and unauthorized landfills are expanding significantly.

In addition, data on waste composition in two cities, Kyiv and Pavlohrad, shows that unsegregated waste was the leading material group, representing 36 percent of waste generation in 2019. This implies that, in terms of treatment options, the biggest opportunity for waste valorization is to implement waste-to-energy solutions for unsegregated waste and composting techniques for organic waste. With its current composition, MSW offers limited opportunities to recover value through recycling.

Additionally, Ukraine's waste-management system faced challenges even before the war, when its coverage rate was only an estimated 79 percent. The war caused significant damage to the solid waste management sector and disrupted the entire waste-management service network. Damage was estimated to be largest in the Luhansk, Donetsk, Kharkiv, Kherson and Zaporizhzhya regions. This has critical implications, considering that just to initiate recovery and reconstruction, debris removal and demolition will have to occur, directly linked to the solid waste sector capacity.

POLICY IMPLICATIONS

Several national initiatives have been developed in Ukraine to improve the waste-management system. However, special attention is required when it comes to (1) adoption of circular economy principles as well as laws for its enforcement; (2) creation of circular bioenergy clusters; and (3) provision of data and information on waste generation, composition, type of technologies and treatment methods that can be used to recover value. Moreover, the recovery of scarce materials (e.g. rare earth materials) and the processing of industrial waste offer some potential for export and domestic use but have not yet been industrially developed in Ukraine. In addition, further efforts are needed to create awareness and improve consumer capacities to segregate waste at the source correctly.

NOTES:

[1] Ukraine hosts more than 100,000 Microsoft-certified software professionals, making the IT sector in Ukraine the largest software development industry in Europe (World Bank, 2019).

[2] The share corresponds to the City of Kyiv (22.5%) + Kyiv-City of Kyiv (3.7%).

[3] As a reference, MVA in 2021 at current prices was US$ 21,559,184,673, captured in **Table 1.1.**

[4] The share corresponds to the City of Kyiv (13.1 percent) plus Kyiv-City of Kyiv (6.1 percent).

[5] Manufacturing subsectors can be categorized according to their technology intensity into resource-based, low-technology and medium- and high-technology industries (OECD, 2011).

[6] The main reasons for the decline in coke production are the following: conservation and partial destruction of production facilities; a high decline in demand for coke from the steel sector due to the drop in production; logistics issues with raw material and finished products delivery; and missiles attack on the energy and the industrial infrastructure of the country (GMK Center, 2023).

[7] The MTN classification is used by the World Trade Organization (WTO) for trade statistics and policy analysis. The nomenclature can be accessed through the statistical portal of the WTO https://stats.wto.org/.

[8] See also: https://ukraineinvest.gov.ua/en/industries/furniture/ and https://ukraineinvest.gov.ua/en/news/new-opportunities-for-ukrainian-furniture-industry/

[9] See also: www.reuters.com/world/europe/ukraine-targets-initial-40-bln-green-marshall-plan-2023-06-18/.

[10] See: https://www.clusters.org.ua/blog-single/innovatsiyi-pid-chas-viyny/.

[11] See www.cisco.com/c/en/us/about/csr/research-resources/digital-readiness.html.

[12] The Ukraine Facility constitutes the EU support for Ukraine's recovery and reconstruction, supporting investments needed to rebuild the country and ensure a smooth transition towards a green, digital and inclusive economy. This will also foster Ukraine's EU accession path and progressive alignment of Ukraine with EU standards. Disbursement has been subject to endorsement by the EU of a "Ukraine Plan" which the Government of Ukraine had to prepare, in close consultation with the European Commission, in order to detail its vision for the country's recovery, reconstruction and modernization as well as its intended reforms on the path to EU accession.

[13] The Diia portal is a single tool where Ukraine's public administration offers services for citizens and businesses. Its main objective is to make all public services available online. In December 2022, more than 21.7 million Ukrainians were users of the Diia portal (Ukraine Now, 2023).

[14] The share corresponds to the sum of the City of Kyiv (30.4 percent) and Kyiv oblast (without the city of Kyiv, 6.6 percent).

[15] Total final energy consumption (TFEC) is the total energy consumed by end users, e.g. households, industry and agriculture. However, TFEC excludes energy used by the energy sector to produce electricity, including for deliveries and transformation.

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2 Analysis of manufacturing sectors

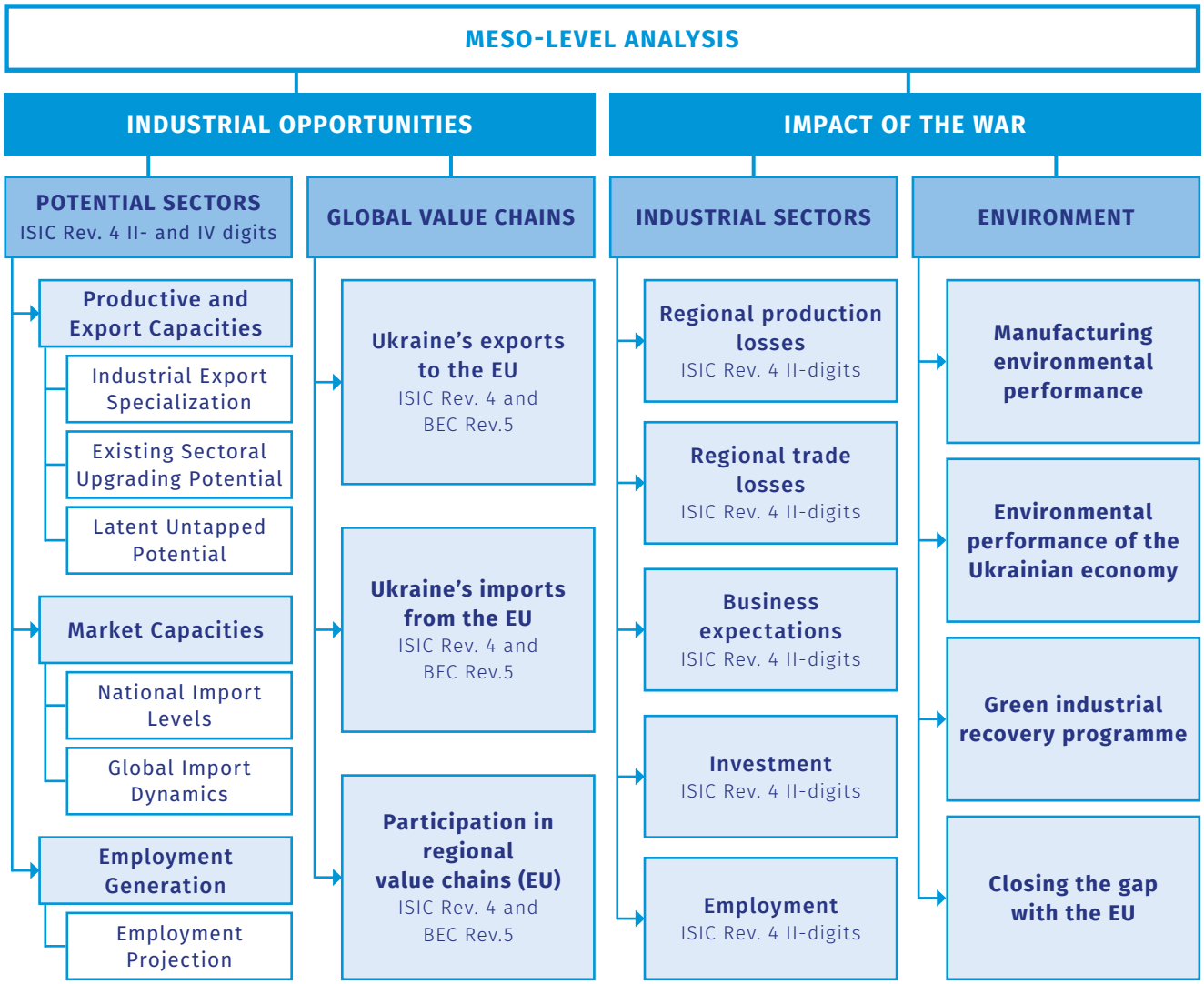
2.1 INTRODUCTION AND STRUCTURE OF THE ANALYSIS

This block is dedicated to a sectoral analysis of manufacturing industries in Ukraine. It aims to analyse the key manufacturing sectors in the Ukrainian economy, and how they have been affected by the war, and identify attractive sectors that may bear the potential to make significant contributions to the country's overall development, promote integration in the European Union (EU)'s value chains and contribute to a green recovery.

Block 2 is divided into two primary sections: 1) identifying industrial opportunities and 2) analysing the impacts of the war (**Figure 2.1**). Each of these sections is further subdivided, resulting in four subsections. The "Manufacturing sectors' prioritization" subsection aims to identify manufacturing sectors that potentially significantly contribute to Ukraine's overall development. The analysis uses six distinct indicators to cover three dimensions: production and export capacities, market capacities, and employment generation. Based on these indicators, the analysis identifies a set of priority manufacturing subsectors. Depending on data availability, sector identification considers the pre-war (2017-2021) and war (2022-2023) periods, respectively. The subsection ends with a regional perspective on manufacturing capability. The second subsection, "Identifying Ukraine-EU potential regional value chains," analyses the evolution of EU-Ukraine manufacturing trade and identify potential regional manufacturing value chains. The third subsection, "The impact of the war on industrial sectors," goes beyond the first section to provide a more nuanced view of how the performance of the various manufacturing sectors has been affected by the war. We also analyse regional vulnerabilities to industrial losses to add a more nuanced regional dimension to the discussion. In this way, it identifies subsectors that were identified as attractive before the war and how the incidence of war may have impacted such their trajectories. The last section, "Environmental and socio-economic consequences of the war and the green recovery program," provides an assessment of Ukraine's manufacturing environmental performance and goes on to assess the consequences of the war on the environmental performance of the Ukrainian economy as well as the environmental and socio-economic impacts of the Green Recovery Programme in Ukraine.

FIGURE 2.1: STRUCTURE OF BLOCK 2

Source: UNIDO elaboration.



2.2 MANUFACTURING SECTORS' PRIORITIZATION

The objective of this section is to identify manufacturing sectors that have the potential to make significant contributions to Ukraine's overall development. The analysis uses six distinct indicators to cover three dimensions: (1) production and export capacities, (2) market capacities, and (3) employment generation. Based on these indicators, it identifies a set of potential priority manufacturing subsectors. Sector identification depends on data availability and considers both the pre-war and war periods. The section ends with a regional perspective on manufacturing capability.

SUMMARY OF FINDINGS:

Production and export capacities

- Ukraine is globally competitive in four sectors: (15) food products and beverages, (16) tobacco products, (20) wood and products of wood and cork, and (27) basic metals;
- Since the war, its revealed comparative advantage (RCA) has declined by 63 percent in (16) Tobacco products and by 55 percent in (27) basic metals, whereas the RCA increased by 4 percent in (20) wood and products of wood and cork, and by 14 percent in (15) food products and beverages.

Emerging comparative advantage

- Ukraine shows emerging comparative advantage (ECA) in two sectors: (17) textiles and (36)) furniture; manufacturing n.e.c.

Latent untapped potential (LUP)

- Ukraine has six untapped potential sectors, including (17) textiles; (18) wearing apparel, dressing, and dyeing of fur; (19) leather, leather products and footwear; (23) coke, refined petroleum products and nuclear fuel; (34) motor vehicles, trailers and semi-trailers; and (36) manufacture of furniture; manufacturing n.e.c.

National import levels

- The five sectors with the highest import substitution potential include: (15) food products and beverages; (23) Coke, refined petroleum products and nuclear fuel; (24) Chemicals and chemical products; (29) Machinery and equipment, n.e.c.; and (34) Motor vehicles, trailers, and semi-trailers.

Global demand dynamics (GDD)

- Ukraine demonstrates a national export dynamic in five sectors: (20) wood and products of wood and cork; (24) chemicals and chemical products; (27) basic metals; (31) electrical machinery and apparatus, n.e.c.; and (32) radio, television, and communication equipment.

Employment generation (EG)

- Five sectors with the highest employment generation potential in the country include: (15) food products and beverages; (26) other non-metallic mineral products; (27) basic metals; (28) fabricated metal products, excluding machinery & equipment; and (29) machinery and equipment, n.e.c.
- The employment generation of these sectors is also markedly higher than that of the corresponding average low-income country.

2.2.1 DATA AND METHODOLOGY

To identify priority manufacturing sectors, this section relies on industry selection criteria design that lies at the heart of meso-level analysis, building upon three components: (1) production and export capacities, (2) market capacities, and (3) employment generation of the manufacturing sector. **Table 2.1** describes the three components, including the requisite indicators and the corresponding data to assess them. Importantly, it also highlights the sample period.

The Production and Export Capacities component assesses the level of specialization across Ukraine's manufacturing subsector. This assessment is based on three mutually exclusive indicators: Revealed comparative advantage (Balassa 1965), Emerging comparative advantage (EMA) and Latent untapped potential (LUP), of which further descriptions are provided in **Table 2.1**. These proposed indicators identify manufacturing sectors that demonstrate potential and existing capabilities in global trade patterns. The Market Analysis component identifies a sizeable domestic demand base as well as the existence of dynamic international markets. Identifying sectors where Ukraine shows such capacities is based on two mutually exclusive indicators: Global demand dynamics (GDD) and National import levels (IMS). Finally, the Employment Generation component projects the employment level across the manufacturing subsectors for countries of an economic configuration similar to Ukraine's. The criterion used to analyse this dimension is the Employment projection criterion, which evaluates the potential of a sector to generate employment.

The sector selection based on these three components relies on the International Standard Industrial Classification, Revision 3 (ISIC Rev. 3). The analysis and subsequent section would be performed at the II-digit ISIC Rev. 3 level but are further broken down to a more disaggregated level using IV-digits ISIC Rev. 3. The underlining objective of the later analysis is to identify subsectors that can be associated with sectors. However, the extent of the analysis across the three dimensions is subject to the availability of disaggregated data. Further, whenever possible, the study would be performed for the pre-war and war periods, respectively.

Except for the oblast data, all trade-related data are taken from the *UN Comtrade Database*. Trade statistics are extracted at the six-digit Harmonized System Classification (HS). Using an appropriate concordance table, trade statistics at HS2 and HS3 were mapped directly to ISIC Rev. 3. For trade statistics at the HS4, HS5 and HS6, a crosswalk was made from them to HS3 and then mapped to ISIC Rev. 3. All correspondence tables for building crosswalks and mappings are sourced from the WITS database (https://wits.worldbank.org) and the UN database (https://unstats.un.org/unsd/classifications/Econ). Throughout this report, only trade in manufacturing-related commodities is considered. Consequently, when discussing trade-related indicators, the analysis is based on traded commodities attributed to a specific manufacturing sector. An important caveat is that trade analysis is performed at the gross exports and imports level, which, by definition, also includes re-imports and re-exports.

TABLE 2.1: INDUSTRY SELECTION CRITERA DESIGN

Source: UNIDO elaboration.

COMPONENT	INDICATOR	DESCRIPTION	SECTOR LEVEL OF ANALYSIS
Production and Export Capacities	Revealed comparative advantage (RCA)	The first criterion used for this dimension is RCA. A high RCA (>1) in a sector corresponds to the respective sector's highly developed and existing production and export capabilities. The calculations consider i) the size of the sector and ii) the share of the sector in Ukraine's total exports compared to the same ratio of world exports. The exercise uses gross export statistics for Ukraine and the World level for 2017-2021 and 2022-2023. The two periods enable us to capture the RCA before and during the war. Primary data source: UN COMTRADE.	Criterion 1: II-digit and IV-digit ISIC Rev. 3
	Emerging comparative advantage (ECA)	The second criterion used for this dimension is ECA. It identifies sectors developing production and export capabilities and is on the brink of becoming globally competitive manufacturing sectors. A sector is considered to have an ECA if 0.3 < RCA < 1, and the RCA shows a positive trend over time. The exercise uses gross export statistics for Ukraine and the World level for 2017-2023. The two periods enable us to capture the ECA before and during the war. Primary data source: UN COMTRADE	Criterion 3: II-digit ISIC Rev. 3
	Latent untapped potential (LUP)	The third criterion used for this dimension is LUP. It identifies hidden or obscured production capacities that remain below the national potential in relation to trends otherwise observed across comparable countries. Given that Ukraine is an Lower Middle Income (LMI) country, a sector is considered to have a latent untapped potential if it (a) performs below what is expected for an LMI and (b) displays a positive national growth pattern over time. The exercise compares real manufacturing value added data for Ukraine to the averages of manufacturing value added for LMIs from 2012 – 2021—primary data source: *INDSTAT* database (UNIDO).	Criterion 4: II-digit and IV-digit ISIC Rev. 3

COMPONENT	INDICATOR	DESCRIPTION	SECTOR LEVEL OF ANALYSIS
Market Analysis	Global demand dynamics (GDD)	GDD highlights sectors where global demand is fast-growing and identifies sectors with the potential to gain importance because of increasing global demand. Sectors identified in this way may allow the country to tap into an expanding and dynamic global market with extensive opportunities for future growth. The exercise is conducted using world gross imports from 2017–2021. Primary data source: *UN Comtrade*. The selection requirements for this criterion are based on the growth rate (dynamism) of a particular sector and its overall size (measured in its share in total manufacturing imports). Following the GDD analysis, a national export dynamics of Ukraine's manufacturing sectors will be conducted to ascertain whether the sectors where global demand is fast-growing also show similar (export) dynamism in the country. In this case, the analysis allows for a simple evaluation of whether the country (a) follows global trade dynamics or (b) has managed to tap into an expanding and dynamic global market with extensive growth opportunities.	Criterion 4: II-digit and IV-digit ISIC Rev. 3
	National imports levels (IMS)	IMS identifies the sectors with the highest level of imports. It captures the size of import substitution potential for one specific sector. More specifically, it measures the size of sector-level imports (per capita US$) of manufacturing sectors in Ukraine. The indicator gauges the potential for import substitution because of high national demand, which is currently accommodated through high imports. The primary data sources are *UN Comtrade* and the World Bank. The period of analysis covers 2017-2021 and 2022-2023.	Criterion 5: II-digit and IV-digit ISIC Rev. 3
Employment Generation	Employment generation (EG)	The EG indicator projects the employment level of manufacturing industries for countries of an economic configuration similar to Ukraine's (i.e. LMI). Primary data source: *INDSTAT* database (UNIDO) and *World Development Indicators* database. The exercise is based on an econometric technique and covers the period 1992 - 2021	Criterion 6: II-digit ISIC Rev. 3 and IV-digit ISIC Rev. 3

Note: $RCA_i = m_r / M_r$, where m_r is the export share of sector r in the country i's total export, while M_r is the export share of sector r in the world's total export.

2.2.2 RESULTS AND DISCUSSION

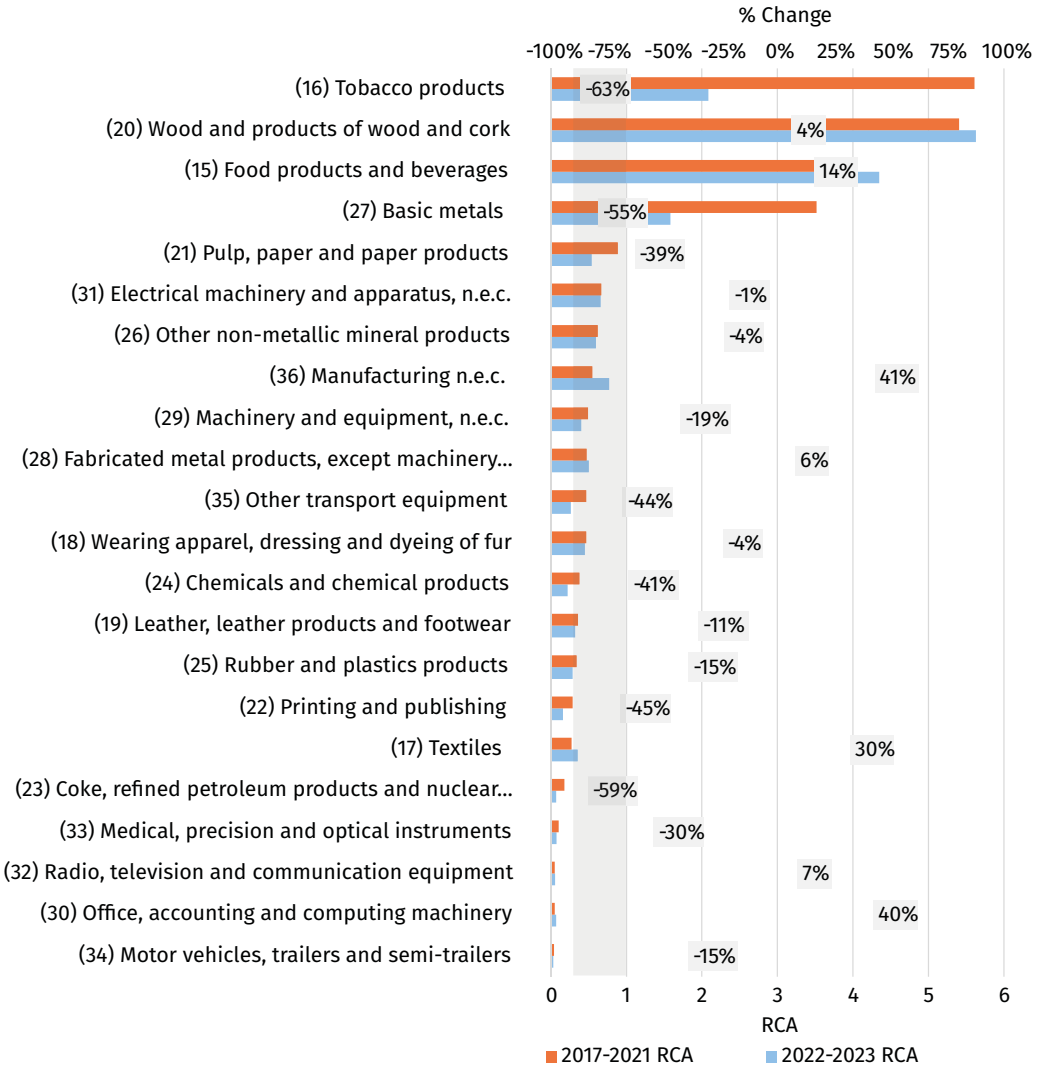
This section presents the results and discussion of the findings for analysing manufacturing sectors' prioritization based on the six indicators highlighted in **Table 2.1**.

REVEALED COMPARATIVE ADVANTAGE (RCA)

II-digit sector analysis: Figure 2.2 shows the RCA of the manufacturing sectors at the II-digit ISIC Rev. 3 classification and the growth rate of the RCA across the sectors.[1] Results for two periods are presented: the pre-war period, comprising the average of observations between 2017 and 2021, and the war period comprising the average of observations between 2022 and 2023.

FIGURE 2.2: REVEALED COMPARATIVE ADVANTAGE (RCA) CHANGE IN UKRAINE, BY II-DIGIT ISIC REV. 3, 2017-2021, 2022-2023

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: *RCA* = revealed comparative advantage. $RCA_i = m_r / M_r$, where m_r is the export share of sector *r* in the country *i*'s total export, while M_r is the export share of sector *r* in the world's total export. Emerging *RCA* takes the range [0.3, 1].

During the pre-war period Ukraine's RCA score for (16) tobacco products was 5.61, making it the manufacturing sector that had the highest developed and existing production and export capabilities before the war. The country also had a high RCA score in three other sectors prior to the war: (15) food products and beverages, with an RCA of 3.8; (20) wood and products of wood and cork, with an RCA score of 5.41; and (27) basic metals, with an RCA score of 3.52. During the war, Ukraine retained a high production and export capabilities in these four sectors as their respective RCA scores remained above one.[2] However, compared to the pre-war period, the country's RCA during the war dropped by 63 percent in (16) tobacco and 55 percent in (27) basic metals. Conversely, the country's RCA increased by 4.1 percent in (20) wood and wood products, and 14 percent in (15) food and beverages over the same two periods.

The loss of RCA in the (16) tobacco and (27) basic metal industries can be attributed to their concentration in extensive facilities located in front line areas, such as Kharkiv for tobacco and Donetsk and Luhansk for metal, as the ongoing war has severely impacted these regions. Industries with more evenly distributed production, like (15) Food and beverage and (17) Textiles, have experienced fewer disruptions. In the case of tobacco, consultations reveal an ongoing relocation of productive plants to regions far from the front lines. However, in the metal industry, the recovery of competitiveness will be more extended due to its heavy reliance on logistics and its capital and energy-intensive continuous-cycle production. This is a significant concern as the sector contributes 26.6 percent of Ukraine's manufacturing output.

Ukraine remained resilient in its production and export capabilities in the (15) food and beverage sector: the RCA score witnessed a continuous fall from its value of 4.07 in 2017 to 3.45 in 2021 but has since increased to 4.36 in 2023 (**Table 2.2**).[3] For (20) Wood and wood products, the RCA score dropped markedly between 2020 and 2021. Interestingly, it started rising during the war period. Ukraine's RCA in the (16) Tobacco sector has fallen continuously from an RCA score of 6 in 2017 to 0.9 in 2023, indicating a total loss of global competitiveness in that sector due to the war. Finally, the RCA scores of the (27) Basic metal sector have been very volatile, although they have, on average, dropped between 2019 and 2023. Compared to the pre-war period – specifically the average from 2017 to 2021 – the Food and beverage and Wood and wood products sectors have managed to increase their exports.[4] The rise in RCA and exports suggests that these sectors have maintained and enhanced their competitiveness despite the war.

TABLE 2.2: EVOLUTION OF RCA ACROSS SECTORS, 2017-2023

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

ISIC REV 3	ISIC DESCRIPTION	2017	2018	2019	2020	2021	2022	2023	AVERAGE (2017-2023)
Sectors with average RCA > 1									
20	Wood and products of wood and cork	6.31	7.38	7.10	2.82	3.42	5.86	5.39	5.47
16	Tobacco products	6.01	5.65	5.85	5.40	5.13	3.27	0.90	4.60
15	Food products and beverages	4.07	4.01	3.91	3.61	3.45	4.33	4.36	3.96
27	Basic metals	3.80	4.10	3.57	2.84	3.28	1.84	1.32	2.96
Sectors with an average of 0.3 < RCA < 1									
21	Pulp, paper and paper products	1.10	1.05	0.80	0.74	0.73	0.53	0.55	0.79
31	Electrical machinery and apparatus, n.e.c.	0.74	0.78	0.70	0.58	0.53	0.66	0.66	0.66
26	Other non-metallic mineral products	0.62	0.70	0.63	0.59	0.57	0.55	0.65	0.62
36	Manufacturing n.e.c.	0.50	0.55	0.54	0.59	0.57	0.70	0.85	0.61
28	Fabricated metal products, except machinery and equipment	0.48	0.49	0.46	0.47	0.48	0.47	0.54	0.48
29	Machinery and equipment, n.e.c.	0.50	0.51	0.49	0.51	0.46	0.42	0.38	0.47
18	Wearing apparel, dressing and dyeing of fur	0.52	0.54	0.48	0.44	0.36	0.52	0.38	0.46
35	Other transport equipment	0.52	0.48	0.41	0.51	0.42	0.28	0.25	0.41
19	Leather, leather products and footwear	0.40	0.41	0.34	0.34	0.30	0.29	0.36	0.35
24	Chemicals and chemical products	0.36	0.39	0.40	0.36	0.40	0.26	0.18	0.34
25	Rubber and plastics products	0.36	0.36	0.34	0.32	0.33	0.28	0.30	0.33
17	Textiles	0.27	0.29	0.27	0.27	0.27	0.30	0.42	0.30
Sectors with an average RCA < 0.3									
22	Printing & publishing	0.40	0.36	0.32	0.18	0.18	0.13	0.18	0.25
23	Coke, refined petroleum products and nuclear fuel	0.21	0.24	0.24	0.11	0.09	0.06	0.08	0.15
33	Medical, precision and optical instruments	0.12	0.11	0.10	0.09	0.09	0.09	0.06	0.10
30	Office, accounting and computing machinery	0.05	0.05	0.04	0.04	0.07	0.07	0.07	0.06
32	Radio, television and communication equipment	0.06	0.06	0.05	0.05	0.04	0.06	0.05	0.05
34	Motor vehicles, trailers and semi-trailers	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04

Note: n.e.c. = not elsewhere classified; RCA = revealed comparative advantage.

IV-digit sector analysis: Figure 2.3 previews the results of the RCA at the IV-digit ISIC Rev. 3 classification. Results for two periods are presented: the pre-war period comprising the average of observations between 2017 and 2021 and the war period comprising the average observations between 2022 and 2023. The figure previews results only for sectors with an RCA>2 in the pre-war period and sectors where RCA felt more than 50 percent. The figure also includes sectors in which Ukraine has gained an RCA during the war.[5]

FIGURE 2.3: RCA CHANGE IN UKRAINE, BY IV-DIGIT ISIC REV. 3, 2017-2021, 2022-2023

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

Note: *RCA* = revealed comparative advantage. $RCA_i = m_r / M_r$, where m_r is the export share of sector ***r*** in the country ***i***'s total export, while M_r is the export share of sector ***r*** in the world's total export. The figure displays industries with *RCA>2*, in which *RCA* felt more than 50 percent and industries that gained an *RCA* between periods (these industries are separated with a discontinuous line). We exclude (3512) building and repairing of pleasure and sporting boats due to numerical problems.

The IV-digit sector with the highest RCA score is (2310) manufacture of coke oven products, with an RCA score of 20.06. This is followed by (1514) manufacture of vegetable and animal oils and fats, with an RCA score of 18.53, and (2710) manufacture of basic iron and steel, with an RCA score of 8.71. Ukraine has lost RCA in eight sectors: (2923) manufacture of machinery for metallurgy; (3520) manufacture of railway and tramway locomotives and rolling stock; (2412) manufacture of fertilizers and nitrogen compounds; (1553) manufacture of malt liquors and malt; (2813) manufacture of steam generators, except central heating hot water boilers; (2212) publishing of newspapers, journals, and periodicals; (2696) cutting, shaping and finishing of stone; and (2102) manufacture of corrugated paper and paperboard.

Ukraine gained RCA in five sectors during the war period, moving from an RCA <1 in the pre-war period to an RCA>1 in the war period: (1551) distilling, rectifying and blending of spirits; (1721) manufacture of made-up textile articles, except apparel; (2694) manufacture of cement, lime and plaster; (3693) manufacture of sports goods; and (3150) manufacture of electric lamps and lighting equipment. These sectors are depicted below a dashed line in Figure 2.3. Despite the ongoing war, industries within the two-digit sector food products and beverages sector have generally maintained their RCA. Notably, industries such as (1514) manufacture of vegetable and animal oils and fats, and (1542) manufacture of sugar have improved their RCA. In the (20) wood and wood products sector, the decline in RCA in (2010) sawmilling and planning of wood has been offset by increased RCA in (2021) manufacture of veneer sheets. Consultations and international reports indicate that northern regions, known for their wood industry, have suffered significant losses in forested areas due to hostilities and fires,[6] which may account for the larger decline in sawmilling and planning compared to veneer sheets. The destruction of forests and their contamination with explosives is of particular concern since they will not be available for many decades.

EMERGING COMPARATIVE ADVANTAGE (ECA)

II-digit sector analysis: As highlighted in the methodology section, a country has an emerging comparative advantage (ECA) in a sector if it fulfills two conditions: the sector has an average RCA that ranges from 0.3 to 1, and the RCA score of that sector shows a positive trend over time. Fifteen sectors in Ukraine met the first condition across the period of analysis. Yet, of the fifteen sectors, only two – (36) Manufacturing n.e.c. and (17) Textile – met the second condition (**Table 2.2**). The analysis identifies these two sectors as manufacturing sectors for which Ukraine is developing production and export capabilities. It suffices to note that these two sectors have been resilient to the war, as observed by their RCA continuous increase even during the war (**Table 2.2**), further reiterating that these sectors may become attractive for the country in the foreseeable future.

Besides these two sectors, however, three other sectors are worth highlighting: (31) electrical machinery and apparatus, n.e.c.; (26) other non-metallic mineral products; and (28) fabricated metal products, except machinery and equipment. Although these three sectors met the first criteria of having an RCA score of 0.3<RCA<1, they did not meet the second condition of having a positive trend across the analysis period. Nevertheless, their RCA score remained between 0.3<RCA<1 across the sample period. Th RCA scores of both (26) other non-metallic mineral products, and (28) fabricated metal products, except machinery and equipment increased since 2022. Accordingly, while these three sectors do not fully embody the adopted definition of an ECA sector, they show a stable and relatively high RCA that reveals that the sectors may become attractive for the country in the foreseeable future. This calls for further consideration to understand factors that are possibly a binding constraint to the sectors' further development.

Ukraine has witnessed a continual erosion of CA in the (35) other transport equipment sector, as shown by a declining RCA score, due primarily to diminishing ties with the Commonwealth of Independent States (CIS) and a lack of investment in moderniza-

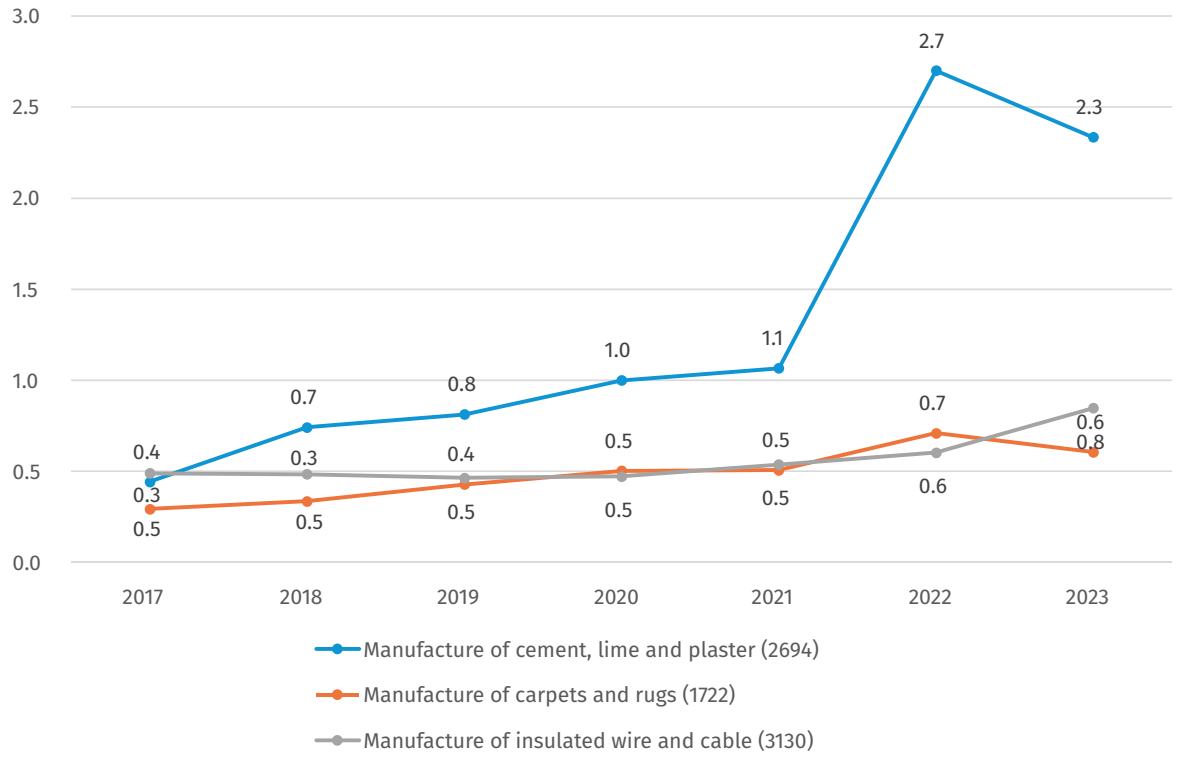
tion, resulting in reduced product demand and increased financial obligations. However, consultations with national stakeholders have uncovered an opening for developing existing capabilities, particularly in producing light armored vehicles and drones. These innovations may eventually find application in civilian sectors such as agriculture.

IV-digit sector analysis: Based on the pre-war sample (i.e. 2017-2021), the analysis identified 43 sectors that met the first condition that the sector has an average RCA that ranges from 0.3 to 1 (i.e. 0.3<RCA<1). However, only three sectors met the second condition of showing a positive trend over time (**Figure 2.4**).[7] The three sectors include: (1722) manufacture of carpets and rugs; (2694) manufacture of cement, lime and plaster; and (3130) manufacture of insulated wire and cable. However, except for (3130) Manufacture of insulated wire and cable, which gained higher RCA in the war period (2022-2023), the RCA of scores of (1722) manufacture of carpets and rugs, and (2694) manufacture of cement, lime and plaster have dropped since the war, although have remained significantly above 0.40.

An interview with one manager in the (3130) manufacture of insulated wire and cable industry revealed that this sector maintains its competitiveness within the national market and is progressively gaining international competitiveness. This is primarily attributed to acquiring certifications, such as the VDE mark, and expanding optic fiber and 5G network component production capabilities. However, since the onset of the war, the industry has encountered challenges in securing essential inputs like copper and aluminum, which were previously sourced from Russia. To enhance and diversify exports, recommended policy actions include export assistance programmes, product certification in European markets, improved logistics and bolstered quality assurance measures.

FIGURE 2.4: EVOLUTION OF RCA ACROSS SELECTED IV-DIGIT SECTORS WITH AVERAGE 0.3 < RCA < 1, 2017-2023

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: RCA – revealed comparative advantage.

Other sectors that did not make it into the list above are worth highlighting, including a group of sectors which did not show a positive trend throughout the entire period, but their RCA across the pre-war and war periods remained above 0.3. Interestingly, whereas we have observed a negative trend for these sectors, they consistently show a positive trend from around 2020 onwards. Six sectors fall into this group: (1549) manufacture of other food products n.e.c.; (1511) distilling, rectifying and blending of spirits; (1721) manufacture of made-up textile articles, except apparel; (2899) manufacture of other fabricated metal products n.e.c.; (2695) manufacture of articles of concrete, cement and plaster; and (2811) manufacture of structural metal products.

Another group of sectors worth highlighting include sectors that show gain in competitiveness in the war period: (2691) manufacture of non-structural non-refractory ceramic ware; (2899) manufacture of other fabricated metal products n.e.c.; (2695) manufacture of articles of concrete, cement and plaster; (3110) manufacture of electric motors, generators and transformers; and 3693) manufacture of sports goods. Although these two groups of sectors do not fully embody the adopted definition of an ECA sector, they show the potential in the foreseeable future. This calls for further consideration to understand factors that are possibly a binding constraint to the sectors' further development.

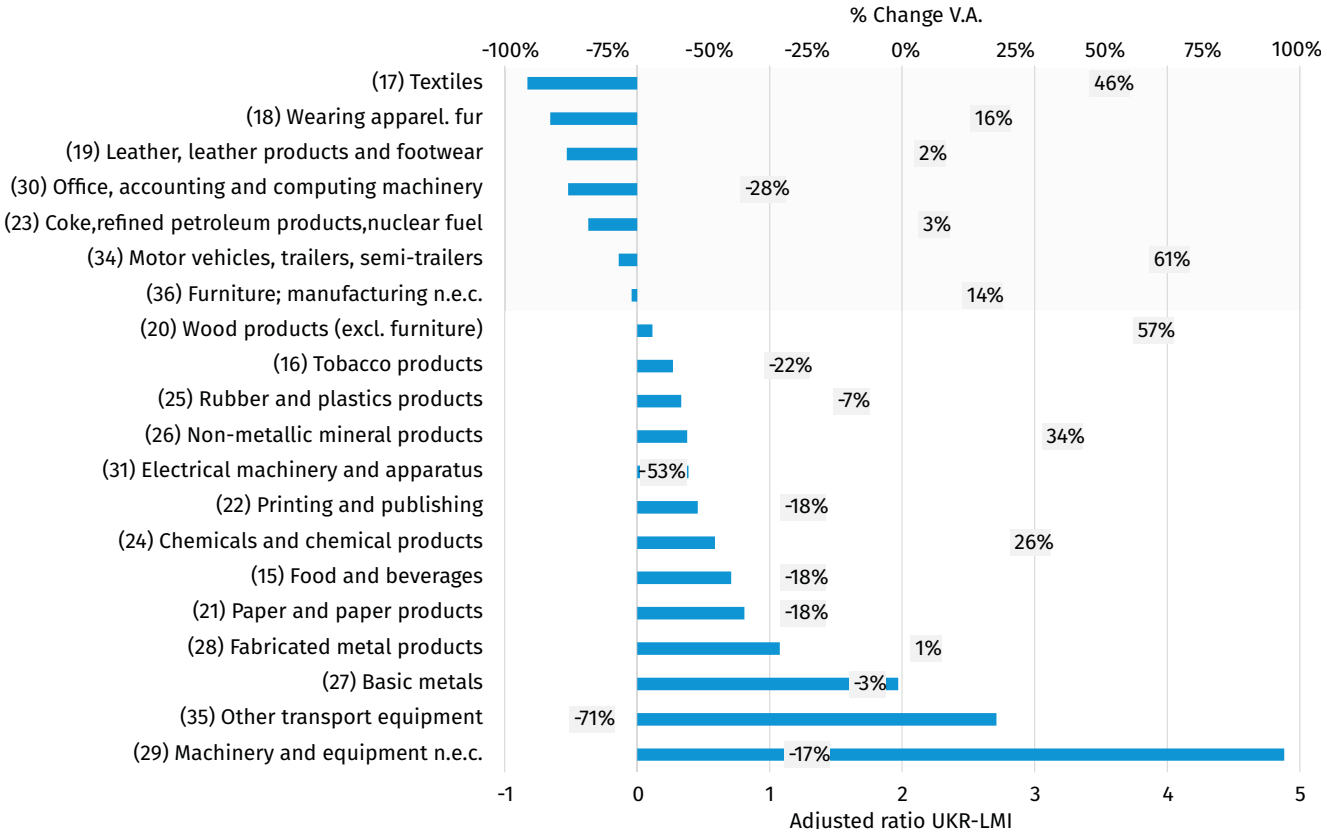
LATENT UNTAPPED POTENTIAL (LUP)

II-digit sector analysis: As highlighted in the methodology section, Ukraine is said to have a latent untapped potential in a sector if the sector's value-added per capita is (a) below that of an average country of a similar economic configuration (i.e. LMI) and (b) displays a positive, national growth pattern over time. **Figure 2.5** shows the results of this exercise at the II-digit ISIC Rev. 3 classification. Six sectors have been identified to jointly meet these criteria.[8] They include: (17) textiles; (18) wearing apparel; (19) leather, leather products and footwear; (23) coke, refined petroleum products, nuclear fuel; (34) motor vehicles, trailers, semi-trailers; and (36) furniture; manufacturing n.e.c.. Ultimately, these six sectors have hidden or obscured production capacities that remain below the national potential in relation to trends otherwise observed across comparable countries. Hence, there is a need for immediate proactive measures to improve their potential.

Based on industry consultations, critical policies for the development of the (17) textiles and (18) wearing apparel sectors include: encouraging the establishment of industrial parks and clusters offering incentives and support for businesses to set up operations; investing in vocational training and education programmes to address skill shortages and improve workforce skill sets; ensuring compliance with international standards and regulations to meet export requirements; and supporting the adoption of European standards and certifications in production processes to enhance product quality and market access. This policy is considered a priority for the Ukrainian National Recovery Council.[9]

FIGURE 2.5: LATENT UNTAPPED POTENTIAL (LUP) CHANGE IN UKRAINE, BY II-DIGIT ISIC REV. 3, 2012-2021

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

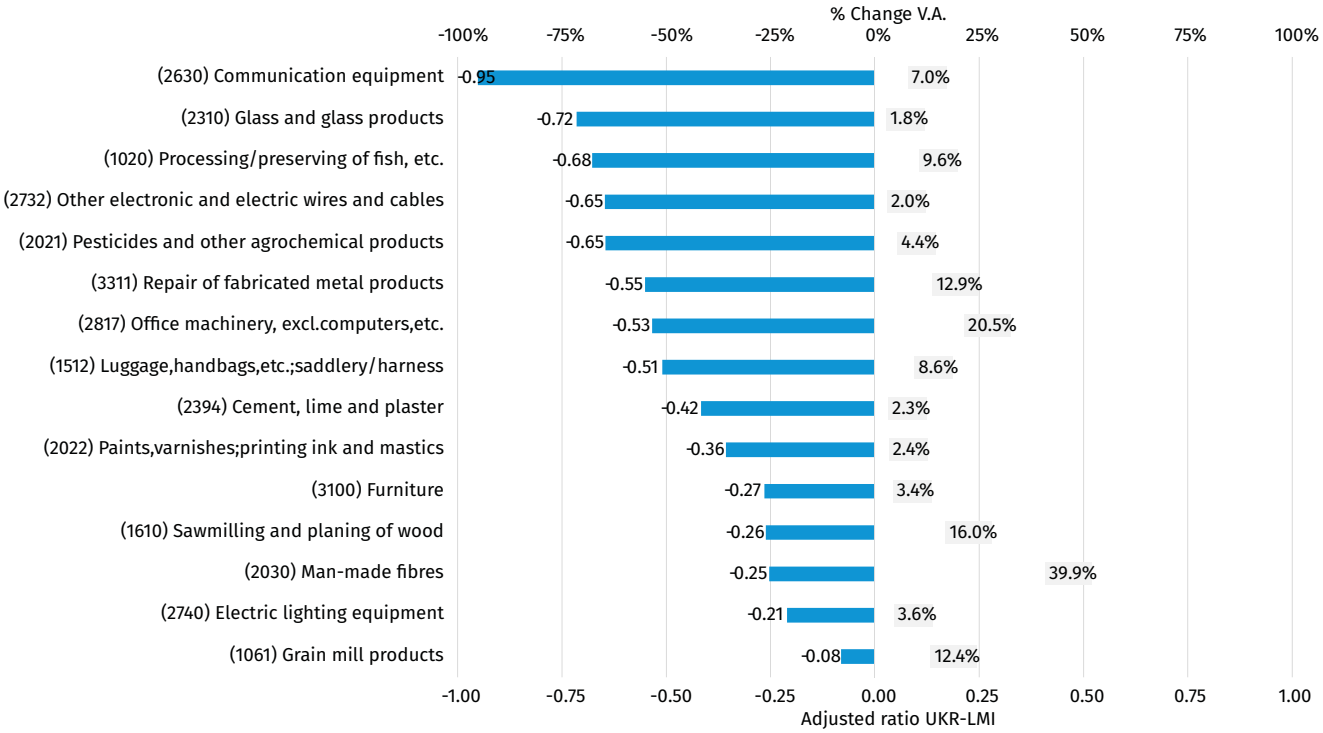


Note: Adjusted Ratio (UKR-LMI) = (Ukraine Value Added Per capita / LMI Value Added per capita) – 1. Sectors identified as LUP are in the shaded area.

IV-digit subsector analysis: At the IV-digit sub-sector level, 35 sectors fulfill the first condition (value added per capita below that of an average country of a similar economic configuration), and 52 achieve the second (positive, national growth pattern over time). Sectors fulfilling both conditions simultaneously are depicted in **Figure 2.6**. Within these sectors, larger manufacturing value added per capita gaps (where Ukraine's value added is lower than that of a representative LMI economy) are (2630) communication equipment; (2310) glass and glass products; (1020) processing/preserving of fish, etc.; and (2732) other electronic and electric wires and cables.

FIGURE 2.6: LUP CHANGE IN UKRAINE, BY IV-DIGIT ISIC REV. 4, 2012-2021

Source: UNIDO, *INDSTAT Database* (accessed September 2023).



Note: Adjusted Ratio (UKR-LMI) = (Ukraine value added per capita / LMI value added per capita) – 1. Sectors identified as LUP are in the shaded area. LUP = latent untapped potential; LMI = lower-middle income.

Consultations with industry experts indicate a robust domestic demand for sheet glass in Ukraine, consistently surpassing supply, primarily met through imports from the Commonwealth of Independent States (CIS). The development of the glass industry presents a significant opportunity to play a pivotal role in the country's reconstruction efforts and help Ukraine reduce external dependency and stimulate employment. However, the production of sheet glass has faced significant disruptions in areas that are or have been under the temporary military control of the Russian Federation, particularly Luhansk. Moreover, the Kharkiv region boasts the largest quartz sand deposits (40 percent) and vital production infrastructure at Pervomaiskyi Khimprom. The cable industry is characterized by untapped potential and has been acknowledged as an industry with a growing RCA, as indicated in Section 2.2.2.

In terms of sector growth, the industries with the highest annual growth rates are (2030) man-made fibres; (2817) office machinery, excluding computers; and (1610) sawmilling and planing of wood. As discussed in previous sections, Ukraine possesses a well-established RCA in wood and wood products. Additionally, this sector stands out as one of the most dynamic in terms of global demand, as outlined in the section on global demand dynamics.

NATIONAL IMPORT LEVELS (IMS)

II-digit sector analysis: Table 2.3 shows the import levels in US$ per capita of the manufacturing sectors at the II-digit ISIC Rev. 3 classification. Results for two periods are presented: the pre-war period, comprising the years between 2017 and 2021, and the war period, comprising the years between 2022 and 2023. Five sectors with the highest import per capita level include: (24) Chemicals and chemical products; (23) Coke, refined petroleum products and nuclear fuel; (29) Machinery and equipment, n.e.c.; (34) Motor vehicles, trailers and semi-trailers; and (15) Food products and beverages. Compared to the pre-war value in 2021, the import per capita across these sectors dropped during the war period. This also applies across all the sectors with lower import per capita shares. The only exception is (18) Wearing apparel, where performance increased from 10.6 in 2021 to 14.2 in 2022 but decreased significantly to 4.9 by 2023.

TABLE 2.3: US$ PER-CAPITA IMPORT LEVELS ACROSS SECTORS IN UKRAINE, BY II-DIGIT ISIC REV.3, 2017-2023

Source: United Nations, *UN Comtrade Database* and World Bank, *World Development Indicators* database (accessed September 2023).

ISIC REV 3	SECTOR	2017	2018	2019	2020	2021	2022	2023 (January - July)
24	Chemicals and chemical products	162.1	173.4	181.0	162.0	222.2	176.0	89.1
23	Coke. refined petroleum products and nuclear fuel	117.5	157.3	148.8	100.1	165.6	255.5	99.2
29	Machinery and equipment. n.e.c.	108.5	121.8	125.5	114.6	155.1	98.0	42.3
34	Motor vehicles. trailers and semi-trailers	75.5	82.9	118.4	112.4	141.9	125.2	57.2
15	Food products and beverages	50.3	61.8	67.7	78.4	98.2	88.4	39.0
25	Rubber and plastics products	44.0	49.8	53.0	52.9	68.0	58.5	24.3
31	Electrical machinery and apparatus. n.e.c.	41.2	53.6	65.5	55.3	63.7	70.6	42.5
27	Basic metals	39.7	48.6	45.4	40.7	56.3	40.3	19.8
32	Radio, television and communication equipment	29.1	33.4	32.6	39.0	42.4	34.2	14.9
28	Fabricated metal products, ex. machinery & equipment	25.5	28.7	34.4	28.8	37.5	26.6	10.6
17	Textiles	24.5	28.8	32.9	32.0	36.9	33.5	13.9
21	Pulp, paper and paper products	21.6	24.7	23.8	22.9	25.8	20.6	9.5
30	Office, accounting and computing machinery	20.2	22.4	24.4	25.5	33.0	28.0	11.8
33	Medical, precision and optical instruments	17.1	21.1	23.4	28.6	32.7	28.7	11.3
26	Other non-metallic mineral products	14.2	16.1	16.3	15.2	18.9	14.7	5.5
19	Leather, leather products and footwear	9.6	11.9	14.0	12.9	16.6	12.9	5.7
36	Manufacturing n.e.c.	7.1	8.7	11.1	12.0	16.5	9.6	4.6
35	Other transport equipment	5.7	8.7	10.4	7.4	14.0	11.8	5.8
20	Wood and products of wood and cork	5.3	6.3	6.5	6.2	9.1	4.5	1.7

ISIC REV 3	SECTOR	2017	2018	2019	2020	2021	2022	2023 (January - July)
18	Wearing apparel, dressing and dyeing of fur	4.8	6.5	10.0	9.3	10.6	14.2	4.9
22	Printing and publishing	1.4	1.4	1.6	1.3	1.5	1.5	0.5
16	Tobacco products	1.4	1.4	1.6	1.4	1.3	3.2	3.4

Note: n.e.c. = not elsewhere classified.

While sectors such as (34) motor vehicles, trailers, and semi-trailers; and (29) machinery and equipment, n.e.c. have shown a low or declining RCA and experienced declining competitiveness over the years, they possess substantial untapped potential (see previous section). Unlocking this potential can significantly benefit the Ukrainian economy by increasing income and reducing imports. Notably, capabilities exist in the Kharkiv region, particularly in tractor production. To fully realize this potential, there is a need to enhance these capabilities through worker and technician training and investment support. Additionally, Ukraine has maintained a consistent RCA score of around RCA = 0.4 in (24) chemicals and chemical products in the years before the war. It is crucial to reestablish production and promote upgrading within this sector, as it offers ample opportunities for import substitution. Ukrainian government's priority sectors for import substitution[10] include the food industry, biofuel production, machinery, metallurgy, and pharmaceuticals, aligning with our findings.

IV-digit subsector analysis: Table 2.4 presents results for the IMS at the IV-digit ISIC Rev. 3 classification. Due to space constraints, results for only the top 20 products by import per-capita level are previewed. Five sectors with the highest import per capita level include: (2320) manufacture of refined petroleum products; (3410) manufacture of motor vehicles; (2423) manufacture of pharmaceuticals, medicinal chemicals and botanical products; (2921) manufacture of agricultural and forestry machinery; and (2413) manufacture of plastics in primary forms and of synthetic rubber.

The per capita imports of (3110) manufacture of electric motors, generators, and transformers have notably risen since the onset of the war. Consultations support operations in specific light industries, particularly front-line regions, ensuring production continuity amid energy supply disruptions.

TABLE 2.4: US$ PER-CAPITA IMPORT LEVELS ACROSS SECTORS IN UKRAINE, IV-DIGIT ISIC REV.3, 2017-2023

Source: United Nations, *UN Comtrade Database* and World Bank, *World Development Indicators* database (accessed September 2023).

ISIC REV 3	SECTOR	2017	2018	2019	2020	2021	2022	2023 (January - July)
2320	Manufacture of refined petroleum products	107.4	145.3	139.6	95.2	156.3	252.8	98.3
3410	Manufacture of motor vehicles	64.1	70.0	103.4	98.0	124.3	106.7	47.8
2423	Manufacture of pharmaceuticals, medicinal and botanical products	39.2	43.6	48.3	49.1	60.7	46.2	20.0
2921	Manufacture of agricultural and forestry machinery	30.9	25.8	21.6	15.7	33.2	22.3	8.8
2413	Manufacture of plastics in primary forms and synthetic rubber	28.5	30.2	27.5	22.6	37.0	30.2	12.8
2710	Manufacture of basic iron and steel	28.3	35.1	32.3	26.6	37.4	27.9	14.5
2520	Manufacture of plastics products	28.0	31.7	33.0	33.0	42.5	38.7	14.9
2412	Manufacture of fertilizers and nitrogen compounds	27.2	24.2	28.7	19.3	36.8	20.8	17.0
2421	Manufacture of pesticides and other agro-chemical products	20.9	21.7	21.0	20.2	23.3	24.0	15.1
3000	Manufacture of office. accounting and computing machinery	20.2	22.4	24.4	25.5	33.0	28.0	11.8
3220	Manufacture of television and radio transmitters	16.6	17.3	16.6	18.8	22.3	18.7	7.3
2411	Manufacture of basic chemicals, ex. fertilizers & nitrogen compounds	16.1	19.0	19.3	15.9	20.3	19.6	7.9
2101	Manufacture of pulp. paper and paperboard	14.6	16.7	15.7	14.6	17.0	13.6	6.0
2899	Manufacture of other fabricated metal products n.e.c.	14.5	16.6	17.8	16.0	22.0	16.1	6.3
2424	Manufacture of soap detergents, and perfumes	14.4	16.5	17.5	18.0	21.1	16.7	8.3
2930	Manufacture of domestic appliances n.e.c.	12.6	15.6	17.1	19.7	22.6	17.0	6.6
2919	Manufacture of other general-purpose machinery	12.5	15.1	15.9	16.5	21.1	13.3	5.6
3120	Manufacture of electricity distribution and control apparatus	11.9	14.6	16.4	14.6	17.6	13.4	6.0
3110	Manufacture of electric motors. generators and transformers	8.0	13.3	21.5	14.8	13.8	25.0	19.2

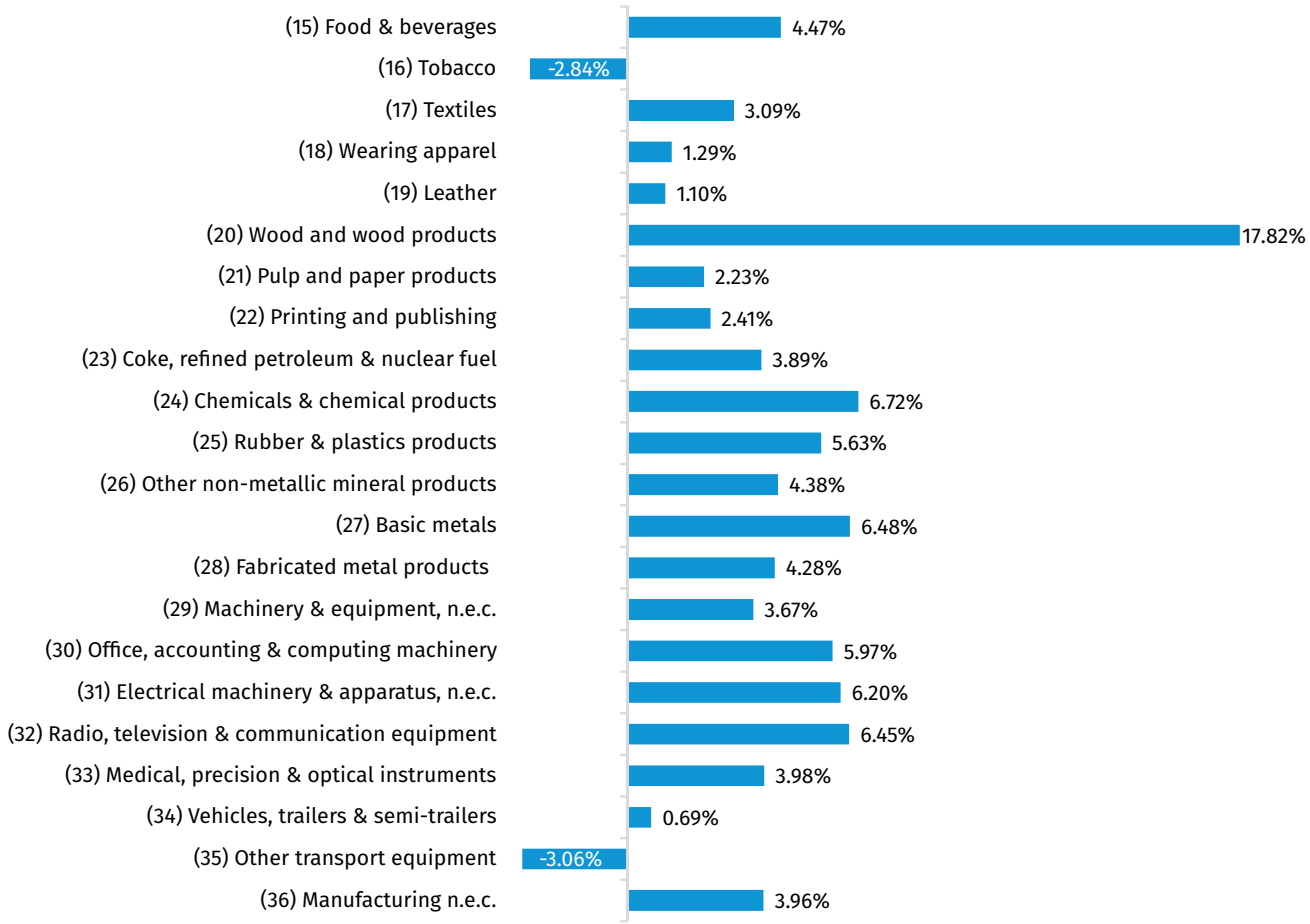
Note: n.e.c. = not elsewhere classified.

GLOBAL DEMAND DYNAMICS (GDD)

II-digit sector analysis: Figure 2.7 shows the results of the global import dynamics at the II-digit ISIC Rev. 3 classification for the pre-war period (2017-2021). The figure identifies six sectors with the most dynamic global manufacturing sectors. In consecutive order, this includes: (20) wood and products of wood and cork; (24) chemicals & chemical products; (27) basic metals; (32) radio, television & communication equipment; (31) electrical machinery & apparatus, n.e.c.; and (30) office, accounting & computing machinery. These sectors provide ample opportunities for Ukraine to expand its degree of global integration. **Figure 2.8** shows the results of the national export dynamics at the II-digit ISIC Rev. 3 classification level for the pre-war period.[11] Finally, **Figure 2.9** depicts the correlation between a sector's global dynamism and its dynamism among Ukraine's export sectors. It features a reference line where the global demand growth rate matches the growth rate of Ukraine's exports. This line evaluates the alignment between global demand and Ukrainian exports.

FIGURE 2.7: GLOBAL IMPORT COMPOUND ANNUAL GROWTH RATE (CAGR) ACROSS SECTORS, BY II-DIGIT ISIC REV. 3, 2017-2021

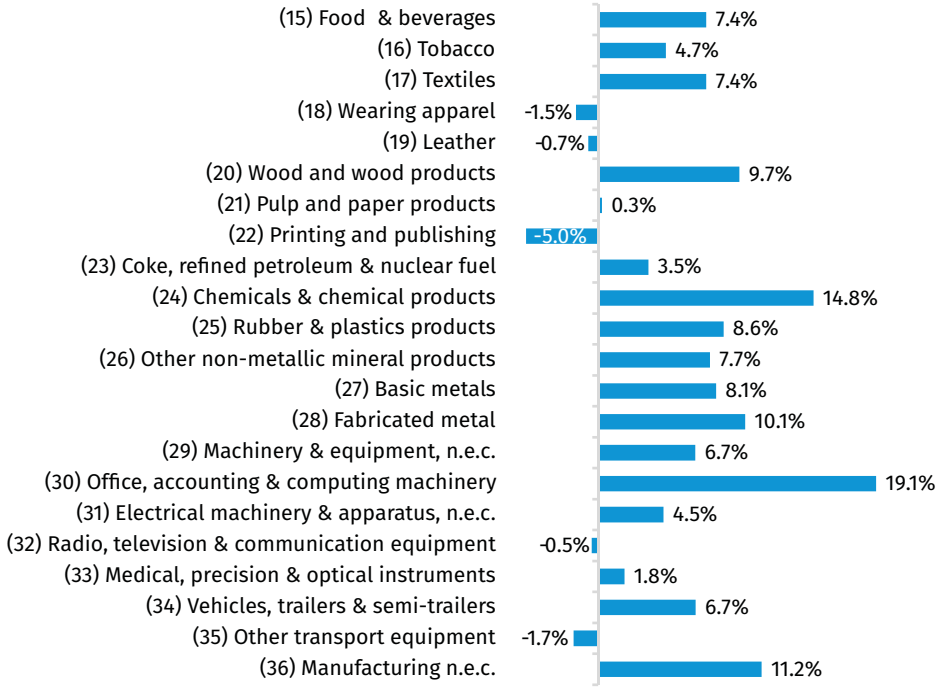
Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: n.e.c. = not elsewhere classified.

FIGURE 2.8: NATIONAL EXPORT CAGR ACROSS SECTORS, BY II-DIGIT ISIC REV. 3, 2017-2021

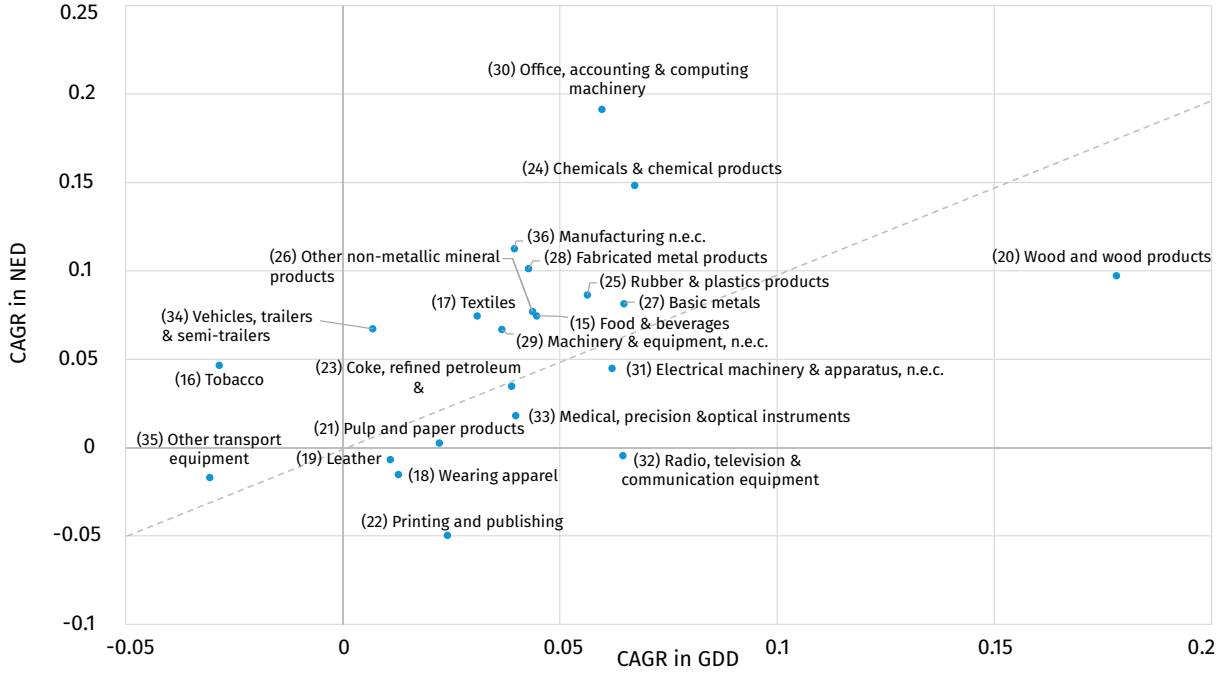
Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified.

FIGURE 2.9: NATIONAL EXPORT CAGR AND GLOBAL IMPORT CAGR ACROSS INDUSTRIES, BY II-DIGIT ISIC REV. 3, 2017-2021

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: Values should be interpreted as multiplied by 100 and as percentage changes. CAGR = compound annual growth rate; GDD = global demand dynamics.

As highlighted earlier, given the identified global import dynamic sectors, the national export dynamic analysis assesses if the local economy follows global trade dynamics by tapping into an expanding and dynamic global market with extensive opportunities for future growth. Of the five sectors identified to demonstrate a global import dynamism, Ukraine shows national export dynamics in three sectors: (30) office, accounting & computing machinery; (20) wood and products of wood and cork; and (24) chemicals & chemical products (**Figure 2.9**) showing an exports growth of about or more than 10 percent. This indicates that the country has successfully tapped into the expanding and dynamic global market for these sectors.

In the case of (20) Wood and products of wood and cork, Ukraine possesses well-established production and export capabilities, as detailed in Section 2.2.1. Nevertheless, the ongoing war has significantly affected the sector. Regarding (24) chemicals & chemical products, Ukraine previously had an RCA score ranging from 0.3 to 1 before the war, but it has experienced substantial losses in competitiveness since the conflict began. Finally, in the case of (30) office, accounting & computing machinery, Ukraine's RCA score remains very low. However, the sector exhibits positive exporting trends, which is encouraging, considering its significance in the global economy.

Although (27) basic metals; (32) radio, television & communication equipment; (31) electrical machinery & apparatus, n.e.c.; and (31) electrical machinery & apparatus, n.e.c., have shown growth, it is evident their growth rates are trailing behind other sectors. This indicates a need for a substantial course correction if Ukraine intends to capitalize on the high global dynamism observed in these manufacturing sectors.

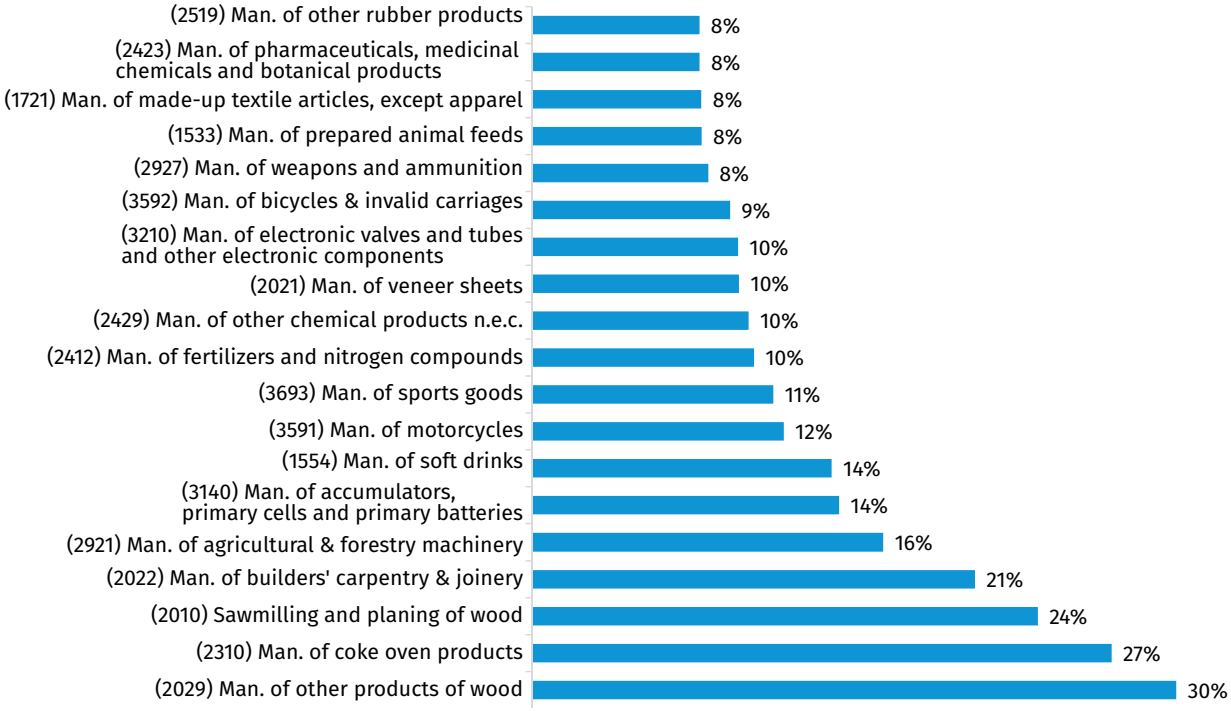
There is a noticeable alignment between the global dynamism of sectors and their performance within Ukraine's exports. Given Ukraine's established capabilities and forestry endowments in the (20) Wood and products of wood and cork sector, the country should seek to expand its exports in this industry (**Figure 2.9**). Based on industry consultations, critical policies for the wood sector's development include implementing and enforcing sustainable forest management policies to combat uncontrolled deforestation; collaborating with international organizations such as the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) to restore the verification of the legality of wood origin in Ukraine; and focusing on investment in modernizing wood processing facilities.

In the (24) chemicals and chemical products sector, efforts are needed to align Ukrainian pharmaceutical standards and certifications with international best practices to ensure products meet global quality and safety standards. In addition, it is imperative to provide legal aid and guidance to pharmaceutical companies looking to expand their exports, ensuring compliance with international regulations and trade agreements.

IV-digit sub-sector analysis: **Figure 2.10** presents the results of the global import dynamics at the IV-digit ISIC Rev. 3 classification level for the pre-war period. The five sectors with the most dynamic global manufacturing sectors include: (2029) manufacture of other products of wood; (2310) manufacture of coke oven products; (2010) sawmilling and planing of wood; (2022) manufacture of builders' carpentry & joinery; and (2921) manufacture of agricultural & forestry machinery. **Figure 2.11** presents the results of the corresponding national export dynamics at the IV-digit ISIC Rev. 3 classification for the same period. Although Ukraine experienced export growth across the five identified global dynamic sectors, none reached the level of the top five national export dynamic sectors. This implies that a more notable course correction is needed if Ukraine wants to exploit these two manufacturing sectors' high degree of global dynamism.

FIGURE 2.10: GLOBAL IMPORT CAGR ACROSS SECTORS, BY IV-DIGIT ISIC REV. 3, 2017-2021

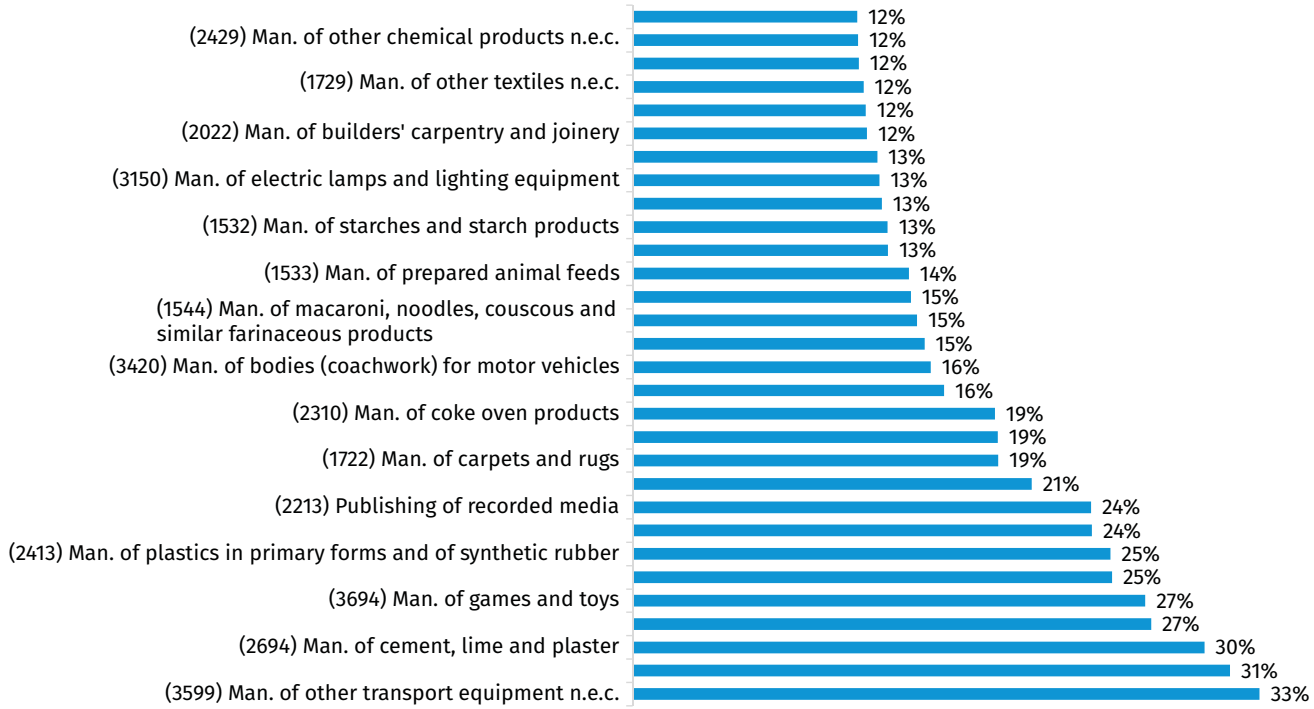
Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified.

FIGURE 2.11: NATIONAL EXPORT CAGR ACROSS SECTORS, BY IV-DIGIT ISIC REV. 3, 2017-2021

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

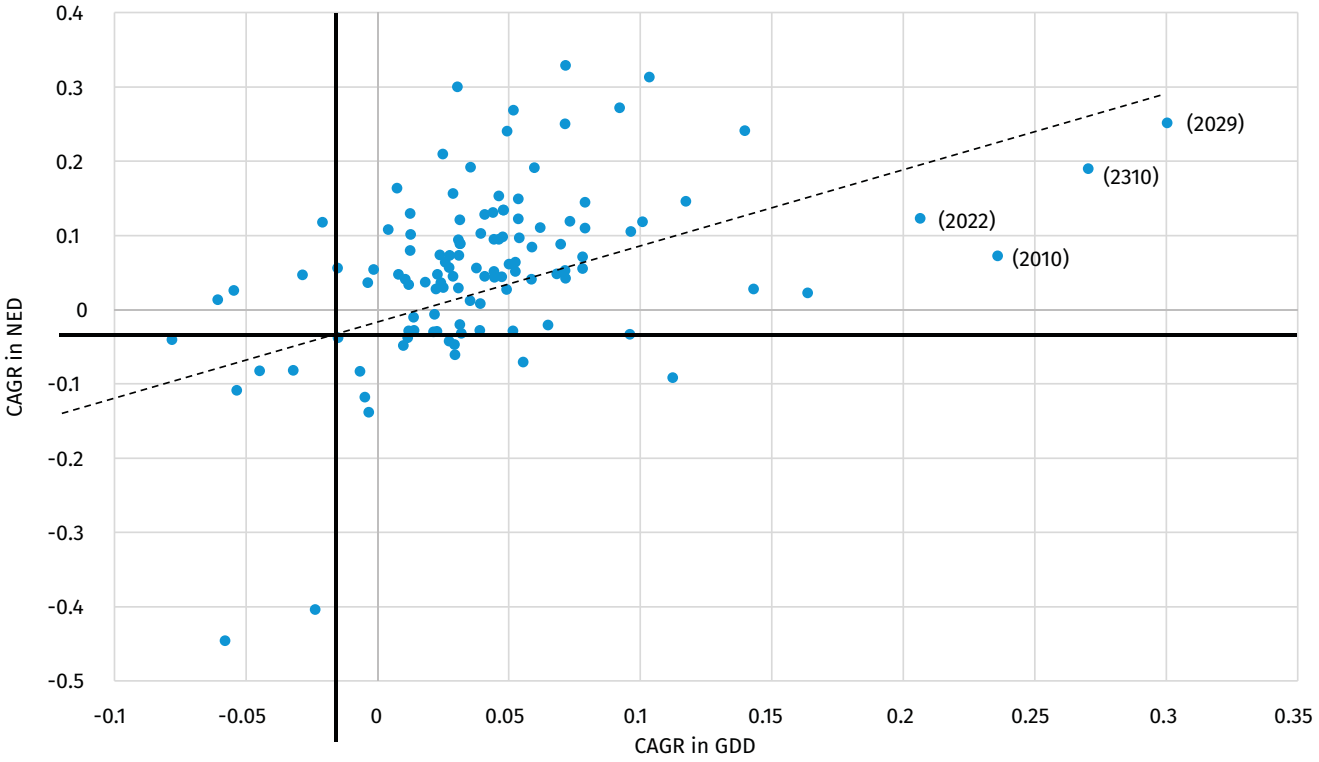


Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified.

The overall alignment between the sectors' global dynamism and their performance within Ukraine's exports is generally positive but somewhat weaker than the aggregate alignment (**Figure 2.12**). Sectors where policies for export promotion and capability upgrading are recommended to align with increasing global demand include: (2022) manufacture of builders' carpentry and joinery; (2010) sawmilling and planing of wood; (2310) manufacture of coke oven products; and (2029) manufacture of other wood products.

FIGURE 2.12: NATIONAL EXPORT CAGR AND GLOBAL IMPORT CAGR ACROSS SECTORS, BY IV-DIGIT ISIC REV. 3, 2017-2021

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



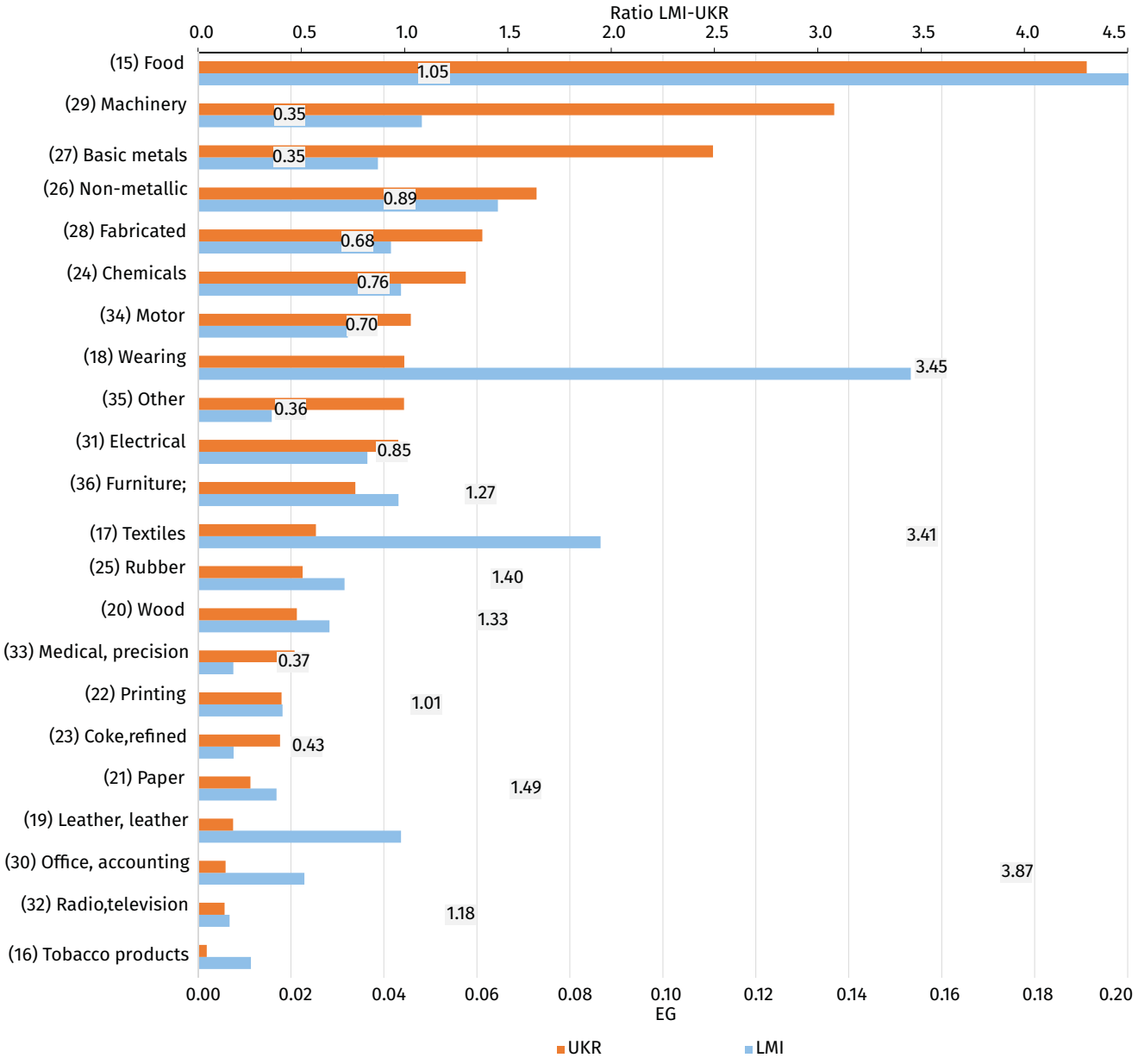
Note: CAGR = compound annual growth rate; n.e.c. = not elsewhere classified. Values should be interpreted as multiplied by 100 and as % changes.

EMPLOYMENT GENERATION (EG)

II-digit sector analysis: Figure 2.13 provides an overview of employment generation within manufacturing sectors using the II-digit ISIC Rev. 3 classification.[12] It illustrates the distribution of manufacturing employment in Ukraine and compares it to a representative LMI economy. The ratio between the two indicates the disparity between employment composition in the two regions. The five sectors with the highest employment generation in Ukraine include (15) food and beverages; (29) machinery and equipment n.e.c.; (27) basic metals; (26) non-metallic mineral products; and (28) fabricated metal products. The top sectors creating more employment than the average LMI economy include (27) basic metals; (29) machinery and equipment n.e.c; and (35) other transport equipment. Sectors generating more employment in LMI economies are typically related to textiles.

FIGURE 2.13: UKRAINE EMPLOYMENT GENERATION (EG) ACROSS MANUFACTURING SECTORS, BY II-DIGIT ISIC REV. 3, 1992-2021

Source: *INDSTAT* Database (UNIDO) and *World Development Indicators* database.



Note: LMI = lower-middle income; n.e.c. = not elsewhere classified. Employment generation for Ukraine is defined as the ratio of sector employment to total population (×1000) and is an average over the period 1992 - 2021; Employment generation for LMI is based on predicted employment generation using equation (2) as specified in the Appendix. For comparison purposes, both indicators were normalized to sum one.

The (15) Food and beverages sector exhibits short, medium and long-term development potential, and Ukraine already has well-developed production and export capabilities in this sector (see section 2.2.1). It is also essential to consider the solid backward linkages of the food industry to the agriculture sector.

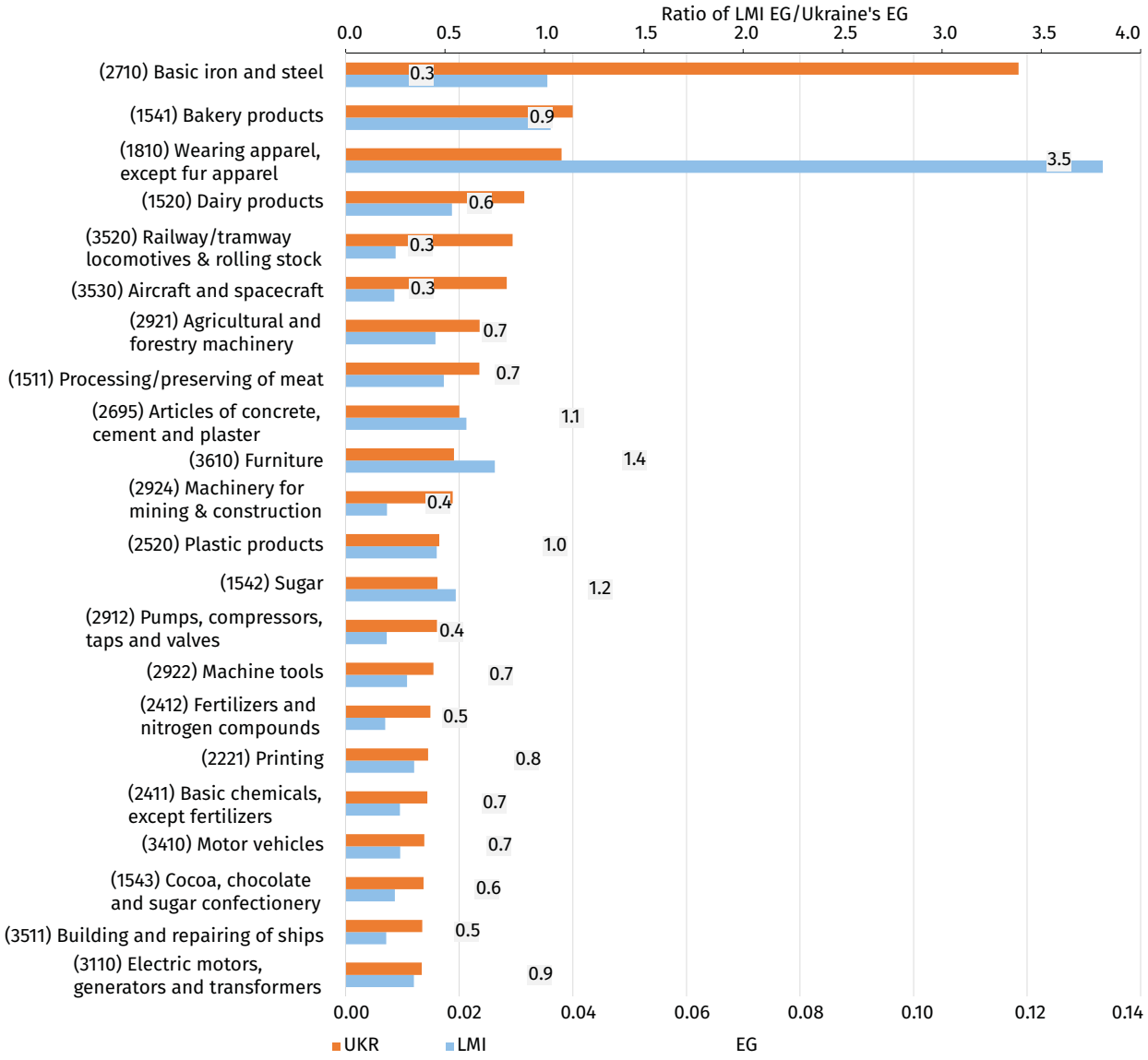
Industry experts and manufacturers interviewed for this project indicate that Ukraine's food and beverage industry is dynamic and holds significant expansion potential. However, there is a clear polarization within the sector. Major corporations such as Sun InBev, Nestle and Shchedro possess the financial resources to enhance production capacity, expand their markets and meet European and international standards. However, local producers have smaller networks and struggle to meet European standards, thereby lagging in production and market capacity.

To foster sector development, we recommend aligning with European standards to enhance integration into European food value chains, strengthen cooperation with EU firms by facilitating participation in international events and exhibitions, and ensure financial support for companies seeking to modernize production.

IV-digit sector analysis: **Figure 2.14** summarizes the employment projection across the manufacturing sectors at the level of IIV-digit ISIC Rev. 3 classification. It previews the results for the 22 sectors with the highest employment generation for Ukraine. The five sectors with the highest employment generation potential include: (2710) basic iron and steel; (1541) bakery products; (1810) wearing apparel, except fur apparel; (1520) dairy products; and (3520) railway/tramway locomotives & rolling stock. The figure confirms the metal sector's critical role in the Ukrainian economy, which is comparable to the role played by textiles in other LMI economies.

FIGURE 2.14: CHANGE IN UKRAINE'S TOP 22 EG SECTORS, BY IV-DIGIT ISIC REV. 3, 1992-2021

Source: UNIDO, *INDSTAT* database and World Bank, *World Development Indicators* database (accessed September 2023).



Note: LMI = lower-middle income; EG = employment generation; n.e.c. = not elsewhere classified. EG for Ukraine is defined as the ratio of sector employment to population and is an average over the peri-od 1992 - 2021, while EG for LMI countries is based on predicted employment generation using equation (2) as specified in the Appendix. For comparison purposes, both indicators were normalized to sum one.

OBLAST ANALYSIS

This section presents results on the spatial distribution of II-digit sector RCA across regions in Ukraine. **Figure 2.15** and **Figure 2.16** provide results for two periods: pre-war period (2017-2021) and the war period (2022)[13] using heatmaps of regional RCA across sectors. To facilitate the reading of the results, RCA values display only in those instances in which RCA≥1. The figure also includes a Diversity column, which features the count of sectors in which a region has an RCA≥1, and a Ubiquity row, which includes the number of regions with an RCA≥1 in each sector. **Figure 2.17** shows the change in RCA between the war and pre-war periods.

FIGURE 2.15: RCA ACROSS UKRAINIAN REGIONS AND SECTORS, BY II-DIGIT ISIC REV. 3, 2017-2021

Source: State Statistics Service of Ukraine statistical information, https://ukrstat.gov.ua (accessed September 2023).

	(15)+(16) Food, beverages and Tobacco	(17) Textiles	(18) Wearing apparel	(19) Leather	(20) Wood and wood products	(21) Pulp and paper products	(23) Coke, refined petroleum & nuclear fuel	(24) Chemicals & chemical products	(25) Rubber & plastics products	(26) Other non-metallic mineral products	(27)+(28) Basic metals, Fabricated metals	(29)+(30)+(31)+(32) Machinery, instruments and appliances	(33) Medical, precision & optical instruments	(34)+(35) Transport equipment	(36) Manufacturing n.e.c.	Diversity
Cherkasy	2.4	1.4	0	0	3.3	0.5		0.4	0.4	1.6	0	0.3	0.9	0.1	1.9	5
Chernihiv	0.8	2.5	11.2	1.2	4.7	7.3	0	0	0.8	0	0.1	0.4	0.4	0.4	0.6	5
Chernivtsi	0.5	8.9	1.1	2.3	15.2	0.1	0	0.2	1.5	0.2	0.1	2.7	0.8	0.2	6.3	7
Dnipropetrovsk	0.4	0.4	0.1	0.3	0.2	0.7	1.7	0.8	0.6	1.1	2.0	0.3	0.3	2.2	0.2	4
Donetsk	0.1	0	0	0		0	1.0	0.1	0		3.7	0.6	0.1	0.2	0	2
Ivano-Frankivsk	0	1.7	1.9	4	7.1	1.9	2.3	4.5	16.0	1.3	0	2.1	0.8	0	1.0	11
Kharkiv	1.8	2.1	1.5	0.4		1.6	0.1	1.1	2.3	4.8	0.2	2.2	8.2	2.9	2.0	11
Kherson	1.7	0.8	0	4.2		1.4		0.1	1.0	0.1	0.6	0.7	0.2	6.3	0	5
Khmelnytsky	0.6	3.3	0.9	0		0.1	0	0.2	2.4		0.2	1.3	2.0	0.2	2.6	5
Kirovograd	2.9	0.6	0	0.1		0	0	0.2	0.2		0	1.3	0.1	0.3	0.3	2
Kyiv city	2.0	0.3	1.2	0.6	0.8	0.5	1.5	1.1	0.6	0.7	0.2	0.4	1.5	0.6	0.6	5
Kyiv	1.1	0.7	0.2	2.8	1.8	5.5	0	0.9	3.2	4.3	0.2	0.6	1.4	0.5	1.6	8
Luhansk	0.6	5.5	0	0.1	0.1	35.6	0.2	5.4	2.5		0.3	0.3	10.2	0.5	2.0	6
Lviv	1.0	5.5	1.9	8.7		2.4	5.5	0.2	0.4	1.2	0.1	2.4	0.6	0.2	6.7	9
Mykolaiv	0.6	0.4	0	1.4	0.4	0	0	5.7	0		0	0.4	0.2	0.2	0	2
Odesa	1.9	0.3	0.9	0		0.2	0.1	0.4	0.4		0.2	0.5	1.4	3.9	0.2	3
Poltava	0.7	1.9	0	0.2	0.2	0.2	2.1	0.4	0	1.4	0.1	0.3	0.4	1.8	0.3	4
Rivne	0.2	2.9	0	0.1	23.4	0.4	0	1.9	0.3		0.1	0.3	0.2	0.5	8.0	4
Sumy	1.3	0.2	7.7	0.1	2.7		0	0.7	4.1	0.7	0.4	1.5	0.4	2.0	0.1	6
Ternopil	0.4	0.9	0	2.3		0.3	0	0.8	1.5		0.1	4.6	1.6	0	4.8	5
Vinnytsia	2.8	1.4	0	0.4		0.1	0	0.5	0.3	0.1	0.1	0.6	0.4	0.1	0.4	2
Volyn	0.3	2.0	0.4	0.5		3.0	0	0.1	2.1		0.2	5.4	0.3	1.7	6.3	6
Zakarpathian	0.1	5.5	7.7	5.3		0.1	0	0.6	0.4	0.1	0	7.3	2.3	0.5	4.6	6
Zaporizhzhya	0.5	0	0.2	0		0.1	1.0	0.7	0.2	0.6	2.6	1.6	0.4	0.6	0.1	3
Zhytomyr	0.2	5.7	2.0	4.7	12.0	3.2	0	0.1	0.7	13.2	0.3	2.4	0.1	0.1	1.1	8
Ubiquity	11.0	14.0	9.0	10.0	8.0	9.0	7.0	6.0	10.0	8.0	3.0	12.0	8.0	7.0	13.0	

Note: *RCA* = revealed comparative advantage. $RCA_l = m_k / M_k$, where m_k is the export share of sector ***k*** in the region ***l***'s total export, while M_k is the export share of sector ***k*** in the country's total export. Only the values of ***RCA>1*** are shown. Blank entries depict non-available values. 15+16 =manufacture food and beverages, and tobacco; 17=manufacture of textiles and textile products; 18=manufacture of wearing apparel; 19=tanning and dressing leather; 20=manufacture of wood and products of wood; 21=manufacture of paper and paper products; 23=manufacture of coke, refined petroleums and nuclear fuel; 24=manufacture of chemicals and chemical products; 25=manufacture of rubber and plastic products; 26=manufacture of other non-metallic mineral products; 27+28=manufacture of basic metals and fabricated metal products; 29+32=machinery (except transport); 33=manufacture of medical, precision and optical instruments, watches and clocks; 34+35=manufacture of motor vehicles, trailers and semi-trailers, of other transport equipment; 36=manufacture of furniture; manufacturing n.e.c. Ubiquity is the column count of ***RCA>1***. Diversity is the row count of ***RCA>1***.

FIGURE 2.16: RCA ACROSS UKRAINIAN REGIONS AND SECTORS, BY II-DIGIT ISIC REV. 3, 2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).

	(15)+(16) Food. beverages and Tobacco	(17) Textiles	(18) Wearing apparel	(19) Leather	(20) Wood and wood products	(21) Pulp and paper products	(23) Coke. refined petroleum & nuclear fuel	(24) Chemicals & chemical products	(25) Rubber & plastics products	(26) Other non-metallic mineral products	(27)+(28) Basic metals. Fabricated metals	(29)+(30)+(31)+(32) Machinery. instruments and appliances	(33) Medical. precision & optical instruments	(34)+(35) Transport equipment	(36) Manufacturing n.e.c.	Diversity
Cherkasy	1.5	0.5	0	0	2.7	0.7		1.0	0.5	1.3	0	0.2	0.3	0.2	0.7	4
Chernihiv	1.3	2.6	9.1	1.2	3.8	4.6	0	0.3	1.0	0.1	0.2	0.2	0.2	0.5	0.3	7
Chernivtsi	0.2	4.7	0.6	2.6	11.7	0.4	0	0.3	2.9	0.5	0.3	1.9	0.6	0.5	2.7	6
Dnipropetrovsk	0.4	0.2	0	0.4		0.3	0.8	0.3	0.8	1.5	3.3	0.1	0.2	2.7	0.1	3
Donetsk	0.4	0	0	0		0	16.4	1.4	0.1		0.3	0.1	0.1	0	0	2
Ivano-Frankivsk	0.1	1.9	2.3	2.1		2.0	0.9	3.8	14.9	1.8	0.3	2.9	3.3	0.1	1.1	10
Kharkiv	1.2	1.9	1.7	0.8		2.3	0.2	1.4	2.6	4.5	0.4	1.5	6.6	3.5	1.1	11
Kherson	2.0	0.6	0	1.6		1.0		0.2	0.5	0	0.5	0.3	0.7	0.7	0	3
Khmelnytsky	0.7	2.4	0.9	0		0.1	0	0.4	2.8		0.3	1.0	0.7	1.2	2.5	5
Kirovograd	2.5	0.3	0	0		0	0	0.4	0.1		0	0.7	0.1	0.1	0.3	
Kyiv city	1.6	0.2	1.1	0.7	0.9	0.4	1.0	1.5	0.5	0.8	0.2	0.5	1.3	0.8	0.3	5
Kyiv	0.9	0.4	0.1	1.5	1.4	4.0	0.6	1.0	2.0	3.0	0.3	0.7	0.6	1.1	1.6	8
Luhansk	0	0	0.4	0		0	0	0.6	0.5	13.5	0	0.4	0	10.3	0.3	2
Lviv	0.9	4.4	1.4	4.8		3.5	5.1	0.4	0.6	1.9	0.2	2.3	0.8	0.4	4.9	8
Mykolaiv	1.3	0.3	0	0.9	0.1	0	0	2.7	0		0	0.3	0.2	0.3	0	2
Odesa	1.3	0.3	0.6	0.1		0.2	0.3	0.4	0.5		0.3	0.3	1.5	1.6	0.1	3
Poltava	0.7	1.1	0	0.1	0.4	0.6	0.3	0.6	0	2.4	0	0.2	0.2	0.7	0.3	2
Rivne	0.4	1.9	0	0.2	17.3	0.6	0	5.9	0.3		0.2	0.2	0.5	0.2	3.0	4
Sumy	0.7	0.1	5.9	0		1.4	0	0.5	5.9	0.7	0.8	1.4	0.3	2.4	0.1	5
Ternopil	0.5	0.6	0	2.1		0.5	0	1.6	2.1		0.1	2.7	1.6	0.1	3.5	6
Vinnytsia	1.8	0.9	0	0.2		0.1	0	0.5	0.4		0.1	0.4	0.5	0.1	0.4	
Volyn	0.6	1.0	0.3	0.5		3.8	0.2	0.1	2.6		0.3	3.2	0.3	0.3	5.0	5
Zakarpathian		3.4	5.8	2.9	4.6	0.2	0	0.3	0.5	0.1	0.1	6.0	4.0	0.4	2.4	7
Zaporizhzhya	0.2	0	0	0		0.2	0.4	0.7	0.2	0.7	5.4	0.9	0.2	0.3	0.1	
Zhytomyr	0.4	5.7	1.1	6.0		5.9	0	0.3	0.8		0.4	3.4	0.7	0.1	1.2	6
Ubiquity	10.0	11.0	8.0	9.0	6.0	9.0	3.0	9.0	9.0	8.0	2.0	10.0	6.0	7.0	11.0	

Note: *RCA* = revealed comparative advantage. $RCA_l = m_k / M_k$, where m_k is the export share of sector ***k*** in the region ***l***'s total export, while M_k is the export share of sector ***k*** in the country's total export. Only the values of ***RCA>1*** are shown. Blank entries depict non-available values. 15+16 =manufacture food and beverages, and tobacco; 17=manufacture of textiles and textile products; 18=manufacture of wearing apparel; 19=tanning and dressing leather; 20=manufacture of wood and products of wood; 21=manufacture of paper and paper products; 23=manufacture of coke, refined petroleum and nuclear fuel; 24=manufacture of chemicals and chemical products; 25=manufacture of rubber and plastic products; 26=manufacture of other non-metallic mineral products; 27+28=manufacture of basic metals and fabricated metal products; 29+32=machinery (except transport); 33=manufacture of medical, precision and optical instruments, watches and clocks; 34+35=manufacture of motor vehicles, trailers and semi-trailers, of other transport equipment; 36=manufacture of furniture; manufacturing n.e.c. Ubiquity is the column count of ***RCA>1***. Diversity is the row count of ***RCA>1***.

FIGURE 2.17: CHANGE IN UKRAINE'S REGIONAL SPECIALIZATION, BY II-DIGIT ISIC REV. 3, 2017-2021 VS 2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).

	(15)+(16) Food, beverages and Tobacco	(17) Textiles	(18) Wearing apparel	(19) Leather	(20) Wood and wood products	(21) Pulp and paper products	(23) Coke, refined petroleum & nuclear fuel	(24) Chemicals & chemical products	(25) Rubber & plastics products	(26) Other non-metallic mineral products	(27)+(28) Basic metals, Fabricated metals	(29)+(30)+(31)+(32) Machinery, instruments and appliances	(33) Medical, precision & optical instruments	(34)+(35) Transport equipment	(36) Manufacturing n.e.c.
Cherkasy	-0.9	-0.9	0	0	-0.6	0.2		0.6	0.1	-0.3	0	-0.1	-0.6	0.1	-1.2
Chernihiv	0.5	0.1	-2.1	0	-0.9	-2.7	0	0.3	0.2	0.1	0.1	-0.2	-0.2	0.1	-0.3
Chernivtsi	-0.3	-4.2	-0.5	0.3	-3.5	0.3	0	0.1	1.4	0.3	0.2	-0.8	-0.2	0.3	-3.6
Dnipropetrovsk	0	-0.2	-0.1	0.1		-0.4	-0.9	-0.5	0.2	0.4	1.3	-0.2	-0.1	0.5	-0.1
Donetsk	0.3	0	0	0		0	15.4	1.3	0.1		-3.4	-0.5	0	-0.2	0
Ivano-Frankivsk	0.1	0.2	0.4	-1.9		0.1	-1.4	-0.7	-1.1	0.5	0.3	0.8	2.5	0.1	0.1
Kharkiv	-0.6	-0.2	0.2	0.4		0.7	0.1	0.3	0.3	-0.3	0.2	-0.7	-1.6	0.6	-0.9
Kherson	0.3	-0.2	0	-2.6		-0.4		0.1	-0.5	-0.1	-0.1	-0.4	0.5	-5.6	0
Khmelnytsky	0.1	-0.9	0	0		0	0	0.2	0.4		0.1	-0.3	-1.3	1	-0.1
Kirovograd	-0.4	-0.3	0	-0.1		0	0	0.2	-0.1		0	-0.6	0	-0.2	0
Kyiv city	-0.4	-0.1	-0.1	0.1	0.1	-0.1	-0.5	0.4	-0.1	0.1	0	0.1	-0.2	0.2	-0.3
Kyiv	-0.2	-0.3	-0.1	-1.3	-0.4	-1.5	0.6	0.1	-1.2	-1.3	0.1	0.1	-0.8	0.6	0
Luhansk	-0.6	-5.5	0.4	-0.1		-35.6	-0.2	-4.8	-2		-0.3	0.1	-10.2	9.8	-1.7
Lviv	-0.1	-1.1	-0.5	-3.9		1.1	-0.4	0.2	0.2	0.7	0.1	-0.1	0.2	0.2	-1.8
Mykolaiv	0.7	-0.1	0	-0.5	-0.3	0	0	-3	0		0	-0.1	0	0.1	0
Odesa	-0.6	0	-0.3	0.1		0	0.2	0	0.1		0.1	-0.2	0.1	-2.3	-0.1
Poltava	0	-0.8	0	-0.1	0.2	0.4	-1.8	0.2	0	1	-0.1	-0.1	-0.2	-1.1	0
Rivne	0.2	-1	0	0.1	-6.1	0.2	0	4	0		0.1	-0.1	0.3	-0.3	-5
Sumy	-0.6	-0.1	-1.8	-0.1			0	-0.2	1.8	0	0.4	-0.1	-0.1	0.4	0
Ternopil	0.1	-0.3	0	-0.2		0.2	0	0.8	0.6		0	-1.9	0	0.1	-1.3
Vinnytsia	-1	-0.5	0	-0.2		0	0	0	0.1		0	-0.2	0.1	0	0
Volyn	0.3	-1	-0.1	0		0.8	0.2	0	0.5		0.1	-2.2	0	-1.4	-1.3
Zakarpathian		-2.1	-1.9	-2.4		0.1	0	-0.3	0.1	0	0.1	-1.3	1.7	-0.1	-2.2
Zaporizhzhya	-0.3	0	-0.2	0		0.1	-0.6	0	0	0.1	2.8	-0.7	-0.2	-0.3	0
Zhytomyr	0.2	0	-0.9	1.3		2.7	0	0.2	0.1		0.1	1	0.6	0	0.1

Note: *RCA* = revealed comparative advantage. Entries are the difference between regional average *RCA* for 2017 and 2021 and a region's *RCA* in 2022. Red denotes positive values, while blue represents negative ones. Darker colours signify higher values.

Figures 2.15 and 2.16 indicate that sectoral specialization patterns are spread across regions in Ukraine. Relevant exceptions to this are (27-28) manufacture of basic metals and fabricated metal products and (24) chemicals & chemical products.

In the former sector, only three regions (Dnipropetrovsk, Donetsk and Zaporizhzhya) had an RCA≥1 during the pre-war period, indicating that they are the only regions with existing production and export capabilities in that sector. This remained the case in the war period, with the RCA score increasing from 2 in the pre-war period to 3.3 in the war period for Dnipropetrovsk and from 2.6 to 5.4 in Zaporizhzhya over the same period. However, Donetsk experienced a drop in RCA score from 3.7 to 0.3 over the same period, indicating a loss in global competitiveness.

Mykolaiv, Luhansk, Ivano-Frankivsk, Rivne and Kharkiv regions exhibited high specialization in the (24) chemicals & chemical products sector before the war. Since then, Mykolaiv has ceded part of its comparative advantage in chemicals to the Rivne oblast, while Luhansk also lost its comparative advantage in the same industry.

Regarding the productive diversity of Ukrainian regions – which can serve as an indicator of productive capabilities – the most competitive regions in 2021 were Ivano-Frankivsk (11 RCAs), Kharkiv (11), Lviv (9), Zhytomyr (8), Kyiv region (8) and Chernivtsi (7). The region most adversely affected by the conflict is Luhansk, which is experiencing a loss of 4 RCAs. In 2022, the Kharkiv, Ivano-Frankivsk, Lviv and Kyiv regions had the highest number of specializations (11, 10, 8 and 7, respectively).

Table D7 (Appendix D) compares the RCA scores of the top three regions by sector to gain further insight into how the war may have affected each region's RCA. On average, the table reveals a drop in the RCA across regions. The only exception is in the (17) manufacture of textiles and textile products sector in the Zhytomyr region, which remained at 5.7 across both periods. The table also identifies regions that gained RCA during the war. Among others, these include (19) tanning and dressing leather, in the Zhytomyr region, with an RCA score that increased from 4.7 to 6.0; and (25) manufacture of rubber and plastic products, in the Sumy region, with an RCA score that increased from 4.1 to 5.9.

2.3 IDENTIFYING POTENTIAL UKRAINE-EU REGIONAL VALUE CHAINS

This section identifies sectors within the manufacturing sector that have the potential for solid collaboration and value chain integration between Ukraine and the EU.[14] Accordingly, the first part of the analysis focuses on a general assessment of Ukrainian manufacturing exports to EU economies and identifying relevant regional value chains. The analysis is inspired by one of the UNIDO methodologies to analyse regional value chains (UNIDO 2022). The second part provides a general examination of EU exports – both capital and intermediate manufacturing goods – to Ukraine. The analysis here relies solely on EU-Ukraine bilateral trade data disaggregated using ISIC Rev. 4 and BEC5.

SUMMARY OF FINDINGS

Potential intermediate goods value chains

- (2410) manufacture of basic iron and steel is the most relevant regional value chain. This aligns with the European Commission analysis revealing Ukraine's main manufacturing exports to the EU are iron and steel;[15]
- (1040) manufacture of vegetable and animal oils and fats is another potential regional value chain. This is again in line with the Commission's analysis;
- (2930) manufacture of parts and accessories for motor vehicles is the last relevant and potential RVC in the region.

Potential capital goods value chains

- (2813, 2819, 2929, 2821, 2822, 2824, 2829) manufacture of machinery and equipment;
- Manufacture of computers, electronics and optional products; especially, (2630) manufacture of communication equipment;
- (2710) manufacture of electrical motors, generators, transformers and electrical distribution, and (2750) control apparatus and domestic appliances.

2.3.1 DATA AND METHODOLOGY

The primary data used for the analysis in this section is the HS4 data sourced from the *UN Comtrade Database* and spanning the years 2015 to 2022. The HS4 data was subsequently transformed into the International Standard Industrial Classification (ISIC) ISIC Rev. 4, which provides a framework for categorizing production activities according to economic industries and subindustries. The objective was to analyse manufacturing data in conjunction with Broad Economic Categories Revision 5 (BEC5) to organize commodities based by their level of processing as intermediate, consumption and capital goods. Intermediate consumption pertains to goods utilized as inputs in the production process, while capital goods (also known as gross fixed capital formation) encompass durable assets such as machinery, equipment, buildings or structures that are employed repeatedly or continuously in production for a period exceeding one year. The difference between intermediate consumption and capital goods hinges on whether the goods involved in the production process are entirely consumed within the accounting period. If they are fully consumed, they fall under the intermediate consumption category, whereas if they endure beyond the accounting period, they fall under the capital goods category. Finally, to identify potential regional value chains, the section uses intermediate goods since these types of goods are essential inputs to produce capital and final consumption goods.

2.3.2 RESULTS AND DISCUSSION

This section first presents and discusses the results of Ukraine's exports to the EU, followed by a discussion of the potential regional value chain between Ukraine and the EU. Finally, the section gauges reciprocal EU exports to Ukraine.

UKRAINE'S EXPORTS TO THE EU

Figure 2.18 illustrates Ukraine's total exports by year disaggregated based on BEC 5 classification. Over the past eight years, Ukraine's primary manufacturing exports predominantly comprised intermediate consumption goods, more than half of the total manufacturing export, accompanied by final consumption goods, with a smaller portion comprising capital goods. This shows that Ukraine could be a potential trade partner of the EU countries, enabling substantial economic gains.

Figure 2.19 presents the shares of Ukraine's exports to the EU across from 2016-2022; more than one-half are manufacturing. Not surprisingly, in 2022, non-manufacturing exports almost doubled, and manufacturing exports fell more than 10 percent compared to 2021.

FIGURE 2.18: SHARE OF UKRAINE'S TOTAL MANUFACTURING EXPORTS TO THE EU, BY BEC5 CLASSIFICATION, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

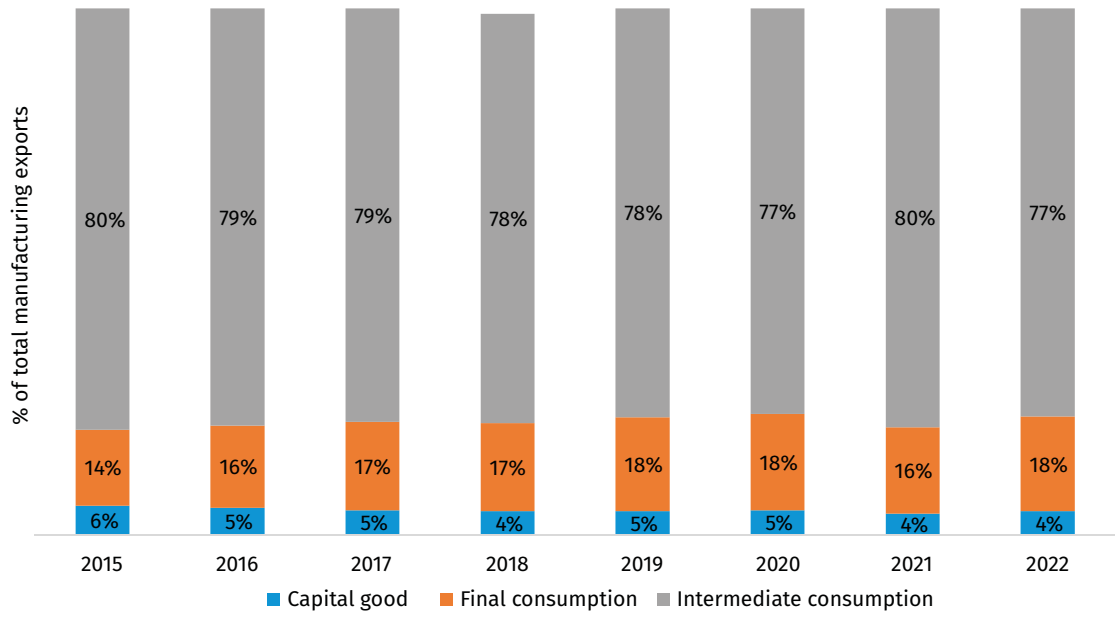


FIGURE 2.19: SHARE OF UKRAINE'S TOTAL EXPORTS TO THE EU, BY ISIC REV. 4, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

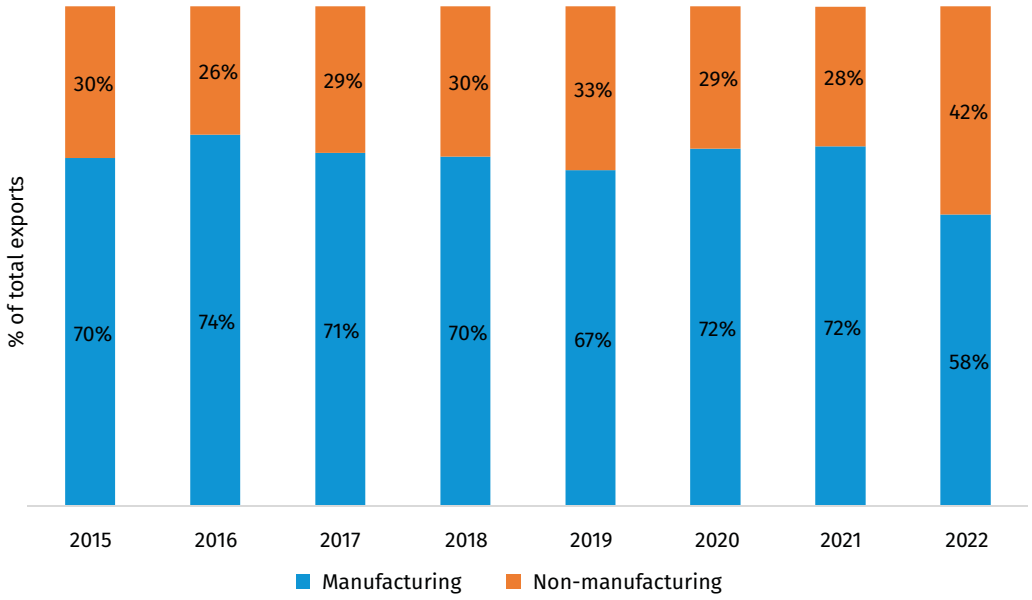
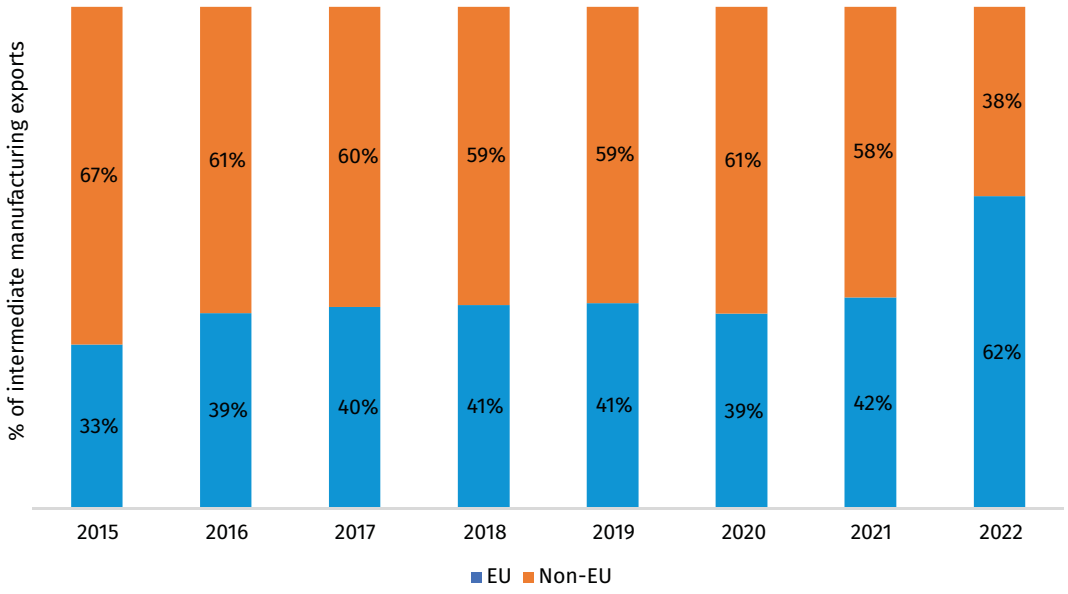


Figure 2.20 shows the share of total Ukrainian manufacturing exports to the EU member states and the rest of the world. Over the last eight years, there has been a remarkable surge in intermediate manufacturing exports from Ukraine to the EU. In 2022, these exports peaked, constituting over 50 percent of Ukraine's manufacturing exports. This upward trend indicates a strengthening trade relationship between Ukraine and the EU, mainly due to the established trade engagements by the Deep and Comprehensive Free Trade Area (DCFTA).

FIGURE 2.20: SHARE OF UKRAINE'S INTERMEDIATE MANUFACTURING EXPORTS, EU VS REST OF THE WORLD, BY ISIC REV. 4, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



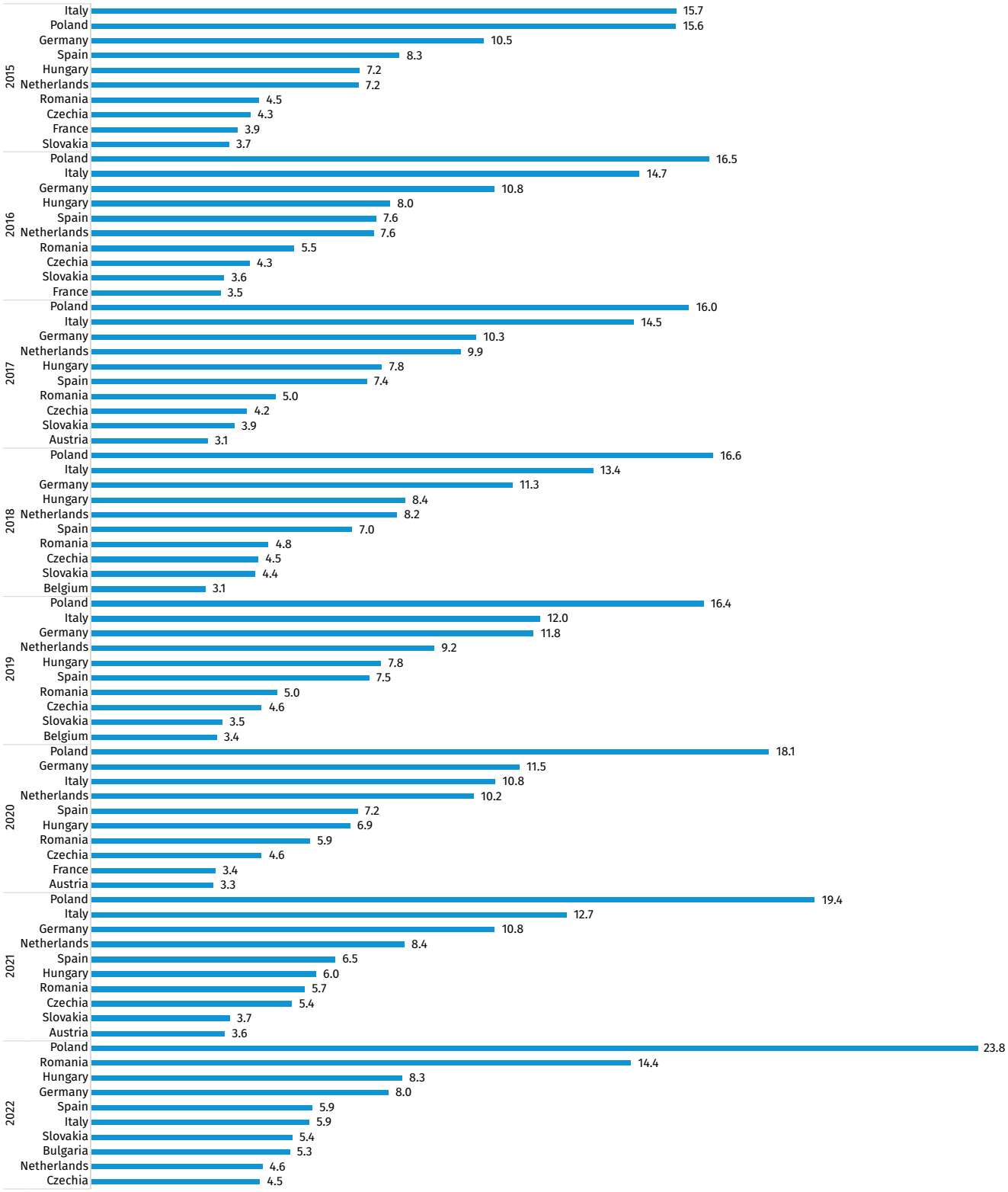
The results of consultations with manufacturing company managers and industrial organization members have highlighted some significant challenges in further integrating into European value chains, stemming primarily from the lack of compliance with EU product standards and the absence of certification for specific products. This issue is particularly pertinent for industries such as wood, food, textiles, leather and footwear, where informal production practices hold substantial weight. It's worth noting that these sectors have been identified in Section 2.2.2 as having high potential in terms of ECA, LUP and EG.

Another limitation to deeper integration arises from the lack of harmonization between national legislation and European standards. This concern is particularly relevant for the pharmaceutical industry, which is a part of the chemical sector and has been identified as having LUP. To address these issues, potential policy actions include providing administrative support to companies seeking certification and formalization; establishing industrial parks; and administrative efforts to bring informal economic activities into the formal sector. Additionally, fostering closer collaboration with regional chambers of commerce, which possess local industry insights and can facilitate the acquisition of skills and training necessary for production in line with European standards, is crucial for enhancing industrial development.

Ukrainian exports to the EU member states vary with the location of the member states. Poland and Germany are the leading importers of Ukrainian exports, followed by Italy, Hungary, the Netherlands and Spain. **Figure 2.21** displays the top destinations of Ukrainian exports per year.

FIGURE 2.21: SELECTED EU COUNTRIES IMPORTING UKRAINIAN EXPORTS, BY TOTAL EXPORTS, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



POTENTIAL REGIONAL VALUE CHAINS

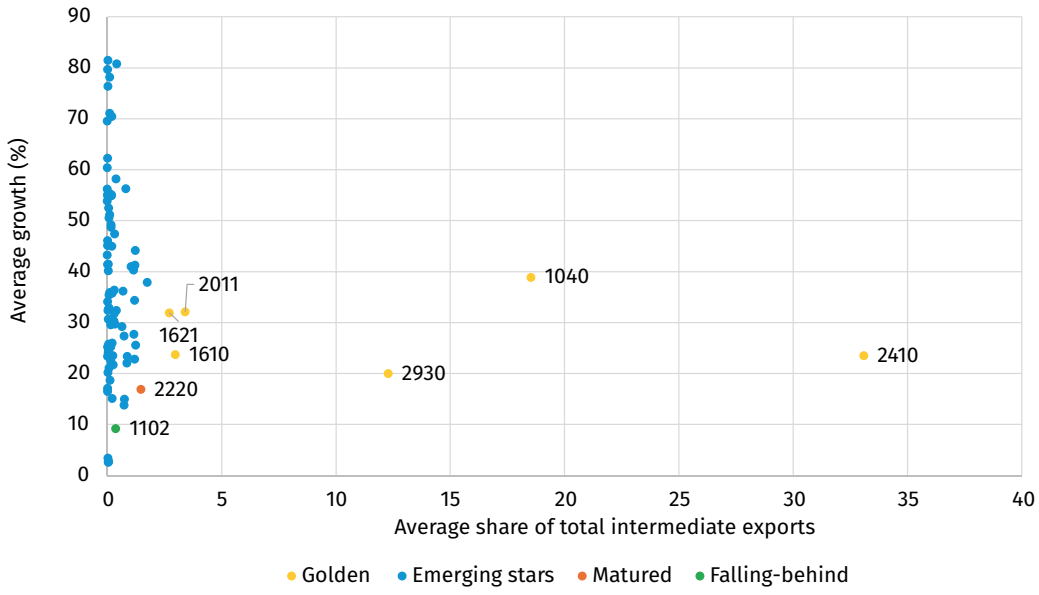
Intermediate manufacturing goods are specifically considered to identify relevant manufacturing regional value chains. Manufacturing sectors that made a notable contribution to Ukraine's overall manufacturing exports and demonstrated sustainability were included in this analysis. Average relative share of the sector and the average growth rate of the sector in the last seven years are measured based on the relative contribution of the intermediate manufacturing sector to total manufacturing exports. Following this analytical technique, the identified sectors are divided into four groups:

- **Golden:** Sectors with more than 20 percent average growth and a relatively large share of total manufacturing intermediate exports, precisely more than 2 percent in the last seven years;
- **Emerging stars:** Characterized by a low average relative share of less than 1 percent and a notably high average growth rate in the last seven years;
- **Matured:** Sectors with a relatively high average share of total exports, more than 1.5 percent, but deficient average growth of less than 20 percent in the last seven years;
- **Falling-behind:** Demonstrate a meagre average relative share of less than 1 percent and less than 10 percent growth in the last seven years.

Figure 2.22 displays the sectors based on the evaluation criteria above, revealing that the structure of intermediate manufacturing goods is highly concentrated. The three sectors with larger shares account for more than 60 percent of the total. Golden sectors include: (2410) manufacture of basic iron and steel; (1040) manufacture of vegetable and animal oils and fats; (2930) manufacture of parts and accessories for motor vehicles; (2011) manufacture of basic chemicals; (1621) manufacture of veneer sheets and wood-based panels; and (1610) sawmilling and planing wood. This indicates the importance of the food, wood and metal sectors in the Ukrainian economy.

FIGURE 2.22: AVERAGE SHARE AND GROWTH OF UKRAINE'S INTERMEDIATE EXPORTS, BY 4-DIGIT ISIC REV. 4, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: Golden sectors = annual average growth (2015-2022) above 20 percent and share in total intermediate manufacturing exports above 2 percent. Emerging stars = average relative share of less than 1 percent and average growth rate of less than 20. Matured = average share of more than 1.5 percent and average growth of less than 20 percent. Falling-behind = average relative share of less than 1 percent and growth of less than 10 percent in the last seven years.

The analysis discovered several relevant regional value chains that can potentially enhance trade engagement between the EU and Ukraine:

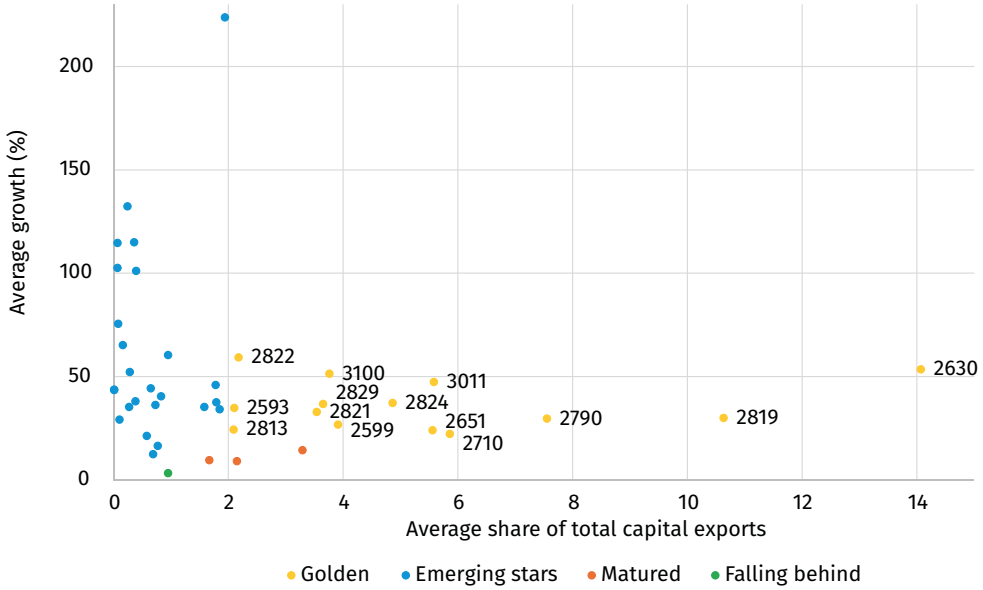
- (2410) manufacture of basic iron and steel is the most relevant regional value chain. This aligns with the European Commission analysis that revealed Ukraine's main manufacturing exports to the EU are Iron and Steel;[16]
- (1040) manufacture of vegetable and animal oils and fats is another potential regional value chain. This is again in line with the Commission's analysis;
- (2930) manufacture of parts and accessories for motor vehicles is the last relevant and potential RVC in the region;
- (201) manufacture of basic chemicals;
- (1610) sawmilling and planing of wood;
- (1621) manufacture of veneer sheets and wood-based panels.

The next section explores the manufacturing exports categorized by the BEC 5 as "capital goods". These goods are also known as gross fixed capital formation, and they include durable assets such as machinery, equipment, buildings or structures that are used repeatedly or continuously in the production process. Capital goods account for less than 6 percent of Ukrainian manufacturing exports to the EU.

Figure 2.23 presents the sectors in Ukraine that export capital goods. It is evident from the figure that the industrial export structure for capital goods is less concentrated than that of intermediate goods. Some of the sector classes meeting the Golden criteria, characterized by more than 20 percent average growth and a share of total manufacturing capital exports of more than 2 percent in the last seven years, are (2824) machinery equipment, particularly specialized machinery for mining, quarrying, and construction; (2822) metal-forming machinery and machine tools; (2829) general; and (2819) special-purpose machinery . Additionally, essential capital goods exports include transport equipment that falls outside the categories of vehicles and trailers. This encompasses (3011) construction of ships and floating structures, (3020) construction of pleasure and sporting structures, as well as (3030) air and spacecraft and related machinery. Other vital sectors are the (2630) manufacture of communication equipment; (2651) manufacture of measuring, testing, navigating; (2710) control equipment; and (2790) manufacture of electrical equipment. These regional value chains for capital goods represent the interconnected processes and industries involved in producing and distributing various capital goods, playing a crucial role in economic development and industrial growth.

FIGURE 2.23: AVERAGE SHARE AND GROWTH OF UKRAINE'S CAPITAL GOODS, BY 4-DIGIT ISIC REV. 4, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



Note: Golden sectors = annual average growth (2015-2022) above 20 percent and share in total intermediate manufacturing exports above 2 percent. Emerging stars = average relative share of less than 1 percent and average growth rate of less than 20 . Matured = average share of more than 1.5 percent and average growth of less than 20 percent. Falling-behind = average relative share of less than 1 percent and growth of less than 10 percent in the last seven years.

Key regional value chains for capital goods can be grouped as divisional sectors or sectors as follows:

- (2813, 2819, 2929, 2821, 2822, 2824, 2829) manufacture of machinery and equipment;
- Manufacture of computers, electronics and optional products; especially (2630) manufacture communication equipment;
- (2710) manufacture of electrical motors, generators, transformers and electrical distribution; and (2750) manufacture of control apparatus and domestic appliances.

These are industries with high potential for industrial development, whose products are manufactured according to European standards.

The previous analysis indicates that Ukraine's capital and intermediate exports are critical and significant for the European markets to enhance the competitiveness of EU exports and increase productivity.

Table 2.5 examines the impact of the ongoing armed conflict in Ukraine on exports in 2022. In particular, the table illustrates the relative growth of exports over the past seven years, using 2015 as the base year for calculations. Overall, there was a significant decline of 35 percent in exports compared to the previous year. This decline was particularly pronounced in capital goods exports, which saw a substantial drop of 35.7 percent compared to 2021. Intermediate consumption exports and final consumption goods were also heavily affected; both experienced significant reductions of approximately 35.4 percent each.

TABLE 2.5: RELATIVE GROWTH OF UKRAINE'S EXPORTS, BY CATEGORY AND BASED ON BEC5 CLASSIFICATION, 2016-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

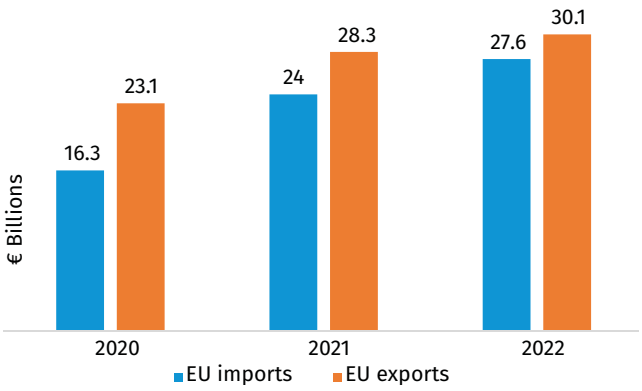
YEAR	CAPITAL GOODS	FINAL CONSUMPTION	INTERMEDIATE CONSUMPTION
2016	74.4	106.0	88.9
2017	8.0	30.1	17.9
2018	6.2	10.3	9.5
2019	-0.9	3.3	6.3
2020	-2.1	-3.5	-3.5
2021	17.1	17.6	36.5
2022	-35.7	-33.3	-35.4

EU EXPORTS TO UKRAINE

This section highlights EU member states' main exports to Ukraine, which expanded tremendously in the last three years, from an export value of €23.1 billion in 2020 to €30.1 billion in 2022 (**Figure 2.24**) Likewise, Ukrainian exports to the EU have steadily grown more than 80 percent. from €16.3 to €27.6 billion.

FIGURE 2.24: EU TRADE WITH UKRAINE, 2020-2022

Source: European Commission (accessed September 2023).



Manufacturing exports of the European Union (EU) to Ukraine primarily consist of intermediate consumption goods, as depicted in **Figure 2.25**. Furthermore, when comparing Ukraine's imports and exports, it is evident that Ukraine imports a larger share of capital goods than it exports – a trend that has been increasing over the years.[17] However, the imports of final consumption goods and intermediate goods have remained relatively consistent over time, except for a noticeable deviation in 2022. This fluctuation may be attributed, at least in part, to the ongoing armed conflict within the country.

The war's impact on the capital goods sector is concerning due to its pivotal role in development and reconstruction. The Donetsk region's exports are predominantly driven by three sectors: the manufacture of machinery and equipment not elsewhere classified (n.e.c.); office, accounting, and computing machinery manufacturing; and electrical machinery and apparatus manufacturing n.e.c. Collectively, these sectors represented 89 percent of Donetsk's total exports in 2021. However, in 2022, exports from these sectors plummeted by 99.6 percent (see Section 4.4.2).

As presented in **Figure 2.26**, the countries that have the highest export volumes to Ukraine are Poland, Germany, Italy and Hungary. They stand out in their significant manufacturing exports compared to other European Union nations. The exports from EU countries to Ukraine primarily consist of various manufacturing products. The major manufacturing sectors dominating Ukraine's imports from the European Union are intermediate, principally consumption goods, including: (2100) manufacture of pharmaceuticals, medicinal chemicals and botanical products;

(222) manufacture of plastics products; (2013) manufacture of plastics and synthetic rubber in primary forms; and (2732) manufacture of other electronic and electric wires and cables. **Figure 2.27** provides a comprehensive overview of Ukraine's top 10 intermediate manufacturing imports from the European Union. According to the BEC 5 classification, manufacturing sectors categorized as capital goods, mainly used to produce other goods, are essential to Ukraine's imports from EU member states. Sectors that use most of these capital goods are the (2821) manufacture of agricultural and forestry machinery, (2910) manufacture of motor vehicles and (2819) manufacture of other general-purpose machinery sectors.

FIGURE 2.25: SHARE OF EU MANUFACTURING EXPORTS TO UKRAINE, BY BEC REV. 5 CLASSIFICATION, 2015-2022

Source: United Nations *UN Comtrade Database* (accessed September 2003).

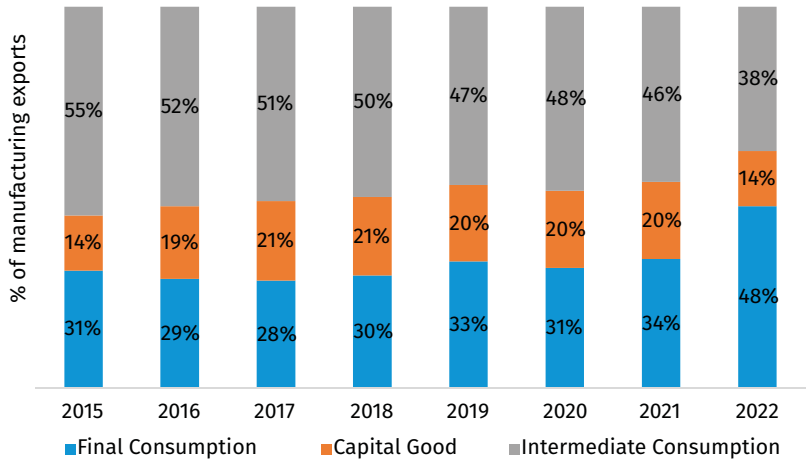


FIGURE 2.26: TOP EU COUNTRIES WITH THE HIGHEST MANUFACTURING EXPORTS TO UKRAINE, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).

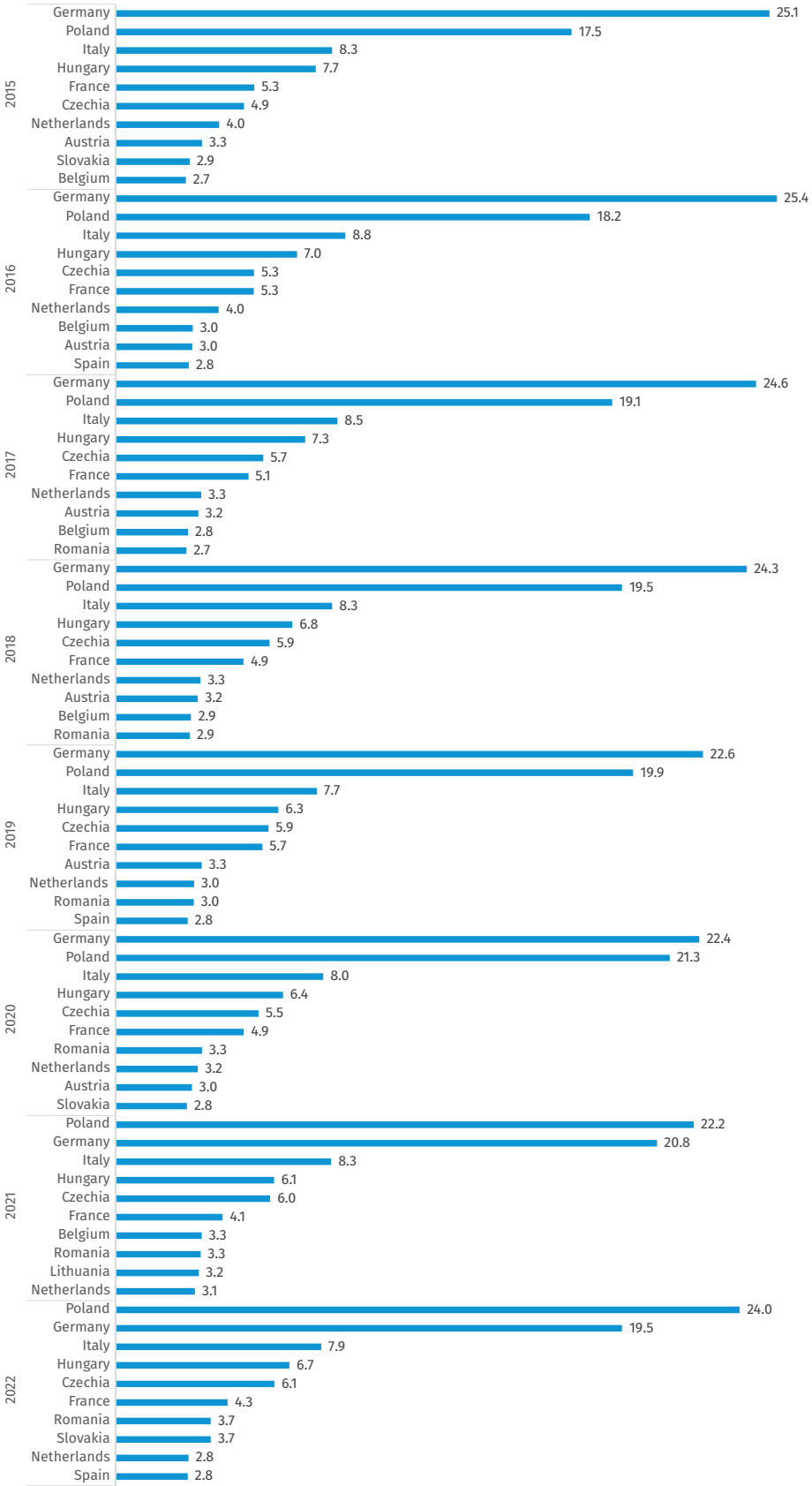
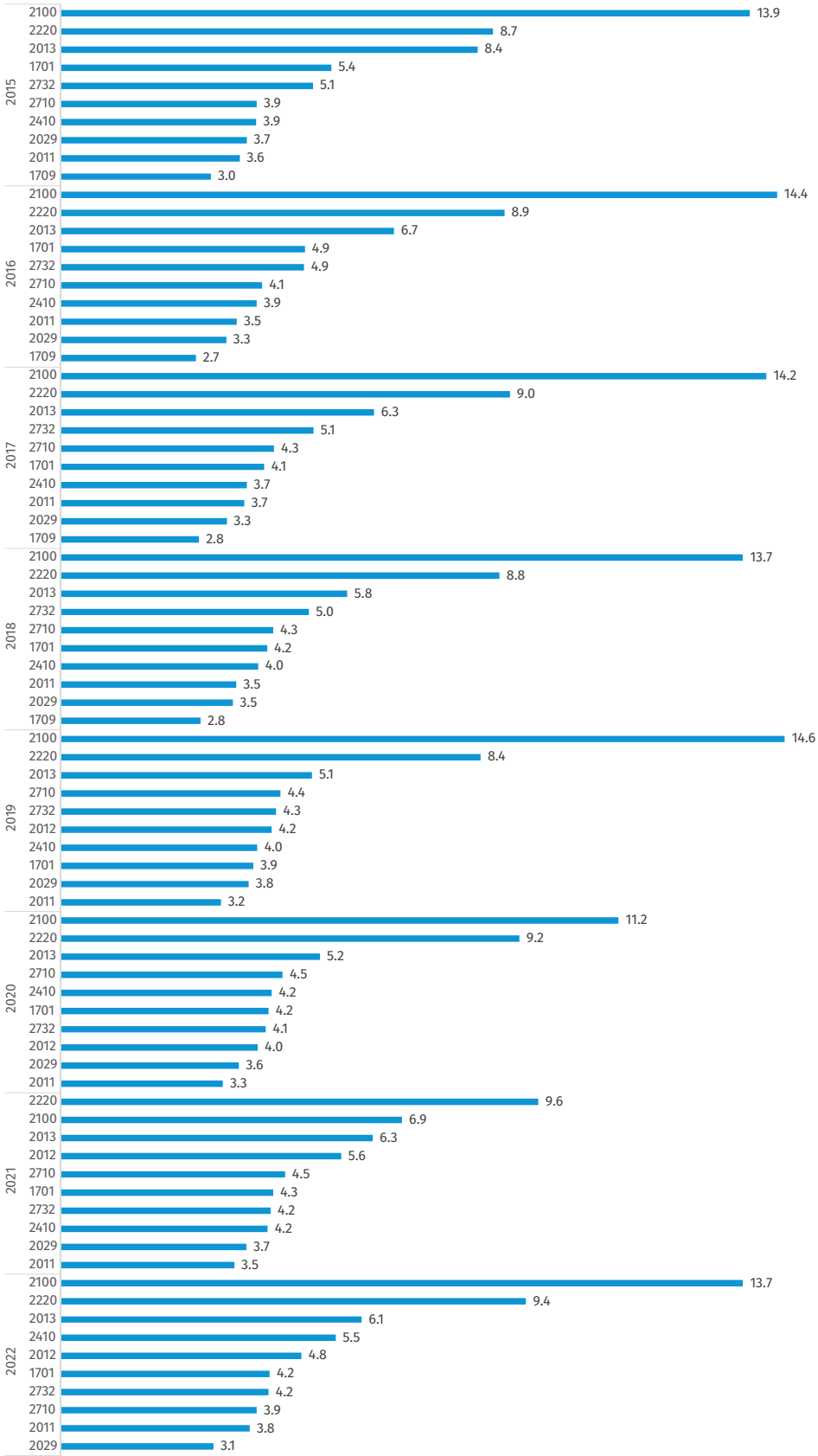


FIGURE 2.27: TOP 10 EU INTERMEDIATE MANUFACTURING EXPORTS TO UKRAINE, 2015-2022

Source: United Nations, *UN Comtrade Database* (accessed September 2023).



2.4 IMPACT OF THE WAR ON INDUSTRIAL SECTORS

This section provides an in-depth analysis of Ukraine's industrial performance at the 2-digit ISIC level, focusing on the economic impact of the war on various industries. The section uses data from 2020-2022 to assess the damage caused by the war, with a particular emphasis on 2022. It also explores regional vulnerabilities to industrial losses, adding a nuanced regional dimension to the discussion. The analysis encompasses the impact on the volume of industrial products sold, the overall production indices and estimates of value-added losses. Furthermore, it scrutinizes the repercussions on trade, regional exports, imports and investment destinations. Finally, it explores business expectations and the factors influencing investment decisions in the current and upcoming years.

SUMMARY OF FINDINGS

On production and the volume of industrial products sold:

- The war has led to a decrease in the volume of industrial products sold in 15 of 24 two-digit industries, with the most significant decline observed in the tobacco industry (53 percent); followed by machinery and equipment, n.e.c. (38 percent); other non-metallic mineral products (34 percent); basic metals (29 percent); and printing and reproduction of recorded media (also 29 percent);
- All two-digit manufacturing industries experienced a decline in production, with basic metals, coke, and refined petroleum, as well as non-metallic materials, seeing a reduction of over 60 percent in 2022 compared to the 2019-2021 average;
- Front-line regions such as Zaporizhzhia, Donetsk, Kharkiv and the City of Kyiv suffered the most regarding value-added loss. Donetsk incurred the highest damage and loss, necessitating an estimated US$10.5 billion in support.

On trade:

- Ukraine's aggregate exports and imports in goods declined by 18.8 percent and 13.3 percent, respectively, in 2022 compared to the 2019-2021 average. However, exports to the EU increased by 30 percent, while non-EU exports decreased by 51 percent. Ukraine's imports from the EU increased by 1 percent, while imports from the non-EU decreased by 24 percent;
- Regionally, exports from front-line regions fell by 58 percent in 2022 compared to the average exports of 2019-2021. The largest declines in exports were observed in Donetsk (95 percent), Luhansk (94 percent) and Kherson (82 percent). Backline regions experienced an increase in exports of 21 percent;
- In many front-line regions, a few sectors account for most of the region's exports. For instance, Basic and fabricated metals accounted for 89 percent of Donetsk's total exports in 2021. These sectors experienced a fall in exports of 99 percent;
- In the Kharkiv region, Food and beverage exports declined by 51 percent, while Machinery exports declined by 58 percent in 2022. These sectors accounted for 34 percent and 22 percent of total region exports, respectively.

On investment destination:

- In 2022, the distribution of investment was similar to previous years, with 48 percent for replacement, 21 percent for extension and 19 percent for rationalization;
- There was no substantial difference between the pre- and during-war periods regarding the destination of investment in the industry.

On business expectations:

- In the second quarter of 2022, businesses in Ukraine's manufacturing sector were more pessimistic, as indicated by the highest score on a scale measuring the difference between positive and negative responses.

On factors that influence investment

- More than 90 percent of business expectations and investment survey respondents identified demand and finance as the major factors influencing investment decisions in the current year. However, their importance has declined over time.

2.4.1 DATA AND METHODOLOGY

The primary data sources for this analysis are the Ukrainian Statistical Office and the World Bank's *World Integrated Trade Solution* (WITS) database.[18] The Ukrainian data provides information on the volume of industrial products sold by sector and the value added by region and industry. Additionally, data for the business expectations and investment survey, which offers insights into the expectations of industrial enterprises regarding their business activities, is obtained from the Ukrainian statistics authority.

WITS and Ukrainian statistics are the primary data sources for trade analysis. WITS analyses Ukraine's imports and exports with the EU and the rest of the world, with data categorized according to ISIC Rev. 3 and HS2022. Data from the Ukrainian statistics authority is for the regional dimension of trade analysis.

To add a nuanced regional dimension to the discussion, information on industries is combined with data on the exposure of each region to different industrial sectors. This helps to understand how the war has affected other regions of the country and identify the most important sectors of each region. Based on World Bank (2023), regions are divided into four broad categories[19]:

- Frontline regions (areas temporarily not under government control and/ or areas of active war): Donetsk, Kharkiv, Kherson, Luhansk, Mykolaiv and Zaporizhzhia;
- Support regions (regions providing logistics for defense and humanitarian cargo): Dnipropetrovsk, Kirovograd, Odesa, Poltava and Vinnytsia;
- Backline regions (regions protecting export/ import logistics hubs and evacuated enterprises): Ivano-Frankivsk, Khmelnytskyi, Lviv, Rivne, Ternopil and Volyn
- Regions no longer under the temporary military control of the Russian Federation (areas recovering from sustained damage): Kyiv, Sumy and Zhytomyr.

In the results and discussion section (2.4.2), analysis of the regional dimension is based on the following classification. The section is based on a five-stage methodology over a time-horizon up to 2022.[20]

Stage I – Production discusses the impact of the war on production through three different indicators and analysis: (1) volume of industrial products sold, which can be seen as an impact on manufacturing turnover rather than production impact or as a trade indicator when the focus is on products sold outside the country; (2) indices of the industrial output of the manufacturing sector; and (3) the war's impact on value added.

Stage II – Trade assesses the effects of the conflict on trade and compares Ukrainian trade with EU and non-EU countries through international data.

Stage III – Damage succinctly presents the World Bank's (2023) estimate of the war's impact that can be used as a useful reference study.

Stage IV – Business and investment expectations focuses on business and investment expectations as part of the sentiment and perceptions of firms.

Stage V – Employment impact assesses the impact of the war on employment.

2.4.2 RESULTS AND DISCUSSION

STAGE I – PRODUCTION

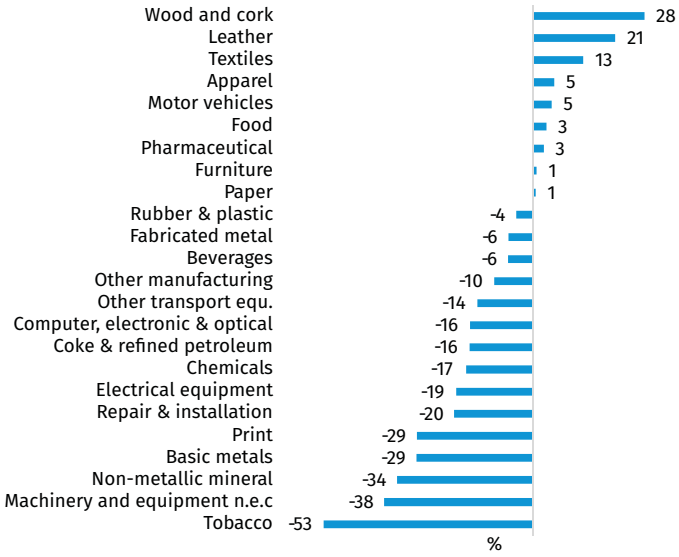
Volume of industrial production sold

In 2022, a decrease in the volume of industrial products sold was observed in 15 of 24 two-digit industries compared to the 2019-2021 average. Despite the overall decline, however, some sectors registered growth. Panel A of **Figure 2.28** reports the change in the volume of industrial products sold in 2022 relative to the 2019-2021 average, while panel B reports the same for industrial products sold outside the country.[21]

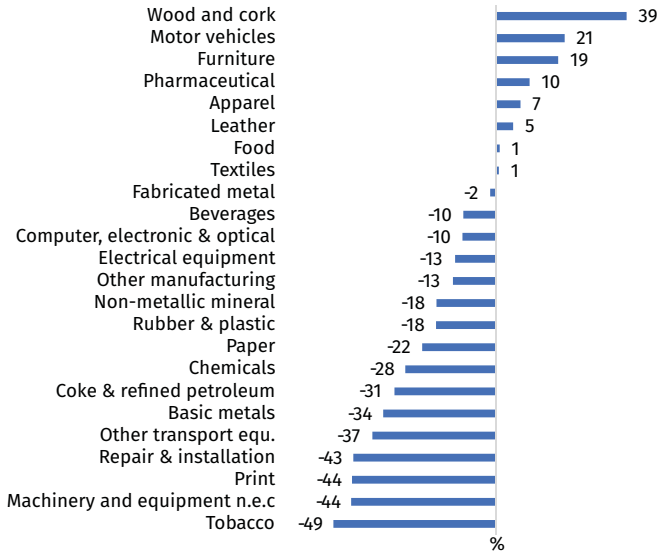
FIGURE 2.28: PERCENTAGE CHANGE IN VOLUME OF INDUSTRIAL PRODUCTS SOLD, 2022 VS 2019-2021 AVERAGE

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).

A. Volume of industrial products sold



B: Volume of industrial products sold outside the country



The manufacture of tobacco products sector experienced the most significant decline, with a decrease of 53 percent. This was followed by the manufacture of machinery and equipment n.e.c. (38 percent), manufacture of other non-metallic mineral products (34 percent), manufacture of basic metals (29 percent), and printing and reproduction of recorded media (also 29 percent). The decline in the manufacturing of basic metals is particularly noteworthy, as this sector contributed 26.6 percent of the manufacturing output in the country in 2021.

On the other hand, the manufacture of food products sector, which contributes 28 percent of the manufacturing output, saw 3 percent growth. The manufacture of furniture and manufacture of paper and paper products saw minimal growth, with only a 1-percent increase. However, the manufacture of wood and products of wood and cork sector showed substantial growth, with a 28-percent increase. This was followed by the manufacture of leather and related products (21 percent) and the manufacture of wearing apparel (13 percent).

In 2022, out of the 24 two-digit manufacturing sectors, only eight sectors saw an increase in the volume of products sold outside the country compared to the average of 2019-2021. The remaining 15 sectors experienced a decline in sales. The manufacture of wood and products of wood and cork sector saw the largest increase, with a growth rate of 39 percent. This was closely followed by the manufacture of motor vehicles, trailers and semi-trailers sector, with an increase of 21 percent. The manufacture of furniture and manufacture of basic pharmaceutical products and pharmaceutical preparations sectors also saw significant increases of 19 percent and 10 percent, respectively. On the other hand, the tobacco sector saw the largest decline, with a drop of 49 percent, followed by the manufacture of machinery and equipment n.e.c., and printing and reproduction of recorded media sectors, each experiencing a 44 percent drop.

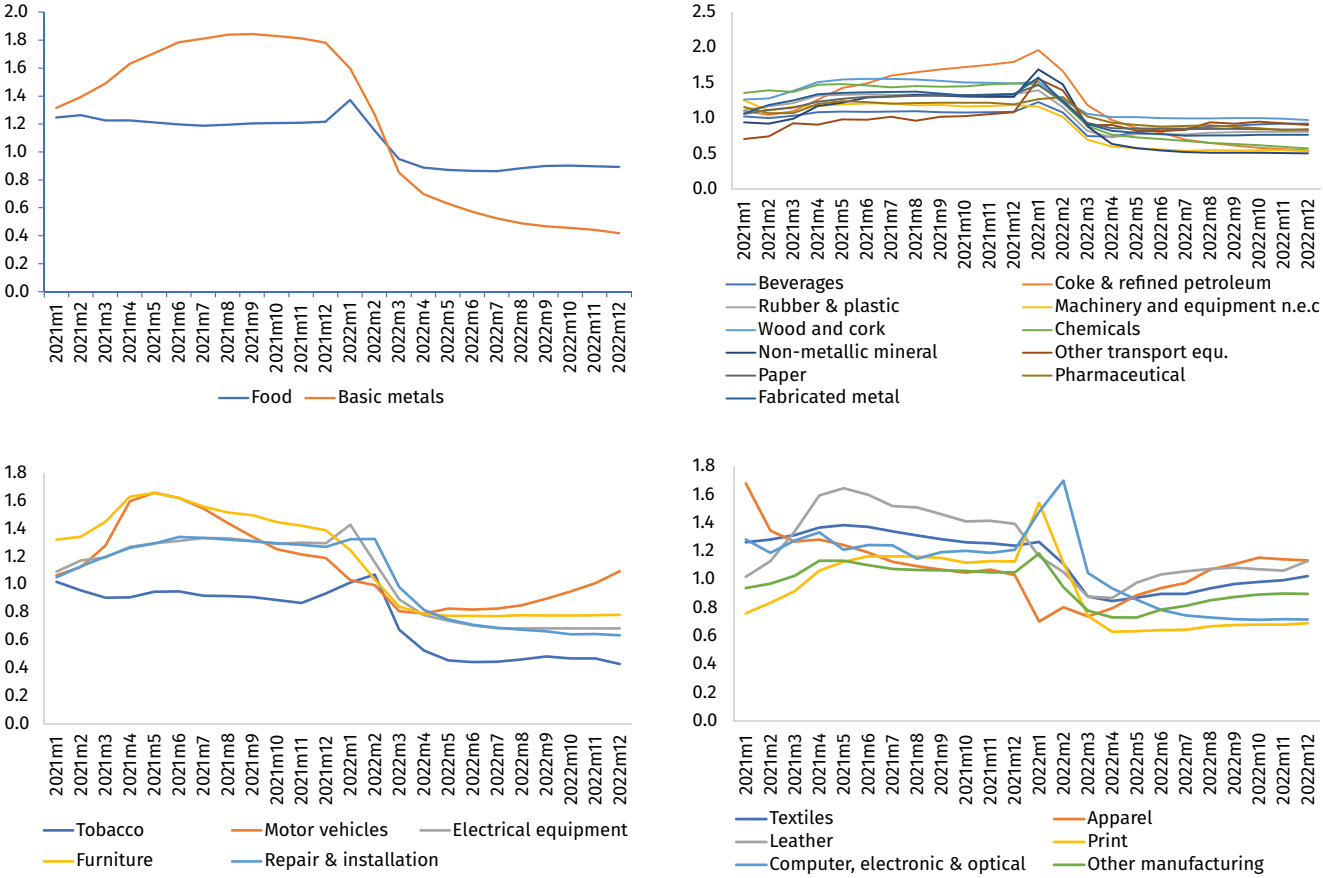
In general, the pattern of change in the volume of industrial products sold abroad by various sectors in 2022 relative to the average of 2019-2021 mirrors the overall pattern of change. Sectors operating at a large scale and dependent on continuous cycles, such as the manufacture of non-metallic mineral products and basic metals, as well as those with production concentrated in front-line regions (e.g. the tobacco industry, centred around large plants owned by Phillip Morris in Kharkiv), experienced more substantial losses. Conversely, industries with more evenly distributed production across the country and those crucial for reconstruction and war efforts – like apparel, textiles, food, and wood – saw production increases.

Consultations with industry members revealed that the tobacco and food industries are relocating to safer backline regions, with plans to return to their original production areas after the conflict. However, returning to pre-war locations may be more challenging for industries heavily reliant on raw materials and logistics, such as wood, glass, minerals and metal products. Given their importance for post-conflict reconstruction, these sectors should be prioritized in policymaking. Furthermore, some sectors depended on the supply of Russian raw materials, and support is necessary for restructuring their supply chains. Incentives to encourage displaced industries and workers to return to their original manufacturing locations should also be considered to ensure regional equity after the conflict.[22]

Figure 2.29 depicts the monthly volume of industrial products sold in comparison to the corresponding month of the previous year, while **Figure 2.30** provides a similar comparison for industrial products sold internationally. Sectors in both figures are categorized into four groups based on their contribution to the total volume of industrial products sold in the manufacturing sector in 2021.

FIGURE 2.29: VOLUME OF INDUSTRIAL PRODUCTS SOLD, SELECTED SECTORS, BY MONTH, 2021-2022

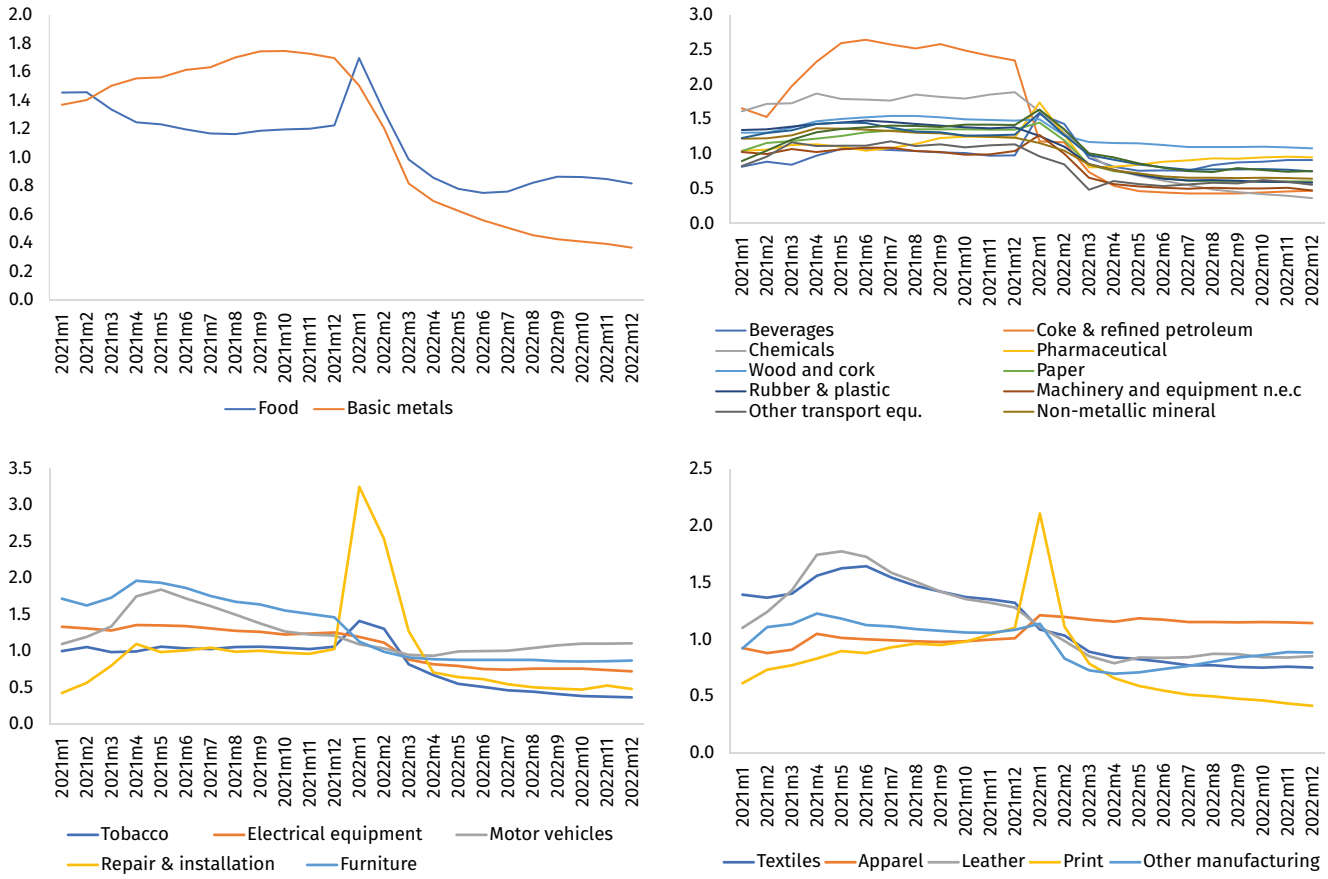
Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).



Note: This figure presents the volume of industrial products sold each month relative to the previous period in the same month. For example, it compares January 2022 to January 2021. A ratio greater than one indicates that more industrial output is sold in 2022 than in 2021, whereas a ratio below one indicates a decrease in industrial output sales in 2022 relative to 2021.

FIGURE 2.30: VOLUME OF INDUSTRIAL PRODUCTS SOLD OUTSIDE UKRAINE, SELECTED SECTORS, BY MONTH, 2021-2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).



Note: This figure shows the volume of industrial products sold each month relative to the previous period in the same month. For example, it compares January 2022 to January 2021. A ratio greater than one indicates more industrial output is sold in 2022 than in 2021, whereas a ratio below one indicates a decrease in industrial output sales in 2022 relative to 2021.

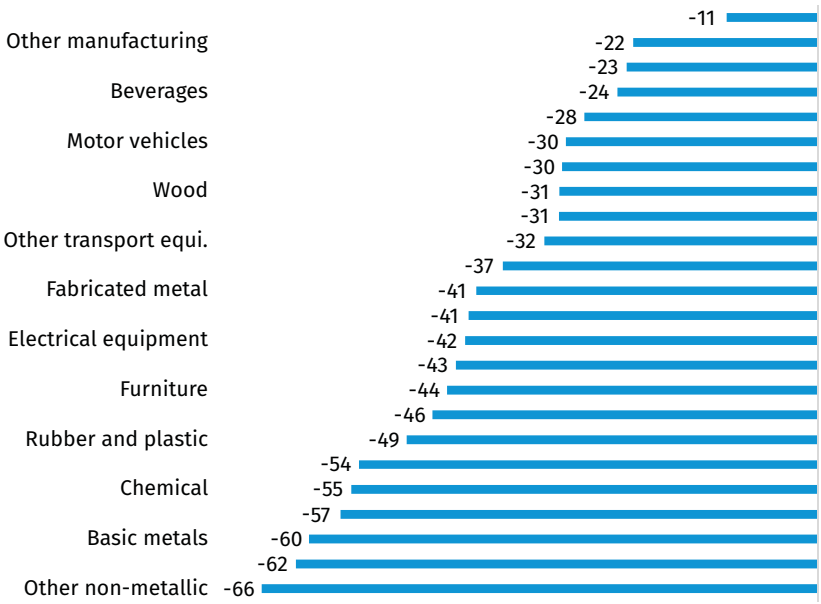
The upper-left quadrant comprises the food and beverage sectors, which accounted for 28 percent and 23.7 percent of the total manufacturing output sold in 2021, respectively. The lower-left quadrant includes sectors contributing 2-6 percent to the volume of products sold. The upper-right quadrant encompasses sectors contributing 1-2 percent, and the lower-right quadrant comprises sectors contributing less than 1 percent to the volume of industrial products sold. In nearly all sectors, the volume of industrial products sold throughout 2022 was lower than in the corresponding months of 2021. Moreover, the extent of the decline in industrial products sold varies across different sectors.

Production and value-added losses

Evaluating the war's impact on industry considers the changes in the volume of production sold and the actual state of the industrial output in Ukraine. Ukraine's industrial production indices were used for this analysis, the results of which are presented in **Figure 2.31**.[23] The data indicates a decline in the production of all two-digit manufacturing industries.[24] Specifically, the manufacturing of basic metals, coke, and refined petroleum, as well as the production of non-metallic materials, saw a significant reduction of more than 60 percent in 2022 compared to the 2019-2021 average output. Among the various manufacturing sectors, the manufacture of wearing apparel experienced the smallest decrease at 10.8 percent, followed by other manufacturing at 21.9 percent. The manufacturing of food products saw a decline of 22.7 percent.

FIGURE 2.31: INDICES OF INDUSTRIAL PRODUCTION, SELECTED SECTORS, 2022 VS 2019-2021 AVERAGE

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).



Without available value-added data for 2022 by region and industry, a preliminary analysis to gauge the war's impact was conducted. This involved using the growth rates in value added for each region and industry in 2021 to project the value-added for 2022 if these regions and industries had experienced the same growth rates as in 2021. This projection yielded value-added figures by region and industry for 2022.[25]

Estimates of the war's impact used the national-level industrial production losses by industries as a reference point for estimating losses at the regional level. For example, the manufacture of basic metals saw a 29 percent decline in industrial production at the national level. In 2021, the value-added growth rate for this industry in Donetsk was 14 percent. Based on the 2021 value added, the projected value added for 2022 would be the 2021 value plus 0.14 times the 2021 value. Given the 29 percent industry-wide decline in 2022, the same percentage fall for this industry in Donetsk in 2022 was assumed. The results are reported in **Table 2.6** for regions, and in **Tables 2.7, 2.8 and 2.9** for regions and industries.

TABLE 2.6: ESTIMATED VALUE-ADDED LOSSES BY REGION, UAH MILLIONS, 2022

Source: State Statistics Service of Ukraine, regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023).

REGION GROUP	REGIONS	ESTIMATED VA FOR 2022 (MILLION UAH)	VA LOSS IN 2022 (MILLION UAH)	PERCENTAGE CHANGE
Backline regions	Ivano-Frankivsk	33,817	-5,875	-17
	Khmelnytskyi	49,228	-7,451	-15
	Lviv	159,038	-6,073	-4
	Rivne	44,153	-2,139	-5
	Ternopil	33,341	-4,393	-13
	Volyn	70,909	-1,655	-2
	Zakarpattia	16,698	-1,114	-7
Frontline regions	Donetsk	55,769	-10,466	-19
	Kharkiv	191,748	-15,246	-8
	Kherson	34,824	-642	-2
	Luhansk	8,289	-1,441	-17
	Mykolaiv	58,786	-7,851	-13
	Zaporizhzhia	305,926	-76,853	-25
Other regions	Cherkasy	90,646	-1,382	-2
	Chernihiv	17,460	-964	-6
	Chernivtsi	12,138	-1,002	-8
Regained regions	City of Kyiv	643,522	-32,495	-5
	Kyiv	205,000	-17,007	-8
	Sumy	54,383	-5,919	-11
	Zhytomyr	43,715	-3,172	-7
Support regions	Dnipropetrovsk	656,613	-144,106	-22
	Kirovohrad	51,759	-2,759	-5
	Odesa	99,489	-13,016	-13
	Poltava	103,920	-7,943	-8
	Vinnytsia	100,494	-8,429	-8

Note: UAH = Ukrainian hryvnia.

TABLE 2.7: ESTIMATED VALUE-ADDED LOSSES BY FRONTLINE REGION AND INDUSTRY, UAH MILLIONS, 2022

Source: State Statistics Service of Ukraine, regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023).

FRONTLINE REGION	INDUSTRY	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Donetsk	Chemicals and chemical products – 20	930	-17	-157
	Computer, electronic and optical products – 26	16	-16	-3
	Electrical equipment – 27	363	-20	-71
	Fabricated metal products, except machinery and equipment – 25	3,719	-6	-234
	Food products, beverages and tobacco products – 10, 11, 12	15,800	0	-25
	Machinery and equipment n.e.c. – 28	12,600	-38	-4,770
	Other non-metallic mineral products – 23	13,100	-34	-4,516
	Rubber and plastic products – 22	318	-4	-14
	Textiles, apparel, leather and related products – 13, 14, 15	1,184	12	139
	Other manufacturing, and repair and installation – 31, 32, 33	7,642	-11	-817
Kharkiv	Basic metal – 24	6,563	-30	-1,935
	Chemicals and chemical products – 20	7,079	-17	-1,199
	Computer, electronic and optical products – 26	5,118	-16	-819
	Electrical equipment – 27	6,523	-20	-1,269
	Fabricated metal products, except machinery and equipment – 25	14,500	-6	-912
	Food products, beverages and tobacco products – 10, 11, 12	75,400	0	-117
	Machinery and equipment n.e.c. – 28	14,200	-38	-5,345
	Other non-metallic mineral products – 23	11,000	-34	-3,773
	Rubber and plastic products – 22	14,800	-4	-637
	Textiles, apparel, leather and related products – 13, 14, 15	6,871	12	808
	Transport equipment – 29, 30	5,340	-6	-336
	Wood and paper products, and printing – 16, 17, 18	14,800	9	1,319
	Other manufacturing, and repair and installation – 31, 32, 33	9,649	-11	-1,031

FRONTLINE REGION	INDUSTRY	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Kherson	Electrical equipment – 27	730	-20	-142
	Food products, beverages and tobacco products – 10, 11, 12	25,500	0	-40
	Machinery and equipment n.e.c. – 28	139	-38	-52
	Other non-metallic mineral products – 23	1,516	-34	-522
	Rubber and plastic products – 22	2,621	-4	-113
	Wood and paper products, and printing – 16, 17, 18	3,505	9	313
	Other manufacturing, and repair and installation – 31, 32, 33	800	-11	-85
Luhansk	Basic metal – 24	285	-30	-84
	Chemicals and chemical products – 20	4,586	-17	-777
	Computer, electronic and optical products – 26	222	-16	-35
	Electrical equipment – 27	21	-20	-4
	Fabricated metal products, except machinery and equipment – 25	244	-6	-15
	Machinery and equipment n.e.c. – 28	487	-38	-184
	Other non-metallic mineral products – 23	429	-34	-148
	Rubber and plastic products – 22	267	-4	-11
	Transport equipment – 29, 30	90	-6	-6
	Other manufacturing, and repair and installation – 31, 32, 33	1,659	-11	-177
Mykolaiv	Basic metal – 24	17,800	-30	-5,250
	Chemicals and chemical products – 20	185	-17	-31
	Computer, electronic and optical products – 26	252	-16	-40
	Electrical equipment – 27	203	-20	-40
	Food products, beverages and tobacco products – 10, 11, 12	28,000	0	-44
	Machinery and equipment n.e.c. – 28	5,082	-38	-1,918
	Other non-metallic mineral products – 23	920	-34	-317
	Rubber and plastic products – 22	557	-4	-24
	Textiles, apparel, leather and related products – 13, 14, 15	1,029	12	121
	Transport equipment – 29, 30	478	-6	-30
	Wood and paper products, and printing – 16, 17, 18	897	9	80
	Other manufacturing, and repair and installation – 31, 32, 33	3,352	-11	-358

FRONTLINE REGION	INDUSTRY	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Zaporizhzhia	Basic metal – 24	222,000	-30	-65,400
	Basic pharmaceutical products and pharmaceutical preparations – 21	502	3	13
	Electrical equipment – 27	18,500	-20	-3,590
	Fabricated metal products, except machinery and equipment – 25	8,493	-6	-535
	Food products, beverages and tobacco products – 10, 11, 12	21,900	0	-34
	Machinery and equipment n.e.c. – 28	7,205	-38	-2,719
	Other non-metallic mineral products – 23	10,400	-34	-3,598
	Rubber and plastic products – 22	4,045	-4	-174
	Textiles, apparel, leather and related products – 13, 14, 15	1,249	12	147
	Wood and paper products, and printing – 16, 17, 18	1,688	9	151
	Other manufacturing, and repair and installation – 31, 32, 33	9,978	-11	-1,066

Note: VA = value added; UAH = Ukrainian hryvnia.

TABLE 2.8: ESTIMATED VALUE-ADDED LOSSES BY REGAINED REGION AND INDUSTRY, UAH MILLIONS, 2022

Source: State Statistics Service of Ukraine, regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023).

FRONTLINE REGION	INDUSTRY	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
City of Kyiv	Basic metal - 24	12,400	-30	-3,657
	Basic pharmaceutical products and pharmaceutical preparations - 21	35,300	3	920
	Chemicals and chemical products - 20	16,000	-17	-2,717
	Coke and refined petroleum products - 19	2,060	-16	-331
	Computer, electronic and optical products - 26	10,200	-16	-1,628
	Electrical equipment - 27	15,200	-20	-2,955
	Fabricated metal products, except machinery and equipment - 25	23,800	-6	-1,500
	Food products, beverages and tobacco products - 10, 11, 12	379,000	0	-589
	Machinery and equipment n.e.c. - 28	17,900	-38	-6,758
	Other non-metallic mineral products - 23	35,900	-34	-12,400
	Rubber and plastic products - 22	18,100	-4	-780
	Textiles, apparel, leather and related products - 13, 14, 15	9,205	12	1,082
	Transport equipment - 29, 30	9,039	-6	-569
	Wood and paper products, and printing - 16, 17, 18	29,000	9	2,591
	Other manufacturing, and repair and installation - 31, 32, 33	30,500	-11	-3,255
Kyiv	Basic metal - 24	5,735	-30	-1,691
	Chemicals and chemical products - 20	21,500	-17	-3,637
	Computer, electronic and optical products - 26	959	-16	-153
	Electrical equipment - 27	2,626	-20	-511
	Fabricated metal products, except machinery and equipment - 25	11,900	-6	-749
	Food products, beverages and tobacco products - 10, 11, 12	58,500	0	-91
	Machinery and equipment n.e.c. - 28	7,197	-38	-2,716
	Other non-metallic mineral products - 23	24,400	-34	-8,391
	Rubber and plastic products - 22	20,800	-4	-892
	Textiles, apparel, leather and related products - 13, 14, 15	11,300	12	1,333
	Transport equipment - 29, 30	10,800	-6	-681
	Wood and paper products, and printing - 16, 17, 18	22,000	9	1,958
	Other manufacturing, and repair and installation - 31, 32, 33	7,362	-11	-787

FRONTLINE REGION	INDUSTRY	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Sumy	Chemicals and chemical products - 20	5,362	-17	-908
	Computer, electronic and optical products - 26	116	-16	-19
	Electrical equipment - 27	126	-20	-24
	Food products, beverages and tobacco products - 10, 11, 12	20,900	0	-32
	Machinery and equipment n.e.c. - 28	11,600	-38	-4,359
	Other non-metallic mineral products - 23	2,185	-34	-753
	Rubber and plastic products - 22	5,792	-4	-249
	Textiles, apparel, leather and related products - 13, 14, 15	3,343	12	393
	Transport equipment - 29, 30	1,090	-6	-69
	Wood and paper products, and printing - 16, 17, 18	2,652	9	237
	Other manufacturing, and repair and installation - 31, 32, 33	1,270	-11	-136
Zhytomyr	Electrical equipment - 27	185	-20	-36
	Food products, beverages and tobacco products - 10, 11, 12	16,000	0	-25
	Machinery and equipment n.e.c. - 28	2,075	-38	-783
	Other non-metallic mineral products - 23	9,624	-34	-3,314
	Rubber and plastic products - 22	1,516	-4	-65
	Textiles, apparel, leather and related products - 13, 14, 15	2,363	12	278
	Wood and paper products, and printing - 16, 17, 18	10,500	9	933
	Other manufacturing, and repair and installation - 31, 32, 33	1,496	-11	-160

Note: VA = value added; UAH = Ukrainian hryvnia.

TABLE 2.9: ESTIMATED VALUE-ADDED LOSSES BY SUPPORT REGION AND INDUSTRY, UAH MILLIONS, 2022

Source: State Statistics Service of Ukraine, regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023).

SUPPORT REGIONS		ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Dnipropetrovsk	Basic metal - 24	419,000	-30	-124,000
	Coke and refined petroleum products - 19	9,162	-16	-1,473
	Computer, electronic and optical products - 26	484	-16	-77
	Electrical equipment - 27	3,618	-20	-704
	Fabricated metal products, except machinery and equipment - 25	20,900	-6	-1,318
	Food products, beverages and tobacco products - 10, 11, 12	89,100	0	-138
	Machinery and equipment n.e.c. - 28	13,100	-38	-4,937
	Other non-metallic mineral products - 23	24,600	-34	-8,464
	Rubber and plastic products - 22	21,100	-4	-905
	Textiles, apparel, leather and related products - 13, 14, 15	4,493	12	528
	Transport equipment - 29, 30	11,700	-6	-733
	Wood and paper products, and printing - 16, 17, 18	10,100	9	897
	Other manufacturing, and repair and installation - 31, 32, 33	29,100	-11	-3,107
Kirovohrad	Basic metal - 24	353	-30	-104
	Chemicals and chemical products - 20	1,230	-17	-208
	Fabricated metal products, except machinery and equipment - 25	1,011	-6	-64
	Food products, beverages and tobacco products - 10, 11, 12	39,300	0	-61
	Machinery and equipment n.e.c. - 28	4,711	-38	-1,778
	Other non-metallic mineral products - 23	1,470	-34	-506
	Rubber and plastic products - 22	183	-4	-8
	Textiles, apparel, leather and related products - 13, 14, 15	579	12	68
	Wood and paper products, and printing - 16, 17, 18	1,110	9	99
	Other manufacturing, and repair and installation - 31, 32, 33	1,847	-11	-197

SUPPORT REGIONS		ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Odesa	Basic metal - 24	1,057	-30	-312
	Computer, electronic and optical products - 26	1,833	-16	-293
	Electrical equipment - 27	4,598	-20	-895
	Fabricated metal products, except machinery and equipment - 25	10,300	-6	-652
	Food products, beverages and tobacco products - 10, 11, 12	37,400	0	-58
	Machinery and equipment n.e.c. - 28	3,450	-38	-1,302
	Other non-metallic mineral products - 23	26,500	-34	-9,141
	Rubber and plastic products - 22	3,861	-4	-166
	Textiles, apparel, leather and related products - 13, 14, 15	1,796	12	211
	Transport equipment - 29, 30	522	-6	-33
	Wood and paper products, and printing - 16, 17, 18	2,474	9	221
	Other manufacturing, and repair and installation - 31, 32, 33	5,578	-11	-596
Poltava	Basic metal - 24	837	-30	-247
	Chemicals and chemical products - 20	13,900	-17	-2,356
	Computer, electronic and optical products - 26	458	-16	-73
	Electrical equipment - 27	469	-20	-91
	Fabricated metal products, except machinery and equipment - 25	4,104	-6	-259
	Food products, beverages and tobacco products - 10, 11, 12	56,700	0	-88
	Machinery and equipment n.e.c. - 28	8,590	-38	-3,241
	Other non-metallic mineral products - 23	3,303	-34	-1,137
	Rubber and plastic products - 22	1,660	-4	-71
	Textiles, apparel, leather and related products - 13, 14, 15	1,892	12	222
	Transport equipment - 29, 30	3,680	-6	-232
	Wood and paper products, and printing - 16, 17, 18	2,654	9	237
	Other manufacturing, and repair and installation - 31, 32, 33	5,680	-11	-607

SUPPORT REGIONS		ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Vinnytsia	Basic metal - 24	1,290	-30	-381
	Chemicals and chemical products - 20	2,603	-17	-441
	Electrical equipment - 27	689	-20	-134
	Fabricated metal products, except machinery and equipment - 25	3,211	-6	-202
	Food products, beverages and tobacco products - 10, 11, 12	54,900	0	-85
	Machinery and equipment n.e.c. - 28	3,286	-38	-1,240
	Other non-metallic mineral products - 23	19,000	-34	-6,528
	Rubber and plastic products - 22	2,662	-4	-114
	Textiles, apparel, leather and related products - 13, 14, 15	647	12	76
	Wood and paper products, and printing - 16, 17, 18	9,821	9	876
	Other manufacturing, and repair and installation - 31, 32, 33	2,386	-11	-255

Note: VA = value added; UAH = Ukrainian hryvnia.

TABLE 2.10: ESTIMATED VALUE-ADDED LOSSES BY BACKLINE REGION AND INDUSTRY, UAH MILLIONS, 2022

Source: State Statistics Service of Ukraine, regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023).

BACKLINE REGION	ISIC2 SECTOR	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Ivano-Frankivsk	Computer, electronic and optical products - 26	186	-16	-30
	Food products, beverages and tobacco products - 10, 11, 12	5,360	0	-8
	Machinery and equipment n.e.c. - 28	284	-38	-107
	Other non-metallic mineral products - 23	17,800	-34	-6,128
	Rubber and plastic products - 22	761	-4	-33
	Textiles, apparel, leather and related products - 13, 14, 15	601	12	71
	Wood and paper products, and printing - 16, 17, 18	6,647	9	593
	Other manufacturing, and repair and installation - 31, 32, 33	2,182	-11	-233

BACKLINE REGION	ISIC2 SECTOR	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Khmelnytskyi	Chemicals and chemical products - 20	3,804	-17	-644
	Electrical equipment - 27	2,185	-20	-425
	Food products, beverages and tobacco products - 10, 11, 12	11,600	0	-18
	Machinery and equipment n.e.c. - 28	1,524	-38	-575
	Other non-metallic mineral products - 23	17,200	-34	-5,911
	Rubber and plastic products - 22	4,898	-4	-211
	Textiles, apparel, leather and related products - 13, 14, 15	3,769	12	443
	Wood and paper products, and printing - 16, 17, 18	1,777	9	158
	Other manufacturing, and repair and installation - 31, 32, 33	2,516	-11	-269
Lviv	Basic metal - 24	7,168	-30	-2,114
	Computer, electronic and optical products - 26	605	-16	-97
	Electrical equipment - 27	1,381	-20	-269
	Fabricated metal products, except machinery and equipment - 25	8,286	-6	-522
	Food products, beverages and tobacco products - 10, 11, 12	59,700	0	-93
	Machinery and equipment n.e.c. - 28	2,610	-38	-985
	Other non-metallic mineral products - 23	8,616	-34	-2,967
	Rubber and plastic products - 22	6,773	-4	-291
	Textiles, apparel, leather and related products - 13, 14, 15	8,652	12	1,017
	Transport equipment - 29, 30	13,800	-6	-871
	Wood and paper products, and printing - 16, 17, 18	28,300	9	2,522
	Other manufacturing, and repair and installation - 31, 32, 33	13,100	-11	-1,404
Rivne	Chemicals and chemical products - 20	4,239	-17	-718
	Food products, beverages and tobacco products - 10, 11, 12	11,100	0	-17
	Machinery and equipment n.e.c. - 28	1,139	-38	-430
	Other non-metallic mineral products - 23	6,070	-34	-2,090
	Rubber and plastic products - 22	1,435	-4	-62
	Textiles, apparel, leather and related products - 13, 14, 15	888	12	104
	Wood and paper products, and printing - 16, 17, 18	16,000	9	1,425
	Other manufacturing, and repair and installation - 31, 32, 33	3,295	-11	-352

BACKLINE REGION	ISIC2 SECTOR	ESTIMATED VA FOR 2022 (MILLION UAH)	INDUSTRIAL PRODUCTION LOSS (%)	VA LOSS IN 2022 (MILLION UAH)
Ternopil	Basic metal - 24	3,196	-30	-943
	Fabricated metal products, except machinery and equipment - 25	2,534	-6	-160
	Food products, beverages and tobacco products - 10, 11, 12	10,800	0	-17
	Machinery and equipment n.e.c. – 28	205	-38	-77
	Other non-metallic mineral products - 23	9,190	-34	-3,164
	Rubber and plastic products - 22	3,857	-4	-166
	Textiles, apparel, leather and related products - 13, 14, 15	779	12	92
	Wood and paper products, and printing - 16, 17, 18	1,738	9	155
	Other manufacturing, and repair and installation - 31, 32, 33	1,061	-11	-113
Volyn	Electrical equipment - 27	349	-20	-68
	Fabricated metal products, except machinery and equipment - 25	808	-6	-51
	Food products, beverages and tobacco products - 10, 11, 12	20,000	0	-31
	Other non-metallic mineral products - 23	7,009	-34	-2,413
	Rubber and plastic products - 22	3,795	-4	-163
	Textiles, apparel, leather and related products - 13, 14, 15	1,537	12	181
	Transport equipment - 29, 30	2,789	-6	-175
	Wood and paper products, and printing - 16, 17, 18	24,300	9	2,171
	Other manufacturing, and repair and installation - 31, 32, 33	10,300	-11	-1,104
Zakarpattia	Electrical equipment - 27	3,275	-20	-637
	Food products, beverages and tobacco products - 10, 11, 12	2,307	0	-4
	Other non-metallic mineral products - 23	2,526	-34	-870
	Rubber and plastic products - 22	409	-4	-18
	Textiles, apparel, leather and related products - 13, 14, 15	2,014	12	237
	Wood and paper products, and printing - 16, 17, 18	4,264	9	380
	Other manufacturing, and repair and installation - 31, 32, 33	1,903	-11	-203

Note: VA = value added; UAH = Ukrainian hryvnia.

STAGE II – TRADE

Ukraine's aggregate exports in goods declined by 19 percent, from $54.7 billion in 2022 to $44.4 billion, compared to the 2019-2021 average. During the same period, Ukraine's imports declined by 13 percent, from $61 billion in 2022 to $52.8 billion, compared to the 2019-2021 average. The tobacco industry recorded a substantial decline of 68 percent, while the printing sector showed a significant decrease of 60 percent. Furthermore, the coke and refined petroleum sector experienced a drop of 58 percent, and the other transport equipment sector saw a decline of 56 percent in exports during 2022 relative to the average exports of 2019-2021. From 2019-2021, the food and beverage manufacturing sector contributed 28 percent to Ukraine's exports. However, in 2022, this sector saw a modest decrease of 0.78 percent in its export volume compared to 2019-2021 average export values. Conversely, the basic metal manufacturing sector, which accounted for 30.5 percent of Ukraine's exports in 2019-2021, experienced a significant contraction of 49.7 percent in its exports in 2022. On the other hand, the wood and cork manufacturing, manufacturing of office, and accounting sectors registered increases of 27 percent in exports during 2022.

However, a different picture emerges when examining Ukraine's exports by EU and non-EU countries (**Figure 2.32**). While exports to the EU increased by 30 percent, non-EU exports decreased by 51 percent. Ukraine's imports from the EU increased by 1 percent, while imports from non-EU countries fell by 24 percent.

Similar results were found when examining two-digit manufacturing industries (**Figure 2.33** and **Figure 2.34**). In 2022, Ukraine's exports to the EU performed much better than its exports to the rest of the world, relative to the averages of the previous three years. Except for the apparel sector, all 22 two-digit manufacturing exports from Ukraine to the rest of the world declined in 2022, while 11 sectors registered higher export growth to the EU. The manufacturing of food and beverages, which accounts for a significant share of Ukraine's exports, recorded a 55 percent growth in exports to the EU in 2022. The same is true for imports. Although imports from the EU and the rest of the world to Ukraine fell in 2022, the decline from the EU was smaller.

FIGURE 2.32: CHANGE IN AGGREGATE GOODS EXPORTS AND IMPORTS, 2022 VS 2019-2021 AVERAGE

Source: World Bank, *World Integrated Trade Solution database* (accessed September 2023).

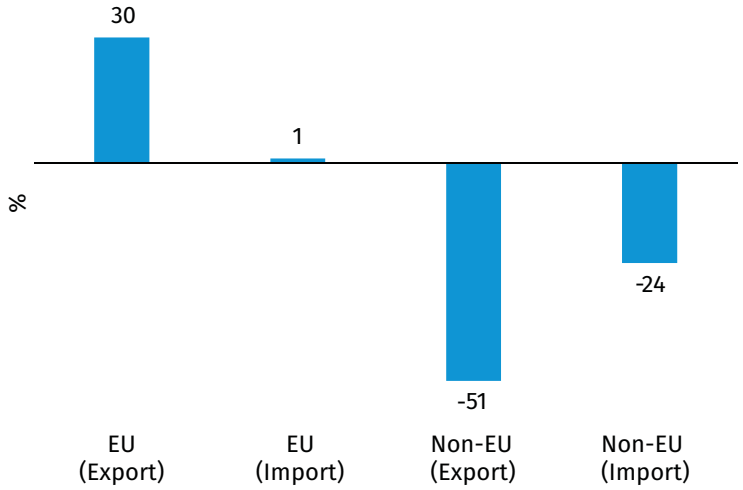


FIGURE 2.33: CHANGE (%) IN GOODS EXPORTS BY SECTOR, EU AND REST OF THE WORLD, 2022 VS 2019-2021 AVERAGE

Source: World Bank, *World Integrated Trade Solution* database (accessed September 2023).

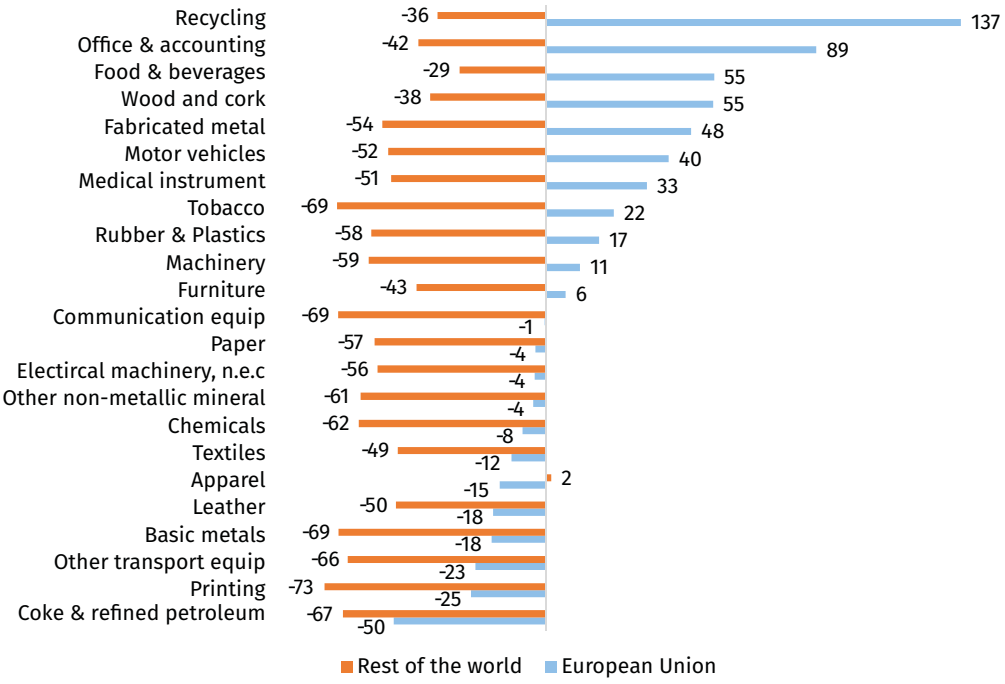


FIGURE 2.34: CHANGE (%) IN GOODS IMPORTS BY SECTOR, EU AND REST OF THE WORLD, 2022 VS 2019-2021 AVERAGE

Source: World Bank, *World Integrated Trade Solution* database (accessed September 2023).

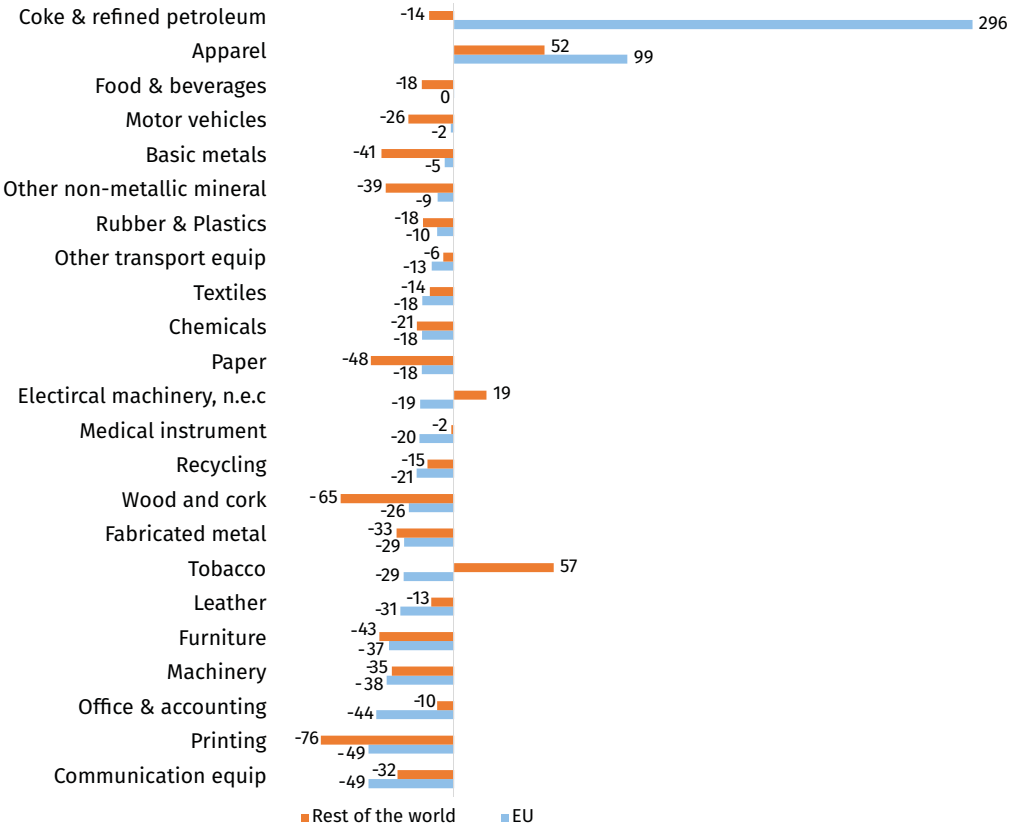


Table 2.11 and **Figure 2.35** provide an overview of the export performance of Ukrainian regions in 2022 compared to the three-year average from 2019-2021, revealing significant regional disparities. Backline regions' exports outperformed the other regions significantly. Except for Ivano-Frankivsk, all backline regions experienced an uptick in their exports in 2022, resulting in an overall increase of 21 percent in their export volumes. Conversely, all frontline regions experienced the most significant decline, with their aggregate exports decreasing by 58 percent in 2022 relative to the 2019-2021 average.

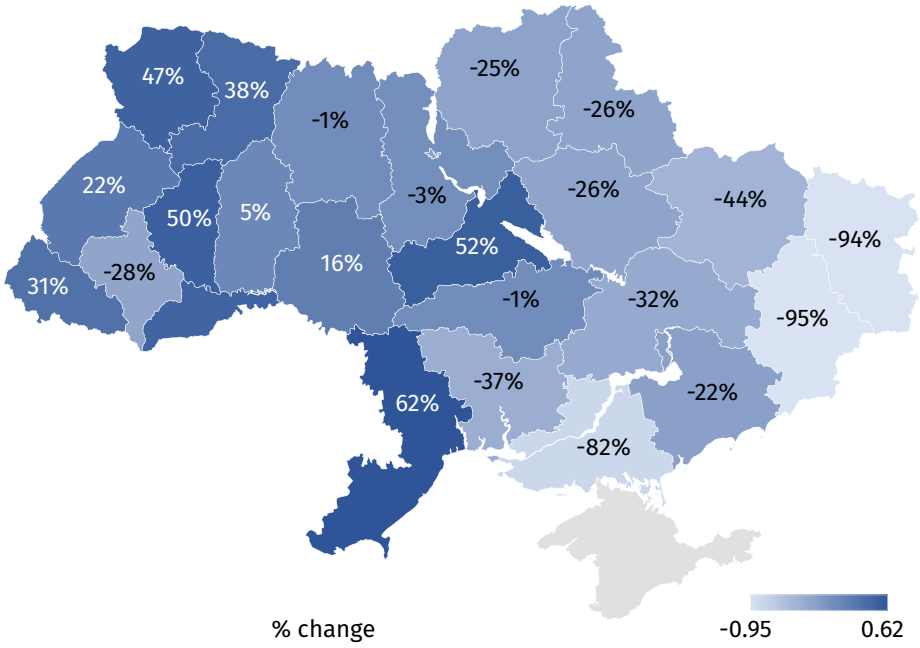
TABLE 2.11: CHANGE (%) IN GOODS EXPORTS, BY REGION, 2022 VS 2019-2021 AVERAGE

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).

REGIONAL GROUP	REGION	2019-2021 AVERAGE (MILLION US$)	2022 (MILLION US$)	PERCENTAGE CHANGE
Backline	Ivano-Frankivsk	945	685	-28
	Khmelnytskyi	741	780	5
	Lviv	2,486	3,025	22
	Rivne	538	744	38
	Ternopil	520	780	50
	Volyn	723	1,066	47
	Zakarpattya	1,508	1,970	31
	Sub-total	7,461	9,050	21
Frontline	Donetsk	5,201	284	-95
	Kharkiv	1,563	880	-44
	Kherson	321	57	-82
	Luhansk	150	9	-94
	Mykolayiv	2,619	1,643	-37
	Zaporizhzhia	3,582	2,809	-22
	Sub-total	13,436	5,681	-58
Others	Cherkasy	853	1,294	52
	Chernihiv	963	717	-25
	Chernivtsi	197	287	46
	Sub-total	2,012	2,298	14
Regained	Kyiv	2,156	2,096	-3
	Kyiv city	13,417	10,464	-22
	Sumy	973	724	-26
	Zhytomyr	724	718	-1
	Sub-total	17,269	14,001	-19
Support	Dnipropetrovsk	9,221	6,251	-32
	Kirovohrad	880	873	-1
	Odesa	1,481	2,400	62
	Poltava	2,536	1,867	-26
	Vinnytsya	1,381	1,600	16
	Sub-total	15,499	12,992	-16

FIGURE 2.35: REGIONAL CHANGE (%) IN GOODS EXPORTS, 2022 VS 2019-2021 AVERAGE

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).

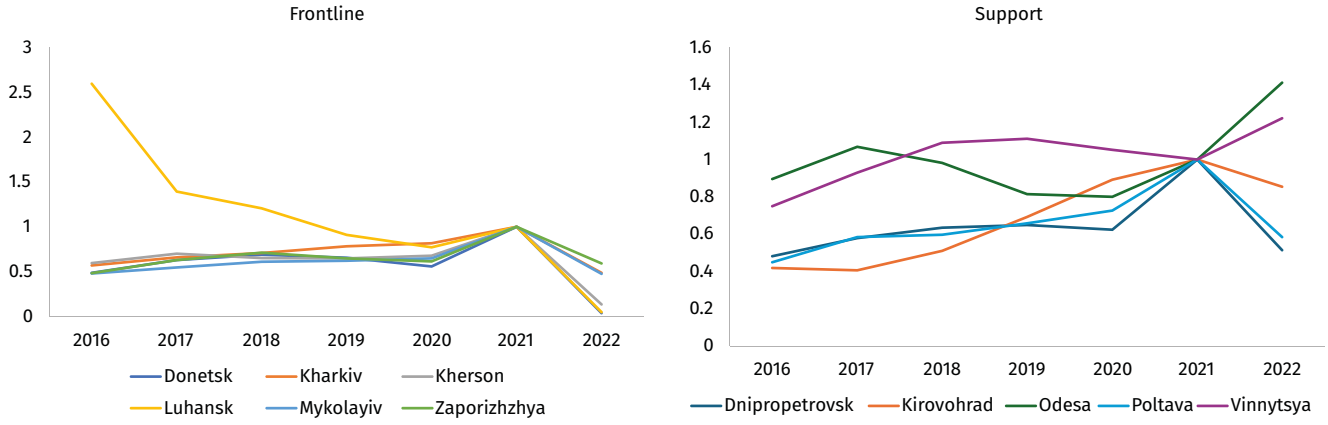


Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

Figure 2.36 and **Figure 2.37** display the aggregate exports and imports, respectively for Ukrainian regions for that year, with the 2021 export normalized to one. Regions are categorized into four groups based on World Bank Classification: front line, support, backline and regained regions.

FIGURE 2.36: UKRAINE'S EXPORTS, BY REGIONAL GROUP, 2016-2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).



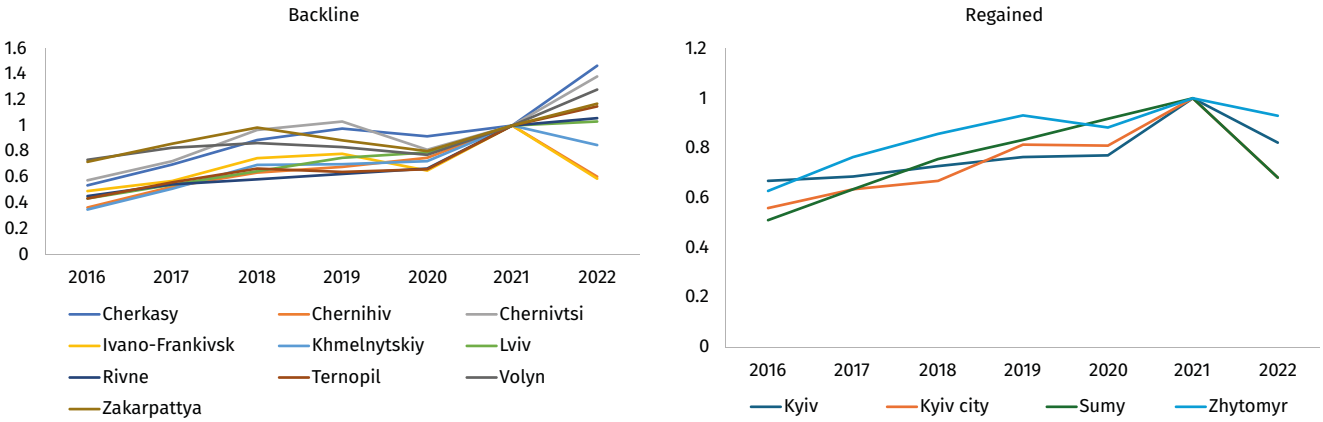
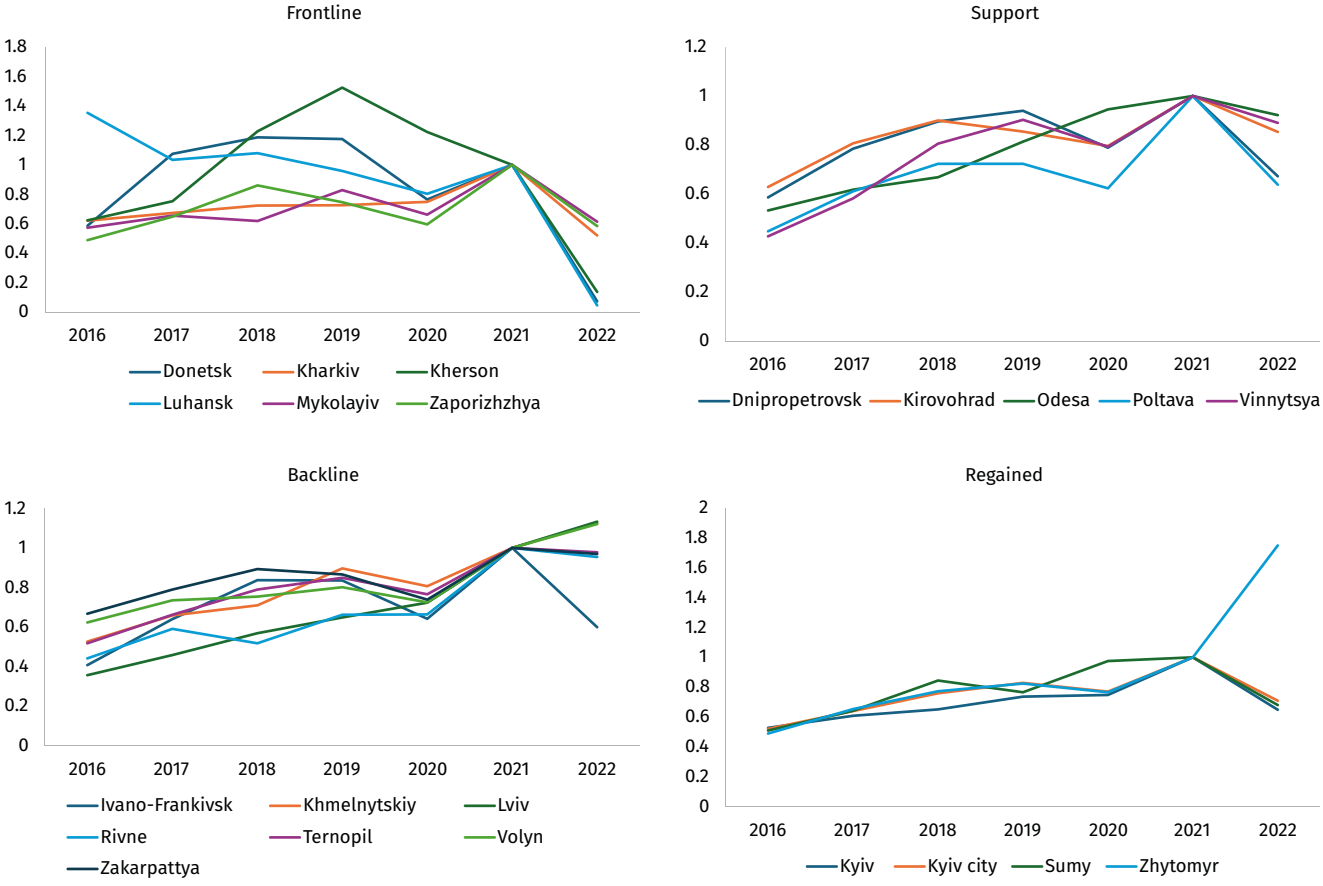


FIGURE 2.37: UKRAINE'S IMPORTS, BY REGIONAL GROUP, 2016-2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua (accessed September 2023).



Exports from all frontline regions in Ukraine saw a significant decrease in 2022 compared to 2021. Overall, they fell by 67.7 percent in 2022, while imports decreased by 58 percent. Regions with the largest declines in exports in 2022 were Donetsk (96 percent), Luhansk (95 percent) and Kherson (86 percent). Other frontline regions such as Mykolayiv (52 percent), Kharkiv (51 percent) and Zaporizhzhia (41 percent) also experienced significant declines in exports.

Data for support regions shows mixed results for exports and imports in 2022 compared to 2021. Overall, exports from support regions fell by 33 percent in 2022, while imports decreased by 26 percent. However, some regions such as Odesa (41 percent) and Vinnytsya (22 percent) showed an increase in exports. In contrast, all support regions experienced a decline in imports.

Regained regions saw a 29 percent decrease in aggregate exports and a 28 percent decrease in aggregate imports in 2022 relative to 2021. In contrast, backline regions saw a 1.5 percent increase in aggregate exports and a 4 percent increase in aggregate imports.

In examining Ukraine's regional industry trade, **Table 2.12** presents the top three export sectors for each frontline region and each industry's share in the region's aggregate exports. This share is calculated using the average exports of the industry from 2019-2021. All remaining sectors are grouped under the "Others" category.

TABLE 2.12: FRONTLINE REGIONAL TRADE BY SECTOR, 2021-2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua, and regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023); State Statistics Service of Ukraine (2018, 2019, 2020, 2021, 2022, 2023).

REGION	INDUSTRY	2019-2021 AVERAGE (THOUSANDS USD)	2022 (THOUSANDS USD)	SHARE OF THE SECTOR	CHANGE BETWEEN 2021
Donetsk	Basic + fabricated metals	4,306,055	17,371	89	-100
	Machinery & equin.e.c.+ office + electrical, n.e.c.	285,227	5,293	6	-98
	Food & beverages	112,778	31,356	2	-72
	Others	126,009	181,197	3	44
Kharkiv	Food & beverages	420,496	206,118	36	-51
	Machinery & equin.e.c.+ office + electrical, n.e.c.	270,735	112,782	23	-58
	Basic + fabricated metals	81,088	53,206	7	-34
	Others	403,093	197,993	34	-51
Kherson	Food & beverages	91,067	20,884	44	-77
	Basic + fabricated metals	41,991	4,133	20	-90
	Motor vehicles + Other transport equ	22,097	293	11	-99
	Others	53,965	5,515	26	-90
Luhansk	Paper	45,811	1	33	-100
	Chemicals	34,592	162	25	-100
	Textiles	13,929	-	10	-100
	Others	46,436	1,561	33	-97
Mykolaiv	Chemicals	543,356	132,173	57	-76
	Food & beverages	283,819	404,040	30	42
	Machinery & equin.e.c.+ office + electrical, n.e.c.	82,880	35,291	9	-57
	Others	45,287	22,737	5	-50
Zaporizhzhia	Basic + fabricated metals	2,062,686	2,101,902	67	2
	Machinery & equin.e.c.+ office + electrical, n.e.c.	480,567	222,783	16	-54
	Food & beverages	312,375	124,351	10	-60
	Others	209,630	116,008	7	-45

A few sectors dominate aggregate exports in many frontline regions. For instance, manufacture of basic metals and manufacture of fabricated metal products accounted for 89 percent of Donetsk's total exports in 2019-2021. However, in 2022, exports of these sectors declined by 99.6 percent, relative to 2019-2021 average. In the Kharkiv region, food and beverage exports, which accounted for 36 percent of the region's exports, fell by 51 percent. In contrast, exports of basic metals and fabricated metals, which accounted for 7 percent of the region's exports, declined by 34 percent.

Production losses in both basic and fabricated metals are of particular concern for several reasons. First, these sectors were internationally competitive before the war. Secondly, there had been growing external demand for these sectors, and Ukraine's exports in these areas were on the rise. This presented significant potential for employment opportunities. Moreover, production is geographically concentrated, primarily due to their high dependence on logistics and the supply of commodity inputs. Similar arguments apply to motor vehicles and other transport equipment, as well as textiles, despite these sectors not having the same level of geographic concentration and Ukraine not demonstrating strong specialization in them.

Table 2.13 displays the primary export sector for each non-frontline region in Ukraine and the share of that sector in the region's total exports (2019-2021 average). The remaining sectors are again grouped under the "Others" category. For example, the primary export sector for Dnipropetrovsk, a support region, is basic metals and the manufacturing of fabricated metals, which accounts for 74 percent of the region's total exports. In the Dnipropetrovsk region, exports of basic metals and fabricated metals declined by 33 percent in 2022 relative to 2019-2021 average. Odessa registered an increase in exports of food products and beverages in 2022 relative to 2019-2021 average. This sector accounts for 53 percent of the region's exports.

Backline regions of Ukraine, such as Khmelnytskyi, Lviv and Rivne, have seen increased exports from specific sectors, notably food and machinery. These sectors are less geographically concentrated compared to industries like metal production. Importantly, consultations with members of industrial organizations have revealed that some multinational food producers successfully relocated production plants to safer backline regions. In contrast, plants in frontline regions that managed to resume production are operating at significantly reduced capacity levels, typically below 30 percent.

TABLE 2.13: NON-FRONTLINE REGIONAL TRADE, BY SECTOR, 2021-2022

Source: State Statistics Service of Ukraine, statistical information, https://ukrstat.gov.ua, and regional statistics, https://ukrstat.gov.ua/druk/publicat/kat_u/publ2_u.htm (accessed September 2023); State Statistics Service of Ukraine (2018, 2019, 2020, 2021, 2022, 2023).

GROUP	REGION	INDUSTRY	2019-2021 AVERAGE (THOUSANDS USD)	2022 (THOUSANDS USD)	SHARE OF THE SECTOR	CHANGE
Support regions	Dnipropetrovska	Basic + fabricated metals	4,328,214	2,891,309	74	-33
		Others	1,493,411	1,098,841	26	-26
	Kirovograd	Food & beverages	428,126	425,786	78	-1
		Others	121,210	84,105	22	-31
	Odesa	Food & beverages	407,668	624,827	53	53
		Others	354,999	322,007	47	-9
	Poltava	Food & beverages	285,212	243,793	46	-15
		Others	333,962	171,049	54	-49
	Vinnytsia	Food & beverages	494,104	508,147	61	3
		Others	311,080	264,514	39	-15
Backline regions	Ivano-Frankivsk	Rubber & plastics	258,389	91,302	32	-65
		Others	550,152	429,988	68	-22
	Khmelnytsky	Food & beverages	68,416	102,888	23	50
		Others	227,120	239,765	77	6
	Lviv	Machinery & equin.+ office + electrical	522,154	587,385	25	12
		Others	1,537,018	2,075,506	75	35
	Rivne	Other non-metallic mineral	60,998	63,863	27	5
		Others	166,093	264,979	73	60
	Ternopil	Machinery & equin..+ office + electrical	207,612	173,331	60	-17
		Others	135,866	238,156	40	75
	Transcarpathian	Machinery & equin..+ office + electrical	911,751	978,176	64	7
		Others	514,831	551,579	36	7
	Volyn	Machinery & equin..+ office + electrical	262,229	219,989	43	-16
		Others	353,954	547,353	57	55
Regained regions	Kyiv	Food & beverages	347,357	374,573	31	8
		Others	756,871	613,904	69	-19
	Sumy	Food & beverages	208,348	93,149	35	-55
		Others	384,787	290,594	65	-24
	Zhytomyr	Machinery & equin..+ office + electrical	168,148	151,231	31	-10
		Others	368,085	362,401	69	-2
Other regions	Cherkasy	Food & beverages	283,868	380,475	64	34
		Others	159,817	179,663	36	12
	Chernihiv	Food & beverages	120,176	175,849	31	46
		Others	265,833	169,253	69	-36
	Chernivtsi	Machinery & equin..+ office + electrical	50,881	47,197	31	-7
		Others	114,466	134,961	69	18

STAGE III – DAMAGE

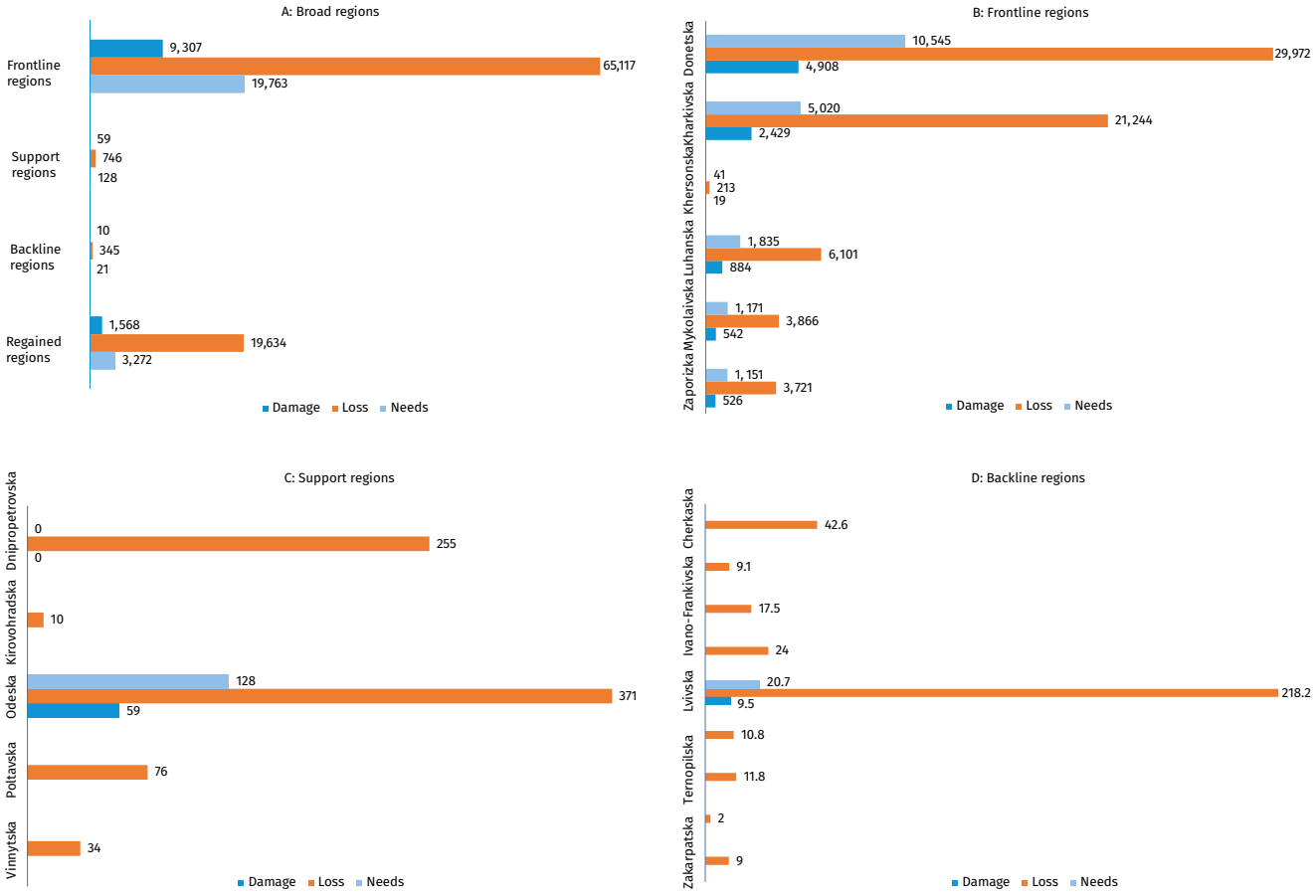
The analysis supplemented by estimates from the World Bank (2023) shows the estimated damage, loss and needs by region (in US$ million) for Ukraine's commerce and industry sector. These estimates encompass the manufacturing sector and commerce.

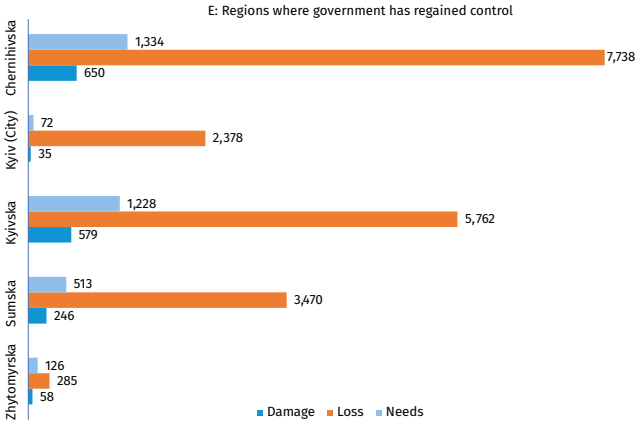
Regions are categorized into four groups: frontline, support, backline and regained regions. As of 24 February 2023, the total damage to industry and commerce facilities is estimated at US$10.9 billion for the one-year period since the onset of the war. Total losses across commerce and industry amount to US$85.8 billion, estimated over 30 months, which includes the one-year period from the start of the war and an additional 18 months accounting for continued losses.

Figure 2.38A illustrates the overall impact of the war on Ukraine's commerce and industry sectors by broad regions. It reveals that frontline regions bore the brunt of the impact, followed by regions that are no longer under the temporary military control of the Russian Federation. **Figures 2.38B-E** detail region-specific impacts of the war. Among frontline regions, Donetsk suffered the most in terms of damage and loss and, consequently, has the greatest need for support, followed by Kharkiv. Donetsk incurred US$4.9 billion in damage and US$29.9 billion in loss and, therefore, requires US$10.5 billion in support.

FIGURE 2.38: ESTIMATED DAMAGE, LOSS AND NEEDS (US$ MILLION), COMMERCE AND INDUSTRY SECTORS, BY REGION

Source: World Bank (2023).





STAGE IV – BUSINESS EXPECTATIONS

In this subsection, the business expectations in Ukraine's manufacturing sector and how they have evolved over 2022 and 2021 were analysed. The Ukraine State Statistics Service (UkrStat) provides information about the expectations of industrial enterprises regarding their business activity development. This information, collected quarterly, covers more than 14 dimensions, including the assessment of industrial production, demand, export orders, and expectations of changes in industrial production; and competitive positions on domestic, the EU and non-EU markets (refer to Appendix **Table D8** for the list of measures).

For each measure, businesses are asked to assess whether their situation has improved (increased), remained the same, or worsened (decreased) or whether they have no opinion about the situation over the past three months. The balance is the difference between the percentage of businesses that reported improvement and the percentage that reported worsening. A negative balance indicates that more firms reported a worsening situation than an improvement over the past three months.

To capture the aggregate trend for expectations of industrial enterprises regarding their business activity development, a score for each measure was assessed. For each quarter and each measure, a score of 1 is given if the balance is negative and a score of 0 if it is positive. The scores for all measures were summed up to create an index that ranges from 0 to 14. A score of 14 indicates that the industry has negative balances for all measures, while a score of 0 indicates that all balances are positive. For example, if the "Assessment of industrial production over the past three months" for the manufacturing of food products sector is considered, for the first quarter of 2022, 11 percent reported an increase and 63 percent reported a decrease, resulting in a -53 percent balance. As the balance is negative, a measure is scored one per our approach.

Table 2.14 reports the results of the scorecard approach. The score is highest in the second quarter of 2022, indicating that businesses were more pessimistic in that quarter. This is likely due to the ongoing war in Ukraine, which has negatively impacted the economy. The score is lowest in the first quarter of 2023, which may be attributed to businesses having some time to adjust to the war and starting to see some signs of recovery.

TABLE 2.14: AGGREGATE SCORE OF BUSINESS EXPECTATION, BY SECTOR, OVER FIVE QUARTERS, 2022-2023

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).

SECTOR	2022				2023
	Q1	Q2	Q3	Q4	Q1
Food	10	12	8	9	10
Beverages	9	6	10	9	4
Tobacco	8	10	6	7	6
Textiles	11	10	9	7	5
Apparel	9	8	4	9	6
Leather	8	11	4	6	5
Wood	8	10	10	12	8
Paper	8	10	6	7	8
Printing	10	11	7	6	4
Coke and refined petroleum	8	11	9	8	10
Chemical	11	12	11	12	10
Pharmaceutical	8	10	11	7	9
Rubber and plastic	10	12	8	11	10
Other non-metallic	9	10	7	10	9
Basic metals	9	12	12	12	8
Fabricated metal	9	12	11	11	10
Computer, electronic and optical	9	12	12	10	12
Electrical equipment	11	12	10	11	12
Machinery and equi n.e.c.	9	12	11	11	11
Motor vehicles	8	11	10	10	8
Other transport equipment	9	11	9	8	7
Furniture	10	12	8	8	10
Other manufacturing	9	11	9	12	8
Repair and installation	9	10	11	12	11
AVERAGE	9.1	10.8	8.9	9.4	8.4

Note: This table reports the scores index. A score of one is assigned if the balance is negative, and zero is assigned if it is positive. The scores for all measures are summed up to create an index that ranges from 0 to 14. A score of 14 indicates that the industry has negative balances for all measures, while 0 indicates that all balances are positive. The data described in this figure as Q1 – Q4 in 2022 and 2023 refers to an assessment of the business situation over each past quarter.

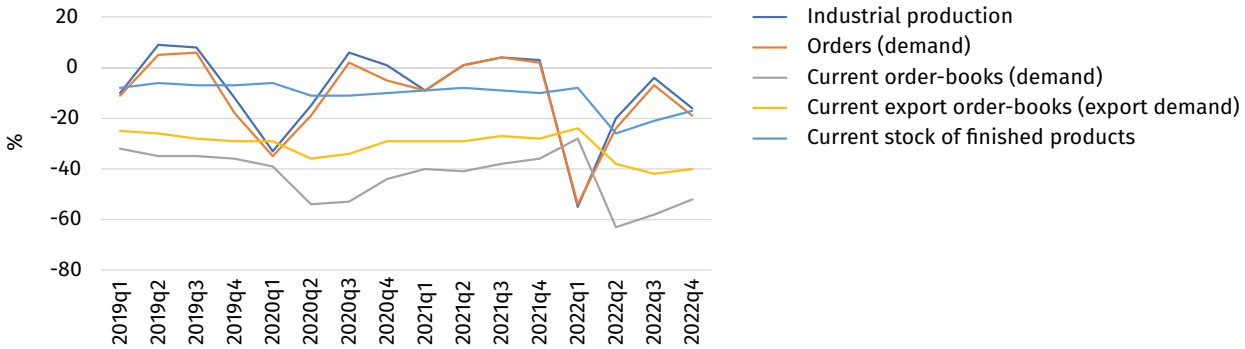
Conversations with members of Ukrainian industrial organizations and company managers revealed that restricted access to bank credit and reliance on internal funds were among the challenges faced by industrial companies hoping for positive growth and development, including modernization of production, in the period leading up to the war. To alleviate financial constraints experienced by manufacturing companies, preferential lending for producers and grants are recommended (World Bank 2023). Additionally, there has been a call for the restoration of the Ministry of Industrial Policy (which merged with the Ministry of Economy in 2014) and regional bodies for industrial policy, ensuring effective coordination with other state entities. In this regard, the Law of Ukraine on State Support of Investment Projects with Significant Investments[26] can be a positive force as it offers support and incentives for projects involving substantial capital investments.

Figure 2.39 details business expectations for the manufacturing sector across different measures. It reveals structural breaks across most of the measures in 2022 following the armed conflict. These results suggest businesses are becoming more cautious about investing in the current economic environment.

FIGURE 2.39: UKRAINE'S BUSINESS EXPECTATIONS, 2019-2022

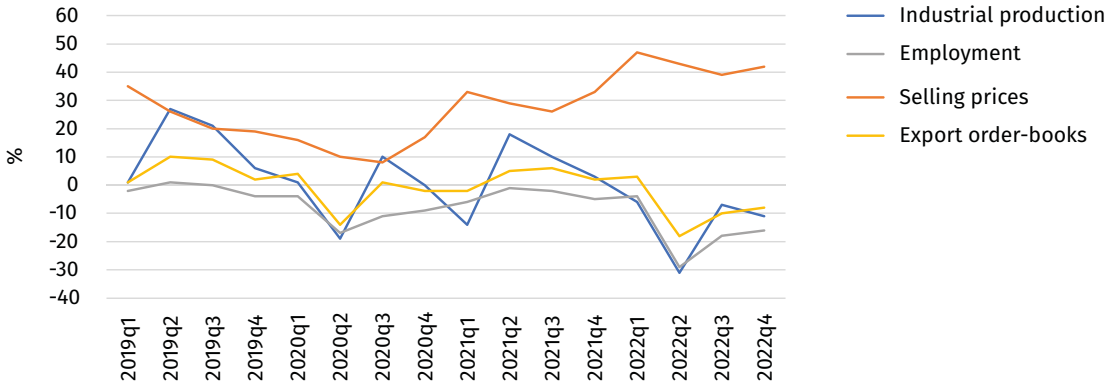
Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).

A: Assessment of the business situation over the past three months in the manufacturing sector



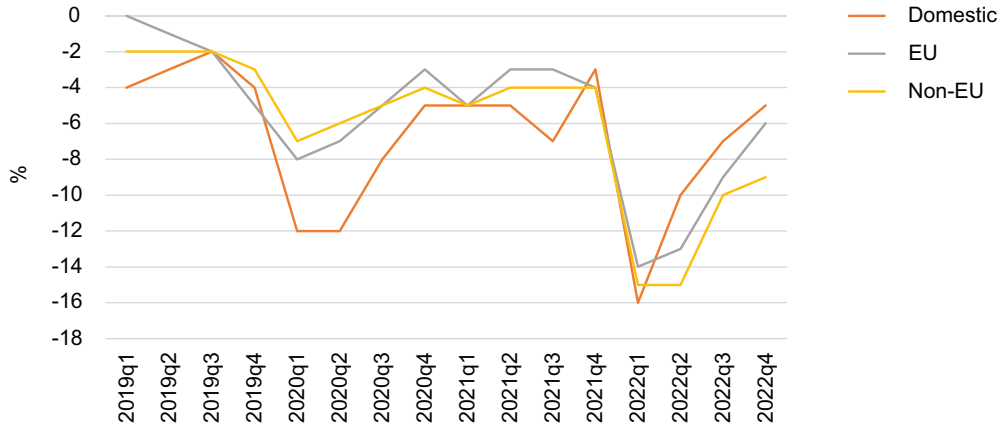
Note: The data described in this figure refers to an assessment of the business situation over the past three months. The values represent the balance between the share of firms reporting an increase and a decrease in each indicator.

B: Expected changes over the following quarter in the manufacturing sector



Note: The data described in this figure refers to an assessment of the business situation over the following quarter. The values represent the balance between the share of firms reporting a positive or negative expectation of each indicator.

C: Assessment of the competitive position of manufacturing enterprises



Note: The data described in this figure refers to an assessment of the business situation for the past quarter. The figure reports the data about quarter X as information concerning the quarter X-1. The values represent the balance between the share of firms reporting a positive or negative expectation of the indicator.

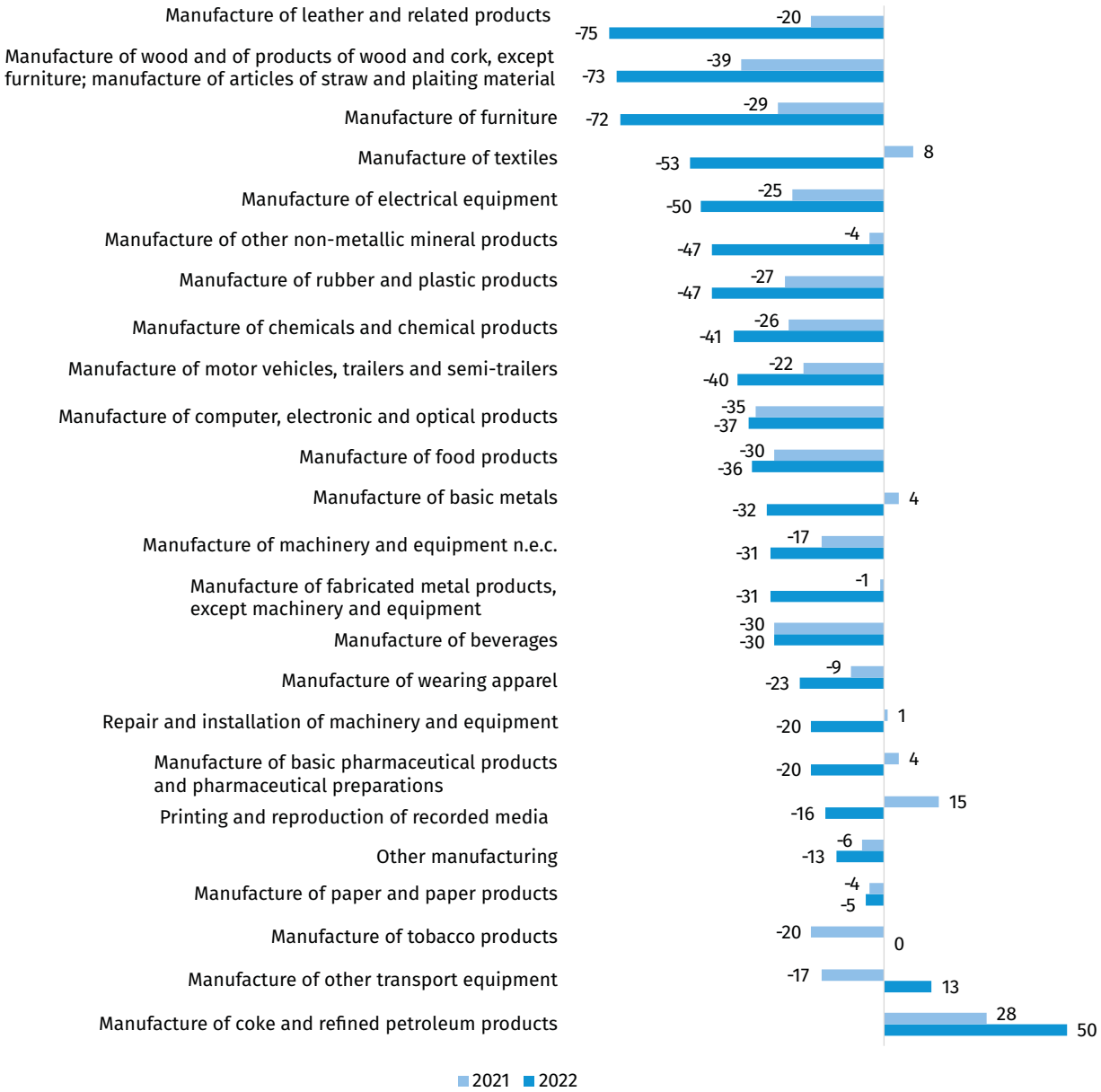
Expected changes in investment in manufacturing

The biannual survey conducted in April and October asks respondents to rate the expected changes in investment in their industry in the current year compared to the previous year. **Figure 2.40** compares results of the 2022 surveys with the results of the 2021 surveys. Panel A presents the results of the April surveys and panel B displays the results of the October surveys. The figure illustrates the expected percentage change of investments over the time-horizons of April 2021 vs April 2022 and October 2021 vs October 2022. The data was collected in April 2021, April 2022, October 2021, and October 2022.

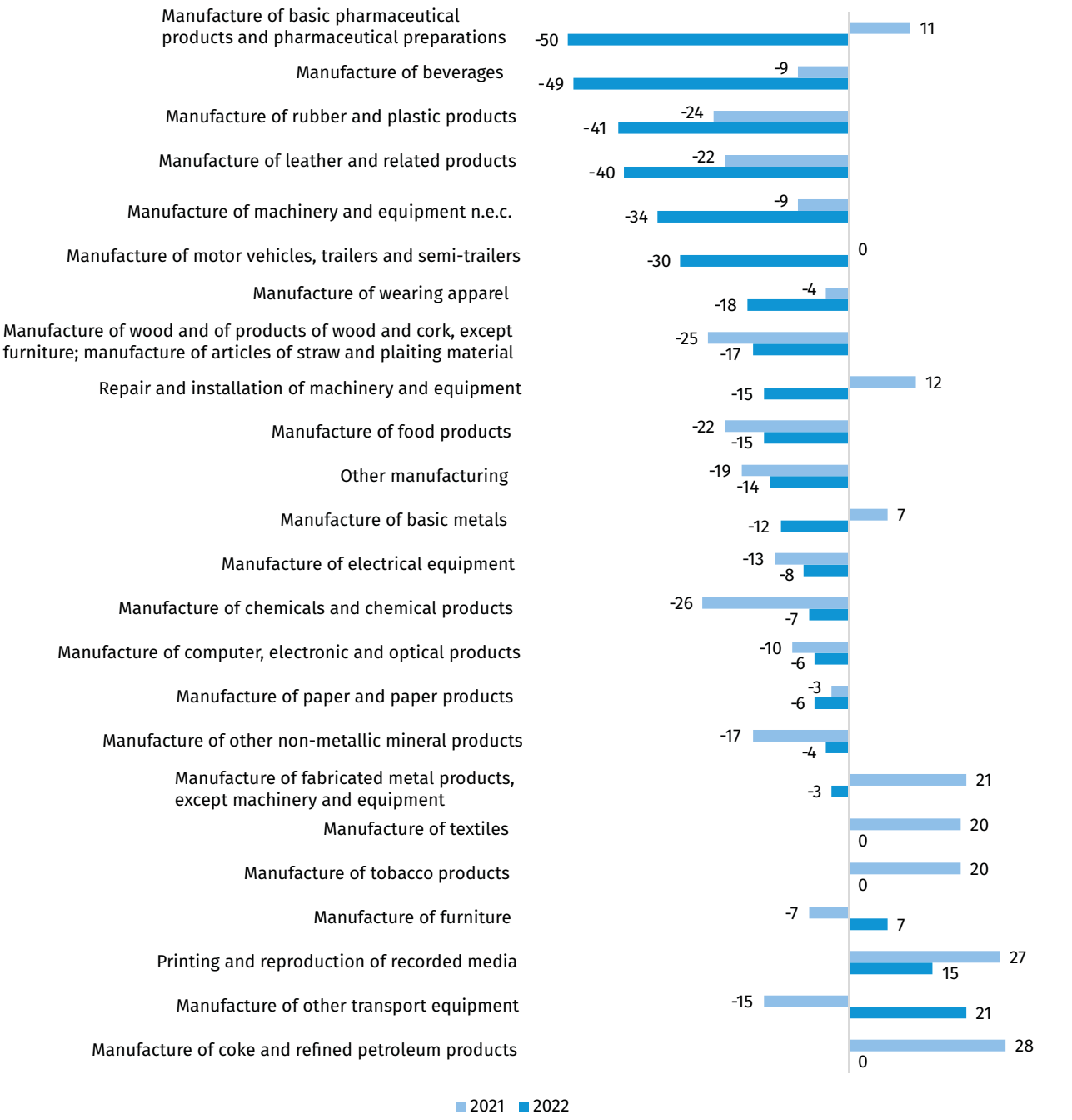
FIGURE 2.40: EXPECTED INCREASE OR DECREASE (%) IN INVESTMENT, BY MANUFACTURING, 2021-2022

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).

A: April 2021 vs April 2022



B: October 2021 vs October 2022



Note: The figure illustrates the expected percentage change of investments over the time-horizons of April 2021 vs April 2022, and October 2021 vs October 2022. The data was collected in April 2021, April 2022, October 2021 and October 2022.

For both 2022 survey rounds, most manufacturing industries expected the changes in investment in their industry in the current year to be significantly smaller than in the previous year. For instance, in the October survey, respondents in the manufacture of basic pharmaceutical products and pharmaceutical preparations expected changes in investment to be 50 percent smaller than in the previous year, the expectation was positive in the same period for 2021. The beverages sector and the rubber and plastic sector followed this trend.

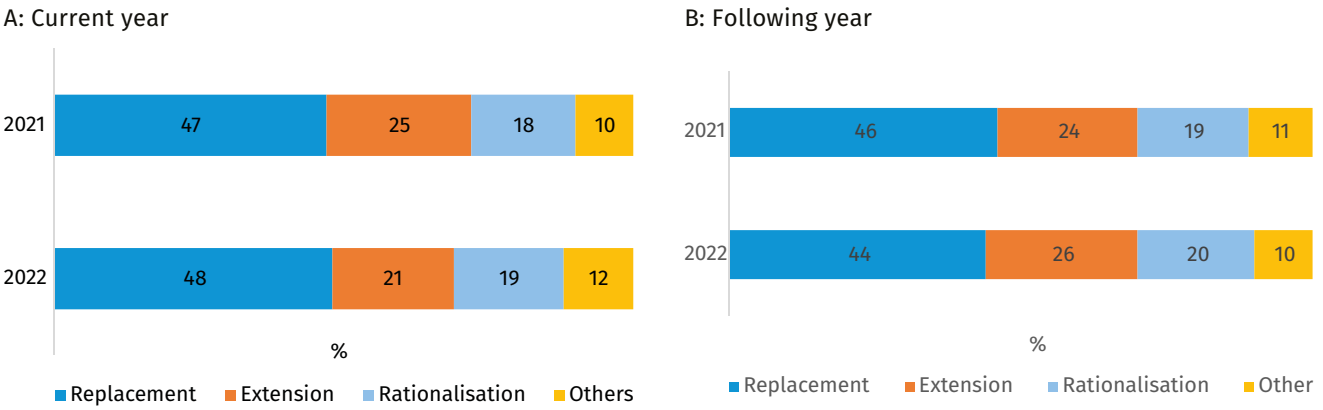
Destination of investment in manufacturing

An October survey inquired about businesses' investment destinations in the manufacturing sector for the current and upcoming year. Responses were categorized as investment in replacement (new equipment or facilities to replace existing ones that are worn out or obsolete), extension (investment in new equipment or facilities to expand the capacity of existing operations), rationalization (investment in new equipment or facilities to improve the efficiency of existing operations), and others.

Figure 2.41 illustrates the destination of investment in the manufacturing sector for 2021 and 2022. Panel A reports for the current year, while panel B presents data for the following year. In 2020, the expectation for 2021 was that 46 percent of the investment in the manufacturing sector was for replacing old equipment, 24 percent was for expanding production capacity and 19 percent was for making other changes to improve efficiency. In 2021, the expectation for 2022 was similar, with 44 percent for replacement, 26 percent for extension and 20 percent for rationalization (panel B). In 2022 (panel A), the distribution across investment types is confirmed with 48 percent replacement, 21 percent extension, 19 percent rationalization and 12 percent others.[27] This suggests no substantial difference between the pre-and during-war periods in terms of the destination of investment in the industry for the current year or the following year. The most common destination for investment is replacement, followed by extension. Rationalization and other investments are less common.

FIGURE 2.41: DESTINATION OF INVESTMENT IN UKRAINE'S MANUFACTURING, CURRENT AND FOLLOWING YEARS (AGGREGATE), 2021-2022

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).



Note: "Following year" refers to the expectations about 2022 with the data collected in 2021, and the expectations about 2021 with the data collected in 2020.

Table 2.15 presents the results, by two-digit industry, for 2022 and the expectations in 2021 concerning 2022. Findings are broadly consistent with the aggregated results, with replacement emerging as the most common form of investment across all industries except for tobacco and other transport equipment. However, there are industry-specific variations. For instance, the manufacture of wearing apparel; other non-metallic; machinery and equipment, n.e.c.; and repair and installation sectors have a higher proportion of investment in replacement than other industries. Conversely, computer, electronic and optical and chemical industries have a higher proportion of investment in rationalization. This indicates that investment strategies can vary significantly across different sectors.

TABLE 2.15: DESTINATION OF UKRAINE'S INVESTMENT IN MANUFACTURING, CURRENT AND FOLLOWING YEARS, BY INDUSTRY (AGGREGATE), 2021 AND 2022

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).

INDUSTRY	CURRENT YEAR (2022)				FOLLOWING YEAR (2022)			
	REPLACEMENT	EXTENSION	RATIONALIZATION	OTHER	REPLACEMENT	EXTENSION	RATIONALIZATION	OTHER
Food	48	19	19	14	45	22	25	8
Beverages	60	10	14	16	42	22	24	12
Tobacco	к/с	к/с	к/с	к/с	23	47	13	17
Textiles	54	29	17	0	37	27	31	5
Apparel	72	17	11	0	61	25	11	3
Leather	66	7	27	0	47	22	31	0
Wood	38	30	24	8	48	13	27	12
Paper	59	24	13	4	40	31	20	9
Printing	к/с	к/с	к/с	к/с	43	27	23	7
Coke and refined petroleum	к/с	к/с	к/с	к/с	35	18	21	26
Chemical	34	20	28	18	40	26	20	14
Pharmaceutical	52	9	24	15	39	29	20	12
Rubber and plastic	40	30	13	17	46	30	17	7
Other non-metallic	45	16	24	15	53	17	14	16
Basic metals	40	24	18	18	35	30	18	17
Fabricated metal	46	25	21	8	40	29	21	10
Computer, electronic and optical	37	16	34	13	45	35	15	5
Electrical equipment	43	24	21	12	39	23	24	14

INDUSTRY	CURRENT YEAR (2022)				FOLLOWING YEAR (2022)			
	REPLACEMENT	EXTENSION	RATIONALIZATION	OTHER	REPLACEMENT	EXTENSION	RATIONALIZATION	OTHER
Machinery and equipment n.e.c.	45	23	22	10	52	16	17	15
Motor vehicles	60	17	16	7	43	39	13	5
Other transport equipment	47	22	14	17	32	33	19	16
Furniture	48	22	21	9	44	33	13	10
Other manufacturing	34	29	25	12	45	29	19	7
Repair and installation	72	22	3	3	49	24	16	11

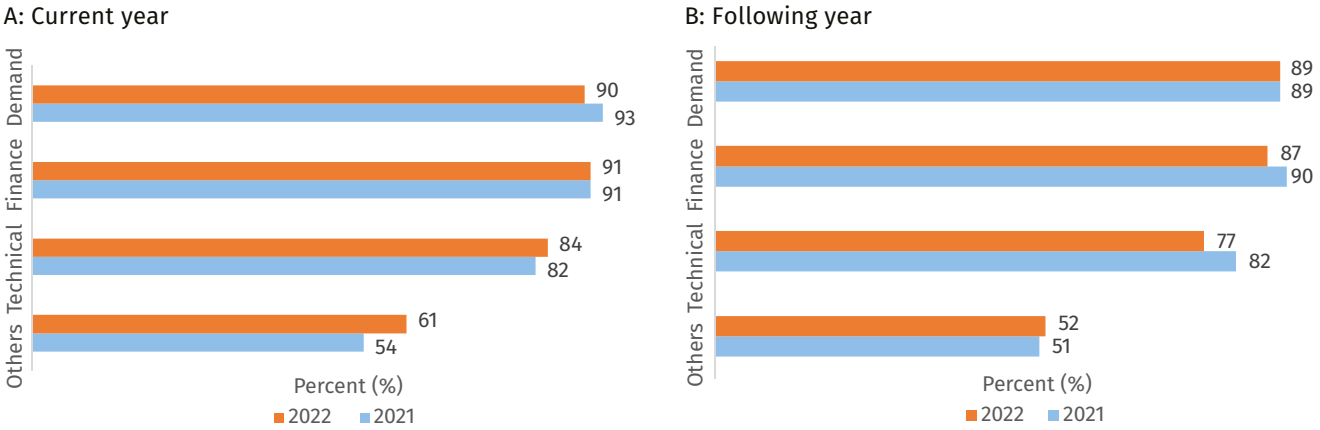
Note: к/с means the result is suppressed. The data represents the information collected from firms in 2022 about destinations of investment in manufacturing in 2022 – "Current year (2022)" – and the information collected in 2021 about expectations concerning destinations of investment in manufacturing in 2022 – "Following year (2022)".

Factors influencing investment in manufacturing

A subsequent survey inquired about the factors that influence investment in manufacturing for the current and the upcoming year. **Figure 2.42** presents the aggregate data for the manufacturing industry, while **Table 2.16** provides data for two-digit industries. At an aggregate level in 2022, more than 90 percent of respondents indicated that demand and finance are the primary factors influencing investment decisions in the current year. There is little difference in the factors influencing investment decisions – such as demand, finance, technical factors, and others – before and after the war.[28]

FIGURE 2.42: FACTORS INFLUENCING UKRAINE'S INVESTMENT IN MANUFACTURING, CURRENT YEAR AND FOLLOWING YEARS (AGGREGATE), 2021 AND 2022

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).



Note: "Following year" refers to the expectations about 2022 with data collected in 2021, and the expectations about 2021 with data collected in 2020.

TABLE 2.16: FACTORS INFLUENCING UKRAINE'S INVESTMENT IN MANUFACTURING, CURRENT AND FOLLOWING YEARS, BY INDUSTRY

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).

SECTOR	CURRENT YEAR (2022)				FOLLOWING YEAR (2022)			
	DEMAND	FINANCE	TECHNICAL	OTHERS	DEMAND	FINANCE	TECHNICAL	OTHERS
Food	91	89	88	59	90	85	75	52
Beverages	95	95	89	74	85	93	74	48
Tobacco	к/с	к/с	к/с	к/с	100	100	80	80
Textiles	100	100	88	38	94	81	88	69
Apparel	81	94	75	56	95	95	74	74
Leather	75	75	100	75	50	67	67	67
Wood	90	90	85	60	95	84	95	63
Paper	85	92	77	69	94	88	69	56
Printing	к/с	к/с	к/с	к/с	94	94	69	44
Coke and refined petroleum	к/с	к/с	к/с	к/с	83	83	100	67
Chemical	82	86	77	68	95	88	74	45
Pharmaceutical	100	100	75	38	88	88	75	46
Rubber and plastic	89	89	89	58	87	85	78	43
Other non-metallic	90	100	85	70	87	85	74	56
Basic metals	95	95	80	45	88	91	72	44
Fabricated metal	92	92	85	73	86	85	80	51
Computer, electronic and optical	79	93	93	64	84	81	77	39
Electrical equipment	100	93	93	60	90	97	74	58
Machinery and equi n.e.c.	94	94	89	67	91	87	87	66
Motor vehicles	93	86	71	50	100	90	81	57
Other transport equi.	70	100	70	50	86	95	90	57
Furniture	80	100	90	60	79	83	83	46
Other manufacturing	88	81	75	69	100	84	72	56
Repair and installation	89	100	89	44	73	81	73	31

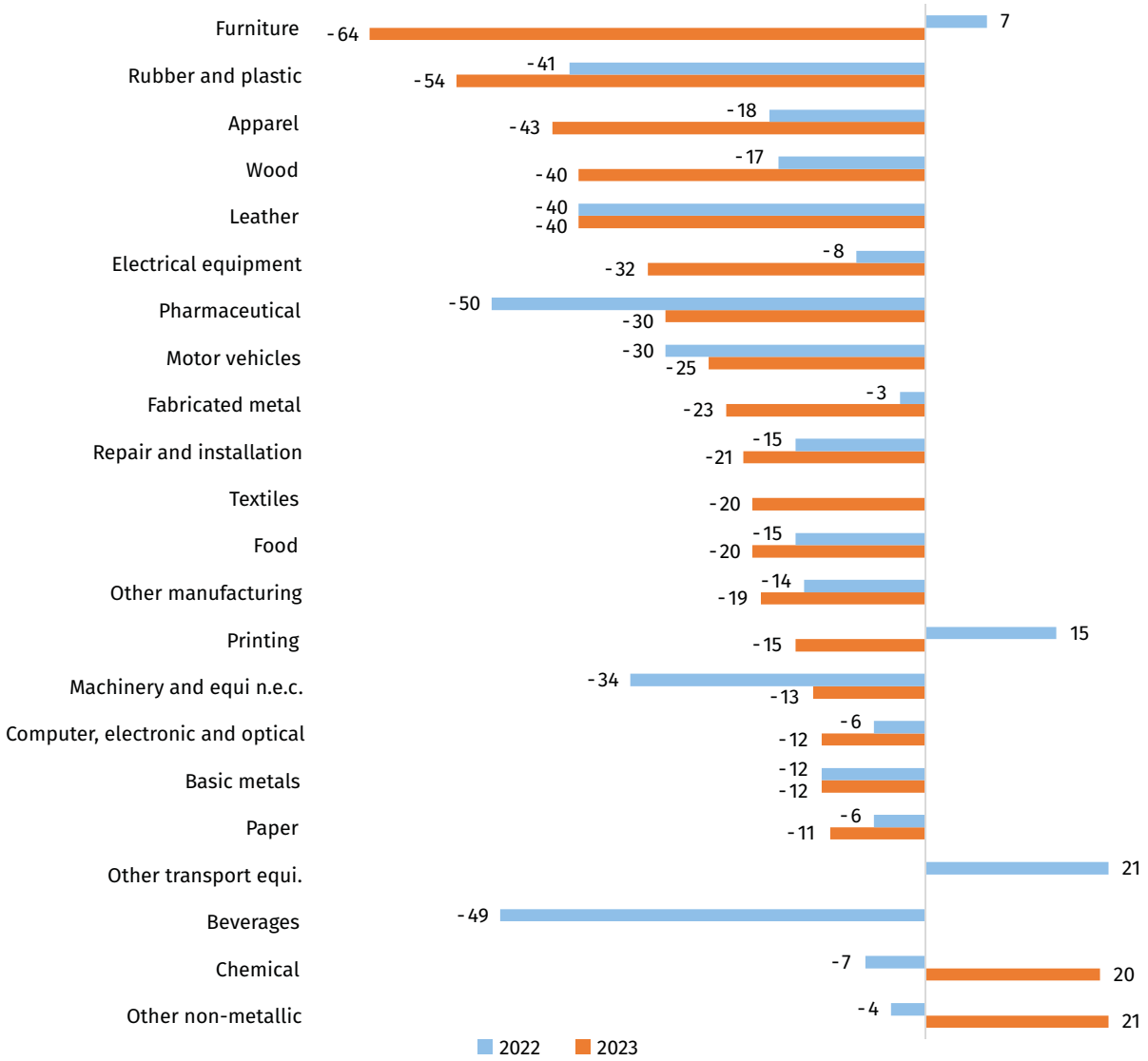
Note: к/с means the result is suppressed. The data represents the information collected from firms in 2022 about factors affecting investments in 2022 – "Current year (2022)" – and the information collected in 2021 about factors affecting investments in 2022 – "Following year (2022)".

Expected changes in investment in the manufacturing sector in 2022 over 2021, and 2023 over 2022

Figure 2.43 illustrates the anticipated changes in manufacturing investment in the upcoming year (2023 bar) compared to 2022 and the expected investment change perceived in 2022 compared to 2021 (2022 bar). Almost all sectors are expected to see negative changes in investment in 2023, with furniture (64 percent), rubber and plastics (54 percent) and apparel (43 percent) being the sectors with the highest anticipated negative changes. On an aggregate level, the manufacturing sector is expected to see a decrease in investment by 18 percent in 2023 compared to 2022.

FIGURE 2.43: EXPECTED CHANGES (%) IN UKRAINE'S INVESTMENT IN MANUFACTURING IN THE FOLLOWING YEAR OVER THE CURRENT YEAR

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).



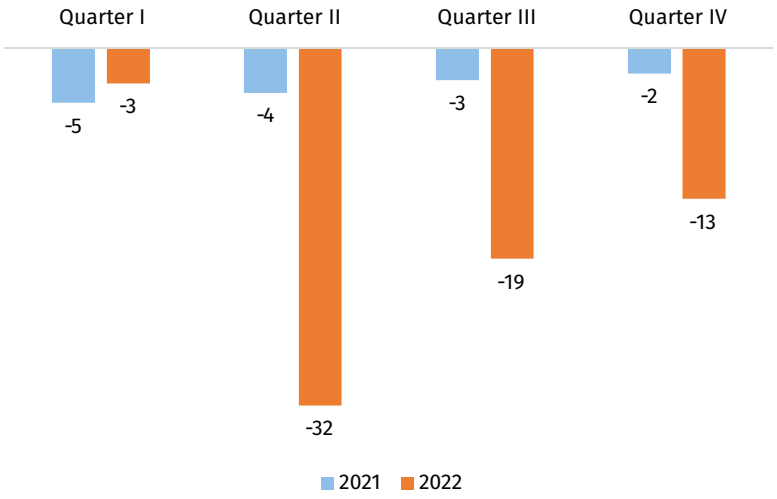
Note: The data described in this figure as 2023 and 2022 refers to the expectations of investment changes in 2023 with the data collected in 2022, and the expectations of investments change in 2022 over the previous year with data collected in 2022. The data of textiles (2022), other transport equipment (2023), beverages (2023), tobacco (2022 and 2023), and coke and refined petroleum (2022 and 2023) are not available.

STAGE V – EMPLOYMENT IMPACT

Figure 2.44 shows the expected changes in employment at industrial enterprises over the next three months for 2021 and 2022. The second quarter of 2022 is expected to have the highest negative change in employment, at 33 percent. This is followed by the third quarter (18 percent) and the fourth quarter (14 percent).[29]

FIGURE 2.44: EXPECTED CHANGES IN INDUSTRIAL EMPLOYMENT, 2021-2022

Source: UNIDO elaboration, based on the State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).



2.5 ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES OF THE WAR AND THE GREEN RECOVERY PROGRAMME

This section discusses the methodology and results of an analysis of the environmental and socioeconomic implications of the war Ukraine and the planned recovery programme. Our contribution relies on the UNIDO National Impacts of Circular Economy (NICE) tool, which is designed to assess the net socioeconomic impact of circular projects in terms of results, prominent drivers and the relevance of direct vs indirect effects, etc. within a simple, flexible and transparent simulation framework. In this context, the scope of the NICE tool has been expanded to investigate the impact of the war on economic, social and environmental indicators and perspectives for Ukraine's green recovery. The analysis includes the study of variables relevant to circular economy, such as materials consumption and other relevant indicators for inclusive and sustainable industrial development. Scenarios are based on an updated version of the NICE tool that have been developed by Albaladejo et al. (2023) and provide sensitivity tests.

2.5.1 THE NICE TOOL

The basis for the analysis is the NICE tool, developed for a former UNIDO project (Albaladejo et al., 2023), which is a static modeling tool based on an input-output model and data from the EORA26 world input-output table for 2016 (Lenzen et al., 2012; 2013).[30] The tool was initially developed to evaluate the socioeconomic and environmental consequences of projects supported by UNIDO in the field of circular economy. The tool helps assess and decompose (direct, indirect, induced effects) the impact of demand and supply shifts on several socioeconomic and environmental variables, accounting for inter-sectoral relationships. Although the tool was developed explicitly for considering shifts related to circularity, it allows us to view a wide array of possible scenarios.

The tool considers Ukraine a small economy, in comparison to the global economy, which allows us to ignore potential feedback loops (i.e. domestic shocks affecting foreign economies, which, in turn, have consequences for the focal country). Each economy is described by its national input-output table (with a 26-sector disaggregation) and the input-output table of imported intermediates (aggregated across all partner countries). The technical coefficient matrix **A** (i.e. direct requirement) and the Leontief matrix **L** (i.e. total requirements) are calculated and used to evaluate how shifts in demand influence sector-level output. Changes in sector-level production are then associated with changes in environmental (CO_2 emissions and material use) and socioeconomic (labour and value added) variables utilizing fixed output coefficients.

The NICE tool is based on the Leontief model and shares its main assumptions. The first assumption is that a corresponding change in supply meets any shift in the demand for intermediate inputs. In addition, the model allows for no adjustment in prices. Implicitly, the model also needs to assume a slack capacity for primary inputs (labour and capital), whose supply accommodates shifts in demand. A second assumption relates to the stability of the technology, defined as the Leontief total requirement matrix, which does not change over time. Finally, no substitution is allowed in principle between domestically produced and imported intermediates. While all these assumptions apply to the basic version of NICE, a few are removed with ad hoc modifications in the present modeling exercise. For example, in one scenario we consider constraints in the supply of male and female labour.

Data about the structure of the Ukrainian economy, as well as the corresponding input-output table, were adapted to account for the absence of economic relationships between those areas of Ukraine under the direct control of the Ukrainian government and occupied territories during the war. Access to domestic intermediate inputs (i.e. the input-output matrix) is rescaled accordingly.[31]

KEY POINTS:

- *Input-output modeling based on the NICE tool (details of the base model in Albaladejo et al., 2023);*
- *Demand-driven model, but also valuable for evaluating supply-side shocks;*
- *Base year is 2016 (latest available from EORA), adapted to replicate 2021 macro-economic figures;*
- *Most up-to-date information from various sources to build the different scenarios;*
- *Significant uncertainty about the actual "magnitude" of the different figures: results should be interpreted in the other channels' direction and relative (rather than absolute) magnitude.*

2.5.2 ASSESSMENT OF THE WAR'S CONSEQUENCES ON THE UKRAINE ECONOMY'S ENVIRONMENTAL PERFORMANCE

The war has led to substantial changes in the structure of the Ukrainian economy. Some sectors collapsed as companies were located in occupied areas (e.g. steel production in Mariupol). Other sectors experienced labour shortages due to refugees leaving the country and increasing numbers of men becoming involved in war operations. The need for military equipment and weapons brought about a reconversion of the economy. For example, the power sector was an explicit military target, leading to shortages in electricity supply and radical changes in the energy mix. All these changes led to a radical change in the economy's structure and, consequently, in its economic and environmental performance. The analysis in this section provides evidence about different CO_2 emissions and material-use scenarios. The war's impact is analysed through three components, as summarized in **Table 2.17**.

TABLE 2.17: SUMMARY OF COMPONENTS AND THEIR IMPACT ON THE STRUCTURE AND MODEL ASSUMPTIONS

Source: UNIDO elaboration.

COMPONENT	WHAT?	HOW?	ASSUMPTIONS MADE
1 Occupied regions: Interruption of production in areas that are or have been under the temporary military control of the Russian Federation.	Reduction in the demand for intermediates in other regions (demand shock); import-substitution (supply shock).	Demand shock is proportional to the share of production by sector in occupied regions; supply shock is modeled as a switch from domestic to imported intermediates.	It is assumed that occupied regions did not purchase any intermediate inputs from regions under the control of the Ukrainian government during the conflict. The corresponding reduction in the demand for intermediate inputs is simulated, assuming that this was not compensated by increased demand for intermediates from domestic or foreign companies.
2 Reconversion of the economy: Reconversion of production for military use.	Structural change to machinery & equipment, transport, and construction.	Sensitivity analysis of various values of structural change.	Positive demand shocks those sectors that most likely provide military equipment and services. The three main sectors were: (1) electrical and machinery (which includes weapons and ammunition); (2) transport equipment (including transport equipment for military purposes); and (3) construction (construction, maintenance and repairing of infrastructure used for military purposes). The magnitude of the shock (+30% in the first two sectors, +20% for construction) is just indicative.

COMPONENT	WHAT?	HOW?	ASSUMPTIONS MADE
3 Labour shortages Displacement of workers to support the military effort and to escape the conflict.	• Labour shortages due to conscription of males: Constraint to production in male-dominated sectors • Labour shortages due to refugees (primarily female): Constraint to production in female-dominated sectors (but partly compensated by internal displacements)	With a constant employment coefficient of output, production (and demand for intermediates) is reduced proportionally to employment decline.	To calculate sector-specific potential shortages, we consider: (1) for males, full mobilization of about one million males; sector-specific shortages are computed by considering the share of male employees over total employees of each sector (source: *ILOStat*); (2) for females, we consider about 1.5 million female refugees abroad (six million female refugees in the first weeks of the conflict, 4.5 of whom returned to Ukraine). This component considers shortages once the first two components are accounted for. For example, it could be that output reduction due to 'occupied regions' for a particular sector already predicts a decreased output that the reduced labour force can fully absorb. Output reduction to labour shortages is assumed to be proportional to the relative magnitude of the shortage (i.e. fixed coefficient of labour-per-output).

Note: For comprehensive analysis, refer to Marin and Paglialunga, 2024.

2.5.3 RESULTS AND DISCUSSION

Results from the NICE tool are summarized in **Table 2.18, Figure 2.45** and **Figure 2.46**. **Figure 2.45** illustrates the calculated effects of each component on employment, value added, CO_2 emissions and material use, and their total impacts. In **Figure 2.46**, changes are expressed in terms of ratios.

TABLE 2.18: SIMULATED ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES OF THE WAR, BY COMPONENT

Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).

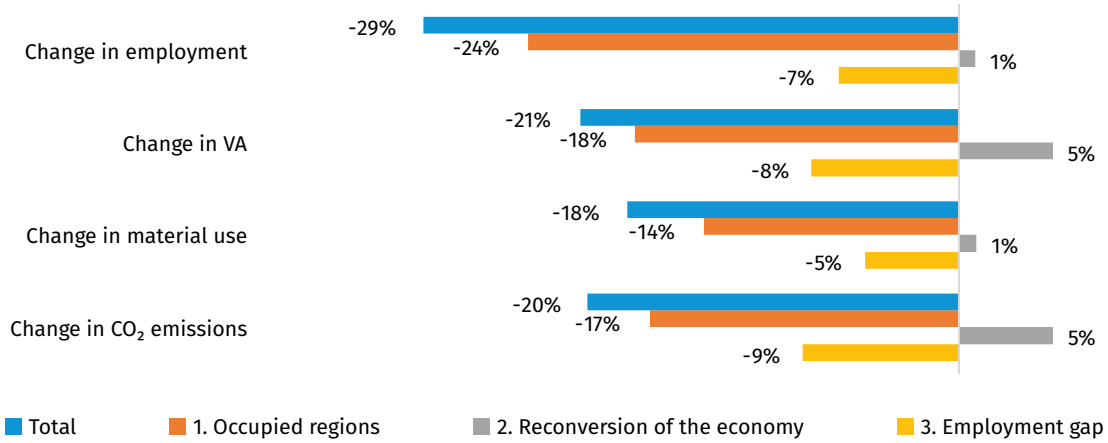
[LEVELS]	CHANGE IN CO_2 EMISSIONS	CHANGE IN VA	CHANGE IN EMPLOYMENT	CHANGE IN MATERIAL USE	
1 Occupied regions	-17.0%	-17.8%	-23.7%	-14%	
2 Reconversion of the economy	5.2%	5.1%	0.9%	+1%	
3 Employment gap	-8.6%	-8.1%	-6.6%	-5%	
Total	**-20.4%**	**-20.8%**	**-29.4%**	**-18%**	

[RATIOS]	CHANGE IN VA/L	CHANGE IN MU/L	CHANGE IN MU/VA	CHANGE IN CO_2/L	CHANGE IN CO_2/VA
1 Occupied regions	-5.9%	9.7%	3.8%	6.7%	0.8%
2 Reconversion of the economy	-4.3%	0.1%	-4.2%	4.3%	0.0%
3 Employment gap	1.5%	1.5%	3%	-2.0%	-0.5%
Total	**-8.6%**	**11.2%**	**2.6%**	**9.0%**	**0.4%**

Note: VA = value added; L = labour, MU = material use.

FIGURE 2.45: UKRAINE'S SIMULATED ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES (LEVELS) OF THE WAR, BY COMPONENT

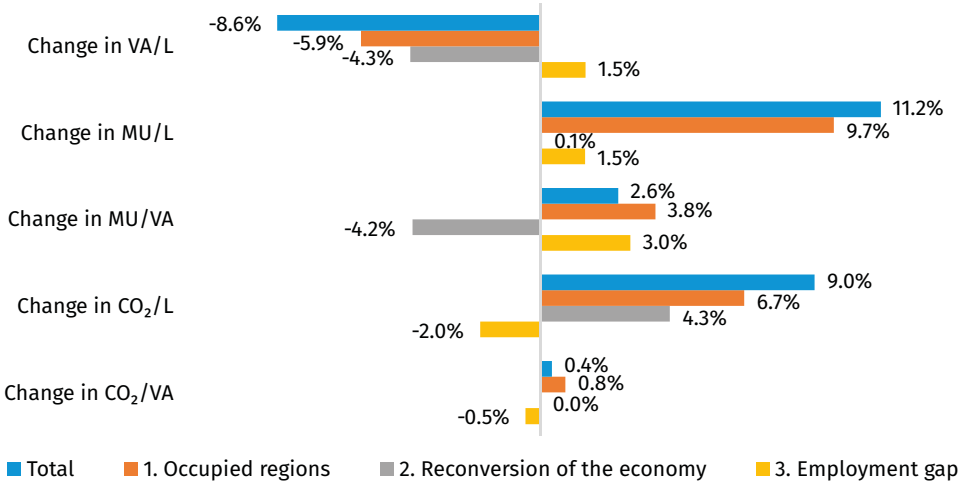
Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).



Note: VA = value added.

FIGURE 2.46: SIMULATED ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES (RATIOS) OF THE WAR, BY COMPONENT

Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).



Note: VA = value added; L = labour, MU = material use.

As seen in Figure 2.45, overall reduction of CO_2 emissions due to the war has been around 20 percent, in line with the reduction of material use (-18 percent), and gross value added (-21 percent), yet smaller than employment change (-29 percent). Overall, the largest effects of the war are driven by the halting of production in areas that are or have been under the temporary military control of the Russian Federation, followed by the labour shortage. The reconfiguration of the industry for military and reconstruction purposes does mitigate some of the adverse consequences but falls short of fully offsetting them.

Combined, these results imply a slight increase in the CO_2 emission intensity of value added and a larger increase in the CO_2 emission intensity of employment (+9 percent). Similarly, there has been a slight increase in the intensity of material use of value added (+2.6 percent), while a larger increase was recorded in material use intensity of employment (+11 percent). On the contrary, the considered changes led to a reduction of labour productivity by almost 9 percent. CO_2 emissions per worker increased due to components 1 and 2, while they decreased due to component 3. As for material use per worker, component 1 and component 3 are contributing to an increase, while component 2 has a neutral effect.

On the other hand, value added per worker increases in the case of labour shortages but declines when affected by the remaining components. This can be attributed to the fact that, in the case of labour shortages, value added decreases proportionally more than employment. Conversely, in the component where we consider that production is halted in areas that are or have been under the temporary military control of the Russian Federation, there is a more pronounced decrease in employment relative to value added. CO_2 emissions per unit of value added remain largely unaffected by the various components, indicating that these two variables move proportionally. Instead, material use per unit of value added exhibits an overall increase, driven mainly by components 1 and 3, partly compensated by a negative contribution of component 2.

The decline in production predicted by the NICE tool is in line with the registered fall in industrial production since the beginning of the war – and this fall in industrial production is reflected in employment, material use and CO_2 emissions.

KEY RESULTS:

- *The net effect of the identified channels through which the war has influenced the Ukrainian economy was substantially negative regarding economic variables (-21 percent gross value added, -29 percent employment) and environmental pressures (-18 percent material use, -20 percent CO_2 emissions);*
- *The average CO_2 intensity and material intensity of the Ukrainian economy increased;*
- *Most of the decline in economic variables and environmental pressures was driven by the disruption of the internal supply chain due to the temporary military occupation of Ukrainian regions, which was about 2-3 times as large as the negative contribution of employment gaps;*
- *The simulated positive impact of the reconversion of the Ukrainian economy only slightly compensated for the economic collapse.*

2.5.4 ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES OF THE GREEN RECOVERY PROGRAMME IN UKRAINE

This section analyses the findings from the NICE tool concerning the environmental and socioeconomic consequences of the Green Recovery Programme in Ukraine.[32] The Ukrainian government's proposal for the 2023 recovery implies a substantial change in the Ukrainian economy and massive infrastructural investments. The analysis evaluates labour demand's environmental and socioeconomic implications and gross value added generation by considering the "investment push" to the economic structure.

More specifically, two dimensions have been accounted for, as summarized in **Table 2.19**. First, planned/desired investments are assessed based on the preliminary information from the Green Recovery Programme. Second, two additional scenarios have been considered for the post-reconstruction performance of the Ukrainian economy in terms of convergence with the EU or Eastern EU regarding labour productivity and environmental efficiency, respectively. We consider scenarios where Ukrainian sectors close their labour productivity and environmental efficiency concerning gaps with the averages of the EU27 and Eastern EU countries, respectively.

TABLE 2.19: SUMMARY OF THE COMPONENTS, THEIR IMPACT ON THE STRUCTURE, AND MODEL ASSUMPTIONS

Source: UNIDO elaboration.

	COMPONENT	WHAT?	HOW?	ASSUMPTIONS
1	Environmental and socioeconomic consequences of the **Green Recovery Programme** in Ukraine	Increased demand for selected sectors	Attribution of planned intervention to sectors and evaluation of total effects	All investments use products and services made in Ukraine
2	**Convergence with EU**	Closing gap with EU in terms of productivity and efficiency	Improvement in labour productivity and environmental efficiency	Distance between labour productivity (output per employment) and CO_2 emissions intensity (CO_2 per unit of output) is reduced by half concerning, respectively: (1) EU27 average (2) Eastern EU average

We first consider labour productivity improvements that can lead to more output for each labour unit. Then, we consider the extent to which improved productivity is compensated by improved environmental efficiency.

KEY POINTS:

- *Scenarios about post-war reconstruction and recovery;*
- *Analysis based on the Ukraine Green Recovery Programme;*
- *Analysis based closing average labour productivity and environmental efficiency gaps with EU27 and East EU;*
- *Consideration of the impact of the investments (direct and indirect) as well as their consequences (structural change, productivity, environmental efficiency).*

SOCIOECONOMIC AND ENVIRONMENTAL CONSEQUENCES OF RECONSTRUCTION

The Ukrainian government's 2023 recovery needs (*Green Recovery Programme*) proposal implies a substantial change in the Ukrainian economy and massive infrastructural investments. The analysis here evaluates the environmental and socioeconomic (labour demand and gross value added generation) implications by considering the "investment push" to the economic structure.

We assume that the financing is implemented for each item of the recovery need. We allocate the expenditure/investment for each item to specific sectors in the EORA classification. The allocation of expenditures by item and sector is reported in the Appendix (see **Table D9** for the assumptions concerning the recovery financing). As the NICE tool is static, the evaluation considers the cumulative effects, rescaled by total figures corresponding to one year. These numbers should thus be interpreted with caution, as many of the plans will span over multiple years. It should also be noted that we consider the impact of the amount of money used for the investment, not its consequence in terms of economic recovery, structural change, improved productivity, etc. Finally, the basic assumption is that investments are used to purchase Ukrainian goods and services. The planned and desired investments for reconstruction are allocated to different sectors, as reported in the Appendix. The baseline assumption is that all investments use local production. This means that baseline results represent an upper bound. In a sensitivity analysis, a more realistic assumption is made about the share of sector-specific output needed for any investments sourced abroad.

Results are summarized in **Table 2.20**, **Figure 2.47** and **Figure 2.48**. **Figure 2.47** illustrates the alterations in individual variables, while **Figure 2.48** demonstrates the impact on the ratios. The plan would significantly influence employment, with effects nearly twice as pronounced as those on value added (VA), material use and CO_2 emissions. This is particularly noteworthy given the strong correlation between development and quality of employment.

TABLE 2.20: SIMULATED ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES OF RECONSTRUCTION INVESTMENTS

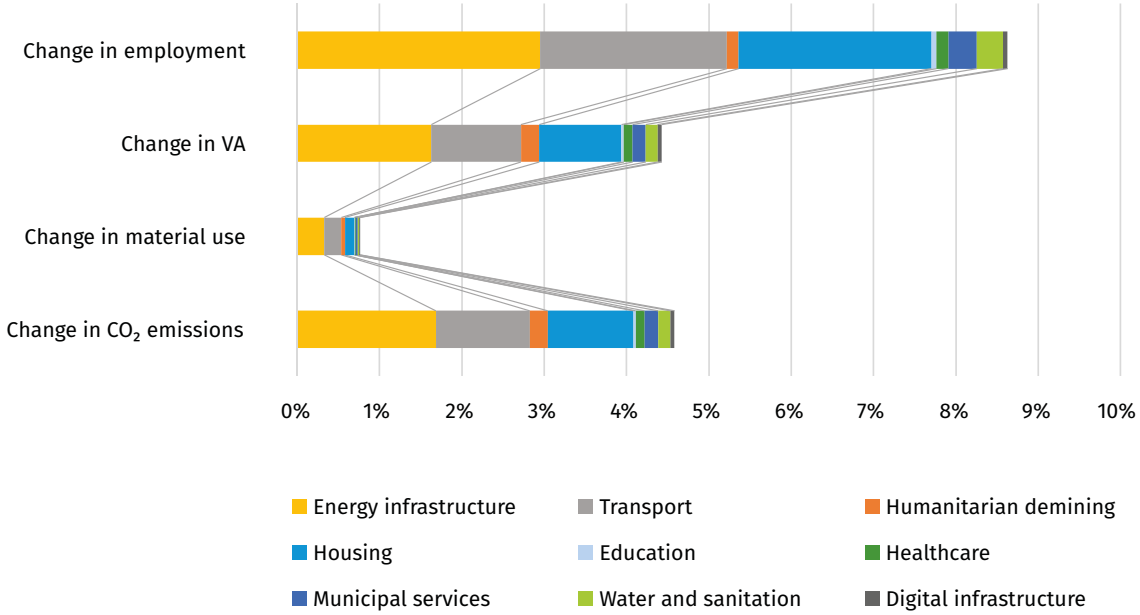
Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).

INVESTMENT	CHANGE IN CO_2 EMISSIONS	CHANGE IN VA	CHANGE IN EMPLOYMENT	CHANGE IN CO_2 /VA	CHANGE IN VA/L	CHANGE IN CO_2/L
Energy infrastructure	1.7%	1.7%	3.0%	0.1%	-1.4%	-1.3%
Transport	1.2%	1.1%	2.3%	0.1%	-1.2%	-1.1%
Humanitarian demining	0.2%	0.2%	0.1%	0.0%	0.1%	0.1%
Housing	1.1%	1.0%	2.4%	0.0%	-1.4%	-1.3%
Education	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Healthcare	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
Municipal services and cross-sectoral infrastructure	0.2%	0.2%	0.4%	0.0%	-0.2%	-0.2%
Water and sanitation	0.2%	0.1%	0.3%	0.0%	-0.2%	-0.2%
Digital infrastructure	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%
Total	**4.7%**	**4.5%**	**8.8%**	**0.2%**	**-4.3%**	**-4.1%**

Note: Results are based on simulation on the NICE tool. Total effects of investments are rescaled by one-year figures even if many plans span multiple years. VA = value added; L = labour, MU = material use.

FIGURE 2.47: SIMULATED ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES (LEVELS) OF RECONSTRUCTION INVESTMENTS

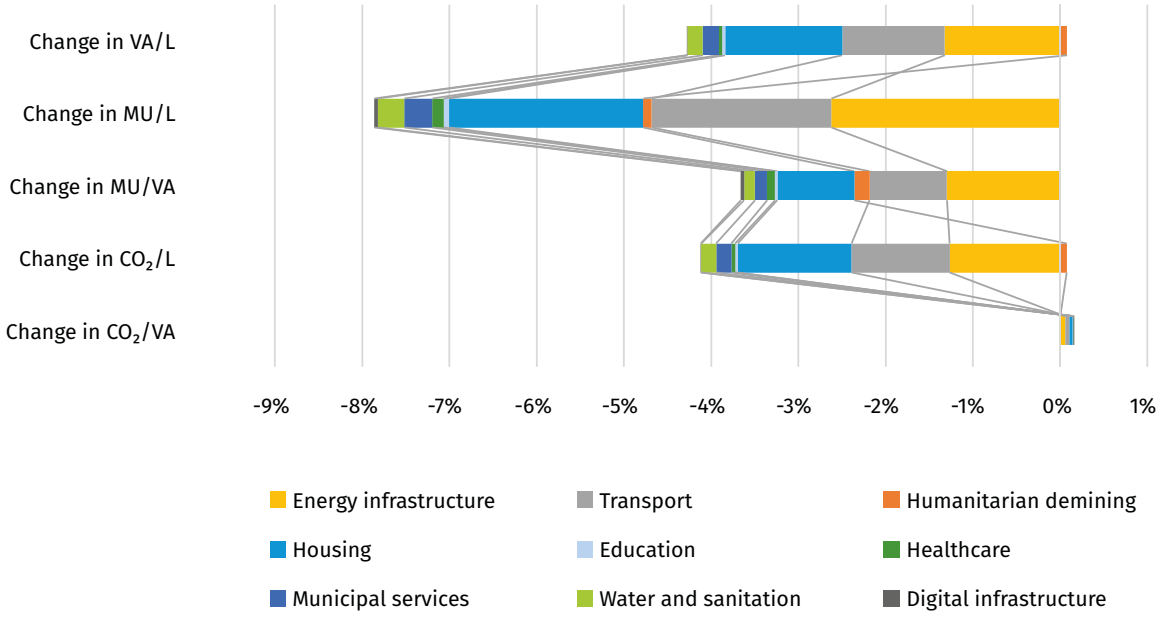
Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).



Note: VA = value added.

FIGURE 2.48: SIMULATED ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES (RATIOS) OF RECONSTRUCTION INVESTMENTS

Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).



Note: VA = value added; L = labour, MU = material use.

Indeed, the recovery plan is expected to substantially boost the Ukrainian economy, leading to a 4.5 percent increase in value added, a 4.7 percent increase in CO_2 emissions and as much as an 8.8 percent increase in employment. This will result in a stable carbon intensity of value added, while labour productivity and carbon intensity of employment are expected to decrease.[33] More than one-half of the boost in all variables arises from investments in reconstruction of the energy infrastructure and transport, followed by housing.

The programme's potential to create jobs would lead to a substantial decrease in the ratios of CO_2 per worker and value added per worker. However, there would be a slight increase in the ratio of CO_2 per value added.

KEY RESULTS

- *Investments foreseen within the Green Recovery Programme for Ukraine are expected to stimulate the economy substantially;*
- *Most of the impacts will be felt on projects related to the reconstruction, repair and renewal of the energy and transport infrastructures and for projects related to housing;*
- *The programme will, ceteris paribus, worsen labour productivity but improve environmental efficiency, as it will favour labour-intensive and environmentally efficient sectors;*
- *As investments are meant to improve the economic situation of the various sectors, the negative impact on aggregate labour productivity due to compositional change is expected to be partly or fully counterbalanced by increases in sector-level productivity;*
- *For the same reason, improvements in environmental efficiency are likely to be larger than the ones simulated in this section, as investments within the Green Recovery Programme are meant to improve sector-specific environmental performance.*

CLOSING PRODUCTIVITY AND EFFICIENCY GAPS WITH THE EU

The upgrading and renovation of Ukraine's economic system are expected to improve the economy's economic productivity (i.e. labour productivity) and environmental efficiency (i.e. CO_2 intensity of value added). Improved productivity increases the output that can be produced with a certain number of inputs (labour). Ceteris paribus, this leads to a proportional increase in the level of sectoral emissions if there is no improvement in environmental efficiency. Environmental efficiency improvements are added to productivity improvements to consider their overall impact on aggregate environmental performance.

Two scenarios are considered. First, we consider halving Ukraine's sector-specific productivity and environmental efficiency gap with the EU27 average. Second, we consider halving the country's sector-specific gap in productivity and environmental efficiency with the average of Eastern EU countries (Estonia, Latvia, Lithuania, Poland, Hungary, Slovakia, Czechia, Slovenia, Bulgaria and Romania). Where the Ukrainian economy's pre-war productivity and environmental efficiency were better than the benchmark, we consider no further improvement.

Results are summarized in **Table 2.21** Firstly, we evaluate output growth (and, consequently, VA and CO_2 emissions) driven by improved productivity for unchanged environmental efficiency. Secondly, we also account for likely improvements in environmental efficiency by assuming partial convergence with EU or Eastern EU levels.

TABLE2.21: SIMULATING IMPROVEMENTS IN LABOUR PRODUCTIVITY AND ENVIRONMENTAL EFFICIENCY

Source UNIDO elaboration, based on data from EORA26, International Labour Organization's *ILOStat* database and State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).

	OUTPUT	VA	CO_2 (SAME ENV EFF)	CO_2 (ALSO CLOSING HALF THE GAP IN TERMS OF ENV EFF)	CO_2 /VA (SAME ENV EFF)	CO_2 /VA (ALSO CLOSING HALF THE GAP IN TERMS OF ENV EFF)
1/2 gap w.r.t. EU27	171.3%	185.3%	184.4%	59.9%	-0.3%	-43.9%
1/2 gap w.r.t. Eastern EU countries	66.5%	74.0%	74.3%	50.8%	0.2%	-13.3%

Note: VA = value added.

Even partial convergence with EU or Eastern EU productivity can contribute to a substantial growth in Ukrainian gross value added: +185 percent for partial convergence to EU and +74 percent for partial convergence to Eastern EU. However, if the emissions intensity of the Ukrainian economy remained unchanged, emissions would increase by almost the same proportion.

However, assuming partial convergence also in terms of environmental efficiency would only partly compensate for the increase in the absolute level of emissions despite the substantial improvement in environmental efficiency. In terms of ratios, these figures imply nearly a 44 percent reduction in CO_2 emissions intensity of VA when closing half the gap in environmental efficiency with, respectively, EU27 and Eastern EU countries.

KEY RESULTS

- *Even a limited convergence to EU or Eastern EU productivity levels can significantly increase value added;*
- *The same degree of convergence with EU or Eastern EU standards is not enough to compensate for increased emissions, and further efforts are needed;*
- *Assuming partial convergence in improved productivity and environmental efficiency, results suggest a non-negligible reduction in CO_2 emissions intensity of VA (-44 percent and -13 percent compared to EU27 and Eastern European countries, respectively).*

2.5.5 CONCLUSIONS AND POLICY IMPLICATIONS

The study has examined the environmental and socioeconomic consequences of the war on Ukraine's economy and the potential outcomes derived from the Green Recovery Programme. The empirical results are based on the NICE tool, a static modeling tool based on an input-output model.

The impact of the war has been simulated, accounting for three components: 1) the interruption of production in areas that are or have been under the temporary military control of the Russian Federation; 2) the reconversion of the economy for military uses; 3) labour shortages due to conscription of male and outgoing refugees.

With respect to pre-war figures, the NICE tool suggests that the conflict led to a decline in both economic and environmental indicators: the net effect of the identified channels through which the conflict influenced the Ukrainian economy was substantially negative both in terms of economic variables (-21 percent gross value added, -29 percent employment) and environmental pressures (-18 percent material use, -20 percent CO_2 emissions). At the same time, the average CO_2 intensity and material intensity of the Ukrainian economy increased.

Most of the decline in economic variables and environmental pressures was driven by declining demand for intermediates from economic activities located in Ukrainian regions under the temporary military control of the Russian Federation, as well as the consequent disruption of the internal supply chain due to the temporary military occupation of Ukrainian regions, which was about 2-3 times as large as the negative contribution of employment gaps. The simulated positive impact of the reconversion of the Ukrainian economy only slightly compensated for the economic collapse.

The investments foreseen within the Green Recovery Programme for Ukraine are expected to stimulate the economy substantially. However, effects of the increased demand coming from the Ukraine Green Recovery Programme would only partially compensate for the collapse, as the programme is estimated to contribute to just a 4.5 percent increase in value added and an 8.8 percent increase in employment. Most of the impacts will be felt by projects related to the reconstruction, repair and renewal of the energy and transport infrastructures and for projects related to housing. At the same time, these relatively small impacts rely on the local availability of inputs, labour, capital, entrepreneurs, materials, energy, etc.). Bottlenecks and shortages would lead to even smaller positive impacts. The programme will, *ceteris paribus*, worsen labour productivity but improve environmental efficiency, as it will favour labour-intensive and environmentally efficient sectors.

As investments are meant to improve the economic situation of the various sectors, the negative impact on aggregate labour productivity due to compositional change is expected to be partly or fully counterbalanced by increases in sector-level productivity. For the same reason, improvements in environmental efficiency are likely to be larger than the ones simulated in this section, as investments within the Green Recovery Programme are meant to improve sector-specific environmental performance.

However, should the plan also contribute to improved productivity and environmental efficiency of the Ukrainian economy with respect to pre-war levels, this could reverse the picture. Indeed, even a limited convergence with EU (or Eastern EU) productivity levels can significantly increase value added. For example, if the plan would contribute to halving the gap in productivity and emission intensity with respect to the EU27 average, this would result in a more than doubling of GDP. However, this increase in economic outcome is likely associated with increased environmental pressure. The same degree of convergence with either EU or Eastern EU standards is not enough to compensate for increased emissions, and further efforts are needed. Thus, it is critical to reconstruct back 'better' using state-of-

the-art technologies. Assuming partial convergence in terms of improved productivity and environmental efficiency, results suggest a non-negligible reduction in the intensity of CO_2 emissions of VA.

Factoring in the ongoing conflict, it is projected that the recovery package, even with substantial efforts in selected sectors such as energy, construction and machinery (+30 percent growth) will only partially alleviate Ukraine's economic losses. A full recovery to pre-war levels is expected to be achievable only in the medium to long term. Recovery efforts are anticipated to have the most significant impact in sectors where resources are concentrated. Therefore, the strategic prioritization of sectors is of paramount importance.

As the recovery progresses, there is likely to be a resurgence in emissions. Thus, the reconstruction phase provides a valuable opportunity to steer production towards a more environmentally friendly path through investments in green infrastructure. It is worth noting that labour gains may surpass gains in value added, mainly when the recovery package targets labour-intensive sectors. Consequently, a dual approach is required to focus on enhancing productivity, aligning with the overarching goal of EU policy, which centres on achieving convergence with EU standards.

2.6 KEY FINDINGS AND IMPLICATIONS FOR INDUSTRIAL POLICY

This section summarizes the main findings in the preceding sections and explores their potential policy implications. Conclusions are based primarily on the data presented in **Table 2.22**, which compiles our findings related to ISIC Rev. 3 II-digit sectors across the various sections in this chapter. Industries are ranked by their prominence within the chapter. The following remarks will focus on these central industries.

(27) basic metals was a cornerstone of the Ukrainian economy before the war. Ukraine's international competitiveness in this sector was robust, with an RCA exceeding three from 2017 to 2021. The sector also holds significant potential for integration into European global value chains, as it exports key intermediates to Europe. Furthermore, it was the third-largest employment-generating manufacturing sector in the country.

However, the benefits of basic metals are offset by certain drawbacks. First, the sector is geographically concentrated, particularly in areas severely impacted by the war, which has led to a substantial decrease in production volume and a sharp decline in exports, reflected also in the country's RCA. Secondly, it is an energy-intensive sector with continuous operations, resulting in high CO_2 emissions per unit of value added.

Reestablishing production capacities during the war is crucial, primarily due to the sector's well-established capabilities and opportunities for market, employment and global value added (GVC) integration. While the sector's reconstruction is expected to be costly, it could ensure territorial equity. Moreover, reconstruction presents an opportunity for modernization and the potential adoption of greener production methods as contemplated in the Ukraine Facility part of the Ukraine Plan.

(15) food products and beverages shares some of the positive characteristics of the basic metals sectors, such as high international competitiveness, employment generation, and opportunities for integration within European value chains. Moreover, it also has unique advantages. First, it is not geographically concentrated, making it less susceptible to disruption and offering development opportunities across the territory. It also has strong linkages with agriculture, long a key sector in the Ukrainian economy, and is essential at all income per capita levels. Additionally, the sector has a high potential for import substitution.

However, the sector faces challenges. There is a stark contrast within the sector between large corporations capable of investing in modernization and meeting European standards and small producers who cannot. Furthermore, large producers in war-affected areas have relocated production to backline regions, causing geographical imbalances. The (16) tobacco products sector faces a similar situation. Ukraine has high competitiveness in this sector, but production was concentrated mainly in a multinational corporation plant in Kharkiv, which ceased production due to the war.

Regarding policy advice, the government must support investment in the modernization of the food industry to meet European standards. This includes supporting internationalization efforts such as assisting participation in international fairs and certifying international quality standards. It is also crucial for the government to help relocate plants moved to backline regions during the war and strengthen the value chain with agriculture.

Ukraine exhibits strong competitiveness in the (20) wood and products of wood and cork sector and shows ECA and untapped potential in the (36) manufacture of furniture; manufacturing n.e.c. sector. These sectors are in high demand in international markets, with the former offering significant potential for GVC integration and for playing a crucial role in reconstruction.

However, the war has severely impacted woodland areas, with forests being destroyed or contaminated with landmines. Consultations reveal that producers face challenges in supplying wood to global furniture retailers due to a lack of verification of the legality of Ukrainian wood.

Critical policies for developing the wood sector should include implementing and enforcing sustainable forest-management policies to combat uncontrolled deforestation. Collaboration with international organizations such as the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) could help restore the verification of the legality of wood origin in Ukraine. Additionally, investment should be focused on modernizing wood processing facilities.

Although Ukraine does not possess a robust RCA in (20) textiles, the country has steadily increased its international RCA. In turn, the (18) wearing apparel, dressing, and dyeing of fur, and (19) leather, leather products, and footwear sectors hold significant LUP. All three sectors are crucial in lower-middle-income economies, creating substantial employment opportunities. The textile industry in Ukraine is widely dispersed, which explains why the sector has experienced fewer production disruptions than other sectors. However, consultation Ukrainian stakeholders reveals that a large part of the sector participates in the informal economy.

Addressing informality is a primary area for improvement. One proposed solution is the establishment of industrial parks, concentrating high-tech production facilities and design centres that would be available for rent by small production cooperatives. This would enable the production of quality products conforming to European standards, fostering increased integration into GVCs.

(24) chemicals and chemical products has a significant opportunity for import substitution. Ukraine has responded to increased international demand by expanding its exports in this sector, aligning with global trade dynamics. Additionally, the sector is integrated into Europe's GVCs. Nevertheless, geographical concentration and the impact of the war, particularly on trade, have posed challenges.

In this context, harmonizing Ukrainian and EU regulations and establishing standardized practices are pivotal for optimizing export performance and deepening integration into GVCs. International institutions should be supportive in helping domestic producers align with production and trade legislation requirements. Furthermore, the Ukrainian government should consider providing grants to facilitate the restoration of production in frontline areas and assist in the sector's decentralization.

Turning our focus to the (29) machinery and equipment, n.e.c.; (34) motor vehicles, trailers, and semi-trailers; and (35) other transport equipment sectors: these are pivotal industries for economic development, demanding a high level of productive and technological capabilities. While Ukraine may not possess a firmly established CA, specific capabilities exist within these sectors. Unfortunately, these sectors have witnessed a decline in competitiveness due to insufficient investment in modernization. Nevertheless, they hold significant potential for import substitution, with notable LUP, particularly in the motor vehicles, trailers, and semi-trailers industry.

The machinery and equipment sector in particular is a significant employment generator. These three sectors are well integrated into European GVCs through the supply of capital goods. Moreover, these industries play a vital role in the war effort, manufacturing spare parts for military equipment, light armored vehicles, and drones. These newly developed capabilities may prove essential during the war, contributing to the country's recovery and development.

TABLE 2.22: SUMMARY OF BLOCK 2 FINDINGS ACROSS UKRAINE'S INDUSTRIES

Source: UNIDO elaboration. The table is created only for synthesis purposes and may not fully follow rigorous statistics criteria. The full text includes more details.

ISIC rev. 3	Sector Description	RCA>1	ECA	LUP	IMS	GDD	EG	GC [A]	Impact of war: Production [B]	Impact of war: Exports [C]	EU-UKR (GVC) [D]	CO_2 intensity	Policy [E]
15	Food products and beverages	X			X		X	Low	Low		Intermediates		
16	Tobacco products	X						High	High	High			
17	Textiles		X	X				Low					Priority
18	Wearing apparel, dressing, and dyeing of fur			X					Low	Low			
19	Leather, leather products and footwear			X						Low			
20	Wood and products of wood and cork	X				X			Low	Low	Intermediates		Priority (reconstruction)
22	Printing and publishing									High			
23	Coke, refined petroleum products and nuclear fuel			X	X			High	High				
24	Chemicals and chemical products				X	X		High			Intermediates		Priority
26	Other non-metallic mineral products						X		High			High	Priority (reconstruction)
27	Basic metals	X				X	X	High	High	High	Intermediates	High	Priority
28	Fabricated metal products, ex. machinery & equipment						X	High					Priority
29	Machinery and equipment. n.e.c.				X		X	Low	High	High	Capital		Priority (defence)
30	Office, accounting and computing machinery							Low			Capital		Priority
31	Electrical machinery and apparatus. n.e.c.					X		Low			Capital		Priority
32	Radio, television and communication equipment					X		Low					
34	Motor vehicles. trailers and semi-trailers			X	X			High	Low	Low	Intermediates		
35	Other transport equipment							High	Low	High	Capital		Priority (defence)
36	Manufacture of furniture; manufacturing n.e.c.		X	X				Low		Low			

Note: **ECA** = emerging comparative advantage; **EG** = employment generation; **EU-UKR** = European Union and Ukraine; **GC** = geographical concentration; **GDD** = global demand dynamics; **GVC** = global value chain; **IMS** = national imports levels; **LUP** = latent untapped potential; **n.e.c.** = not elsewhere classified; **RCA** = revealed comparative advantage. **A:** 'High' indicates less ubiquitous industries. 'Low' indicates ubiquitous industries. **B:** 'High' indicates the top five industries that experienced the highest decline in industrial production. 'Low' indicates the five industries that experienced the least decline in the index of industrial production (% change). **C:** 'High' indicates the top five industries with a decline in exports in 2022 relative to the 2019–2021 average. 'Low' indicates the top five industries with an increase or least decline in exports in 2022 relative to the 2019–2021 average (% change). **D:** 'Intermediate' indicates that the sector contains industries whose intermediate exports to the European Union grew by more than 20% and constituted a large share of total manufacturing intermediate exports (over 2% in the last 7 years). 'Capital' indicates that the sector contains industries whose capital goods exports to the EU fulfilled the previous conditions. **E:** Based on the 2022 National Recovery Plan, the Resolution of the Cabinet of Ministers of Ukraine "On Approval of the Procedure for the Formation and Maintenance of the State Register of Import Substitution and Cooperation in Strategic Industries" of 30 January 2019, No. 127. Legislation of Ukraine. URL: https://zakon.rada.gov.ua/laws/show/127-2019-%D0%BF#Text and the Ukraine Plan under the project the Ukraine Facility for the EU Financial Support of Ukraine in 2024–2027.

NOTES

[1] Please see **Table D1** for a synthesis version of the RCA across industrial sectors at ISIC Rev. 3 II digits level.
[2] As noted in Table 2.1, a sector with ***RCA>1*** is considered to have a highly developed and existing production and export capabilities.
[3] Please see **Table D2** for a description about the evolution of RCA across sectors at IV digits level.
[4] According to *WITS/UN Comtrade Database*, an average level of exports in Ukraine for the food sector over the period 2017-2021 was US$ 9,409,142 thousands, in 2022 it was US$ 10,057,756 (about + 7%). The wood sector had an average level of exports over the period 2017-2021 of US$ 1,329,501 thousands and a level of exports in 2022 equivalent to US$ 1,780,313 (about + 30%).
[5] The cutoff number of ***RCA > 2*** is set on a discretionary basis to facilitate synthetic and narrative purposes.
[6] See, for example: World Bank (2023). *Ukraine: Rapid Damage and Needs Assessment, February 2022 – February 2023*. New York. Available at https://documents1.worldbank.org/curated/en/099184503212328877/pdf/P1801740d1177f03c0ab180057556615497.pdf; Texty.org.ua (2023). *How many forests were damaged by the war and how quickly they can be restored*, 5 May. Available at https://texty.org.ua/fragments/109583/skilky-lisiv-postrazhdalo-vid-vijny-i-yak-shvydko-yih-mozhna-vidnovyty/.
[7] Please see **Table D3** for description about the evolution of RCA across sectors at IV digits level.
[8] Please see **Table D4** for a synthesis of the LUP findings results across industrial sectors.
[9] See: Ukraine's National Recovery Plan, available at: https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/ukraine_en.
[10] See: Order of the Cabinet of Ministers of Ukraine (2023). *On Approval of the List of Priority Sectors of the Economy*, legislation of Ukraine, 14 August, No. 843-p. Available at https://zakon.rada.gov.ua/laws/show/843-2013-%D1%80#n7; and Resolution of the Cabinet of Ministers of Ukraine (2023). On the Invalidation of Certain Acts of the Cabinet of Ministers of Ukraine, legislation of Ukraine 17 March, No. 242. Available at https://zakon.rada.gov.ua/laws/show/242-2023-%D0%BF#n50.
[11] As a robustness test, a world dynamism analysis is also conducted for the period 2017-2022. In this slightly different time-horizon, the most dynamic sectors are wood, coke, chemicals, basic metals, office accounting and computing.
[12] See **Table D5** and **Table D6** for a synthesis of the results across industrial sectors.
[13] A synthesis of the results across industrial sectors is contained in the **Table D7**.
[14] See Ukraine's National Recovery Plan, available at: https://www.urc-international.com/urc2022-recovery-plan.
[15] See European Commission, for details: https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/ukraine_en.
[16] See: https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/ukraine_en.
[17] This finding is confirmed by Lyvch and Shapovalenko (2022): "the majority of EU exports to Ukraine consist of higher complexity goods that are closer to or represent the final consumption stage of the value-added chain".
[18] UNIDO data is shown in Appendix B and Appendix C for the index of industrial production.
[19] According to World Bank (2023), backline regions are those protecting export/ import logistics hubs and evacuated enterprises.
[20] Some information also covers 2023, but the main focus of the study was 2022.

[21] Results concerning Figure 2.28 are produced by using the ISIC rev. 4 classification and data from the State Statistics Service of Ukraine. Results based on ISIC rev. 3 are included in Appendix B. For comparison, *UN Comtrade Database/WITS* data is shown in Appendix B.

[22] See the 2023 State Strategy of Regional Development 2021-2027.

[23] Results for Figure 2.31 are produced by using the ISIC rev. 4 classification and data from the Ukraine Statistics Office. Results based on ISIC rev. 3 are included in Appendix C. For comparison, UNIDO data is also shown in Appendix C.

[24] The overall index of industrial production for the manufacturing sector is 59% when considering the industrial production over the period January-December 2022 compared to the same period in 2021. However, more recent data indicates a 108% recovery of industrial production over the period January-September 2023.

[25] Initially, the growth rates for VA in 2019-2020 (g1) and 2020-2021 (g2) were computed. Subsequently, the average growth rate, denoted as g, is calculated using the formula: g = (g1 + g2) / 2. Following this, the VA for 2022 based on this average growth rate, expressed as: VA_2022 = VA_2021 + (g * VA_2021), was projected. Finally, the industry production (IP) loss in 2020 was utilized as a reference point to determine the VA loss in 2022, represented as VA-loss-2022 = VA_2022 * IP_loss.

[26] See the law here: https://zakon.rada.gov.ua/laws/show/1116-20#Text.

[27] In 2023, in the manufacturing sector the distribution of investments is similar, with 44% replacement, 21% extension, 20% rationalization and 15% other typologies of investment.

[28] In 2023, the updated data indicates a drop in the share of firms, flagging demand, financial resources, technical factors and other factors as drivers affecting investments in manufacturing (45%, 64%, 36% and 48%, respectively) as availability and cost of production inputs are becoming more important bottlenecks (See Block 3).

[29] In 2023, employment expectations are increasing.

[30] For the purpose of this report, the tool was updated to 2021 to accommodate changes in macro-economic aggregates (GDP, employment and CO_2 emissions), while information about the input-output structure has been considered at 2016 values.

[31] Sector-specific output of occupied regions has been estimated by combining aggregate (i.e. all manufacturing together) gross output statistics by region and further decomposing macro sectors (especially manufacturing) into subsectors using data on export by detailed product and by region.

[32] For an overview of the programme see: https://www.unido.org/green-recovery-vision-ukraine.

[33] It should be noted that predicted changes in relative measures (CO_2/VA, VA/L, CO_2/L) are due simply to changes in the composition of the Ukrainian economy because of the reconstruction.

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APPENDIX A: TRADE STATISTICS

The primary trade data for this section's analysis comes from the *UN Comtrade Database*. The original trade statistics are extracted at the six-digit Harmonized System Classification (HS). Using an appropriate concordance table, trade statistics at HS2 and HS3 were mapped directly to ISIC Rev. 3. For trade statistics at the HS4, HS5 and HS6 levels, we made a crosswalk to HS3 and then mapped to ISIC Rev. 3. All correspondence tables for building crosswalks and mappings are sourced from the WITS database (https://wits.worldbank.org) and the UN database (https://unstats.un.org/unsd/classifications/Econ). Mapping the six-digit HS to the II-digit or IV-digit ISIC typically assigns different HS products to an ISIC sector. Hence, there is a need to transform the data from product- to sector-level data. We sum across the ISIC sectors to achieve this and arrive at a sector-specific time-varying value.

REVEALED COMPARATIVE ADVANTAGE

An essential component of our analysis is revealed comparative advantage (RCA). The index measures the relative importance of a country's sector worldwide. Following Balassa (1965), the index for sector r in country i is computed as follows:

$$RCA_i = m_r / M_r \quad (1)$$

where m_r is the export share of sector r in the country i's total exports. M_r is the export share of sector r of total global exports. Depending on the level of analysis, r is either the II-digit or IV-digit ISIC Rev. 3 sector.

EMPLOYMENT PROJECTION

To compute the employment projection, we combined sector-level information on employment from the UNIDO *INDSTAT* database and country-level information on population and GDP per capita from the *World Development Indicators* database. We use this information in an econometric equation to predict employment. The equation that guides this exercise is given in Equation 1:

$$lnem_{rit} = \delta_0 + lnX_{it}\,\theta + \delta_i + \delta_t + \varepsilon_{it} \quad (2)$$

Where $lnem_{it}$ is the log of manufacturing employment relative to the population for sector r at period t in country i. Equation 1 is therefore estimated separately for all r individual sectors, and we retain subscript r to highlight this feature of our model. The explanatory variables in X contain the logs of real GDP per capita and are added in their linear, quadratic and cubic representation. Furthermore, δ_i and δ_t denote country and time effects. The analysis proceeds in three steps. First, we estimate each sector's employment using Equation 1. Second, we predict the employment. Third, we average the predicted employment across the periods and compare Ukraine's employment projection to the predicted employment of countries with an economic configuration similar to Ukraine's (i.e. LMI). For the latter, we use income group classification data from the World Bank to identify and map countries into different income groups.

APPENDIX B: EXPORTS LOSSES WITH ALTERNATIVE STATISTICS CLASSIFICATIONS AND DATASETS

Figure 2.28 employs data about losses in industrial production from the Ukraine Statistics Office and is thus expressed with an ISIC Rev. 4 classification. It is possible to transform ISIC Rev. 4 data into ISIC Rev. 3 by using the following concordance table (**Table B1**).

Only the ISIC Rev. 4 sector 26 "Computer, electronic and optical products" cannot be decomposed into ISIC Rev. 3 sectors and must remain unchanged. Further information on the concordance table is available at the UNIDO sourced User´s Guide Statistical Data Portal. Losses of exports in 2022 and an average 2019-2021 according to an ISIC Rev. 3 classification are then summarized (**Figure B1**). Sectors with the highest percentage losses are tobacco, machinery, printing, other transport equipment and basic metals.

A comparison of data from the Ukraine Statistics Office with data from the *UN Comtrade Database/WITS* data set (ISIC Rev. 4 classification) is summarized in **Figure B2**.

TABLE B1: ISIC REV. 3 AND REV. 4 CONCORDANCE TABLE

Source: UNIDO (2018).

ISIC REV. 3	ISIC REV. 4
15	10 + 11
16	12
17	13
18	14
19	15
20	16
21	17
22	18
23	19
24	20 + 21
25	22
26	23
27	24
28	25
30F (30+32+33)	26
31	27
29	28 + 33
34	29
35	30
36	31 + 32

FIGURE B1: EXPORT LOSSES, 2022 VS 2019-2021 AVERAGE, ISIC REV. 3

Source: State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).

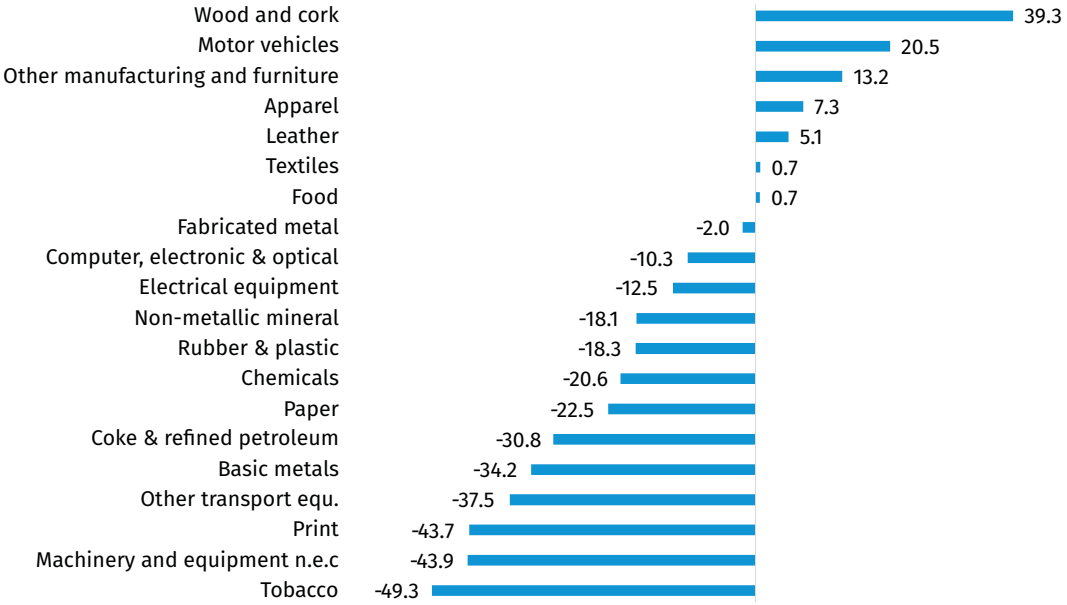


FIGURE B2: EXPORT LOSSES, 2022 VS 2019-2021 AVERAGE, ISIC REV. 4

Source: United Nations, *UN Comtrade Database* and World Bank, *WITS (World Integrated Trade Solutions)* database (accessed October 2023).

APPENDIX C: INDUSTRIAL PRODUCTION LOSSES WITH ALTERNATIVE STATISTICS CLASSIFICATIONS AND DATA SETS

Figure 2.31, employing data about losses in industrial production from the Ukraine Statistics Office, is expressed with an ISIC Rev. 4 classification. It is possible to transform ISIC Rev. 4 data into ISIC Rev. 3 using the following concordance table (**Table C1**).

Only the ISIC Rev. 4 sector 26 "Computer, electronic and optical products" cannot be decomposed into ISIC Rev. 3 sectors and must remain unchanged. Further information on the concordance table is available at the UNIDO sourced User´s Guide Statistical Data Portal.

Two indices of industrial production belonging to ISIC Rev. 4 sectors are aggregated into a single ISIC Rev. 3 index by using weights provided by the Ukraine Statistics Office that are used to calculate the Ukraine Industrial Production Index (https://ukrstat.gov.ua/).

Losses on the industrial production index in 2022 vs the 2019-2021 average, according to an ISIC Rev. 3 classification, are then summarized in **Figure C1**. Non-metallic mineral products, coke, basic metals, tobacco and machinery are sectors with the highest percentage losses.

It is possible to compare data from the Ukraine Statistics Office with that from the UNIDO data set https://stat.unido.org/database/Quarterly%20IIP (ISIC Rev. 4 classification), which can be summarized in **Figure C2**.

TABLE C1: ISIC REV. 3 AND REV. 4 CONCORDANCE TABLE

Source: UNIDO elaboration.

ISIC REV. 3	ISIC REV. 4
15	10 + 11
16	12
17	13
18	14
19	15
20	16
21	17
22	18
23	19
24	20 + 21
25	22
26	23
27	24
28	25
30F (30+32+33)	26
31	27
29	28 + 33
34	29
35	30
36	31 + 32

FIGURE C1: LOSSES ON THE INDEX OF INDUSTRIAL PRODUCTION, 2022 VS 2019-2021 AVERAGE, ISIC REV. 3

Source: State Statistics Service of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed October 2023).

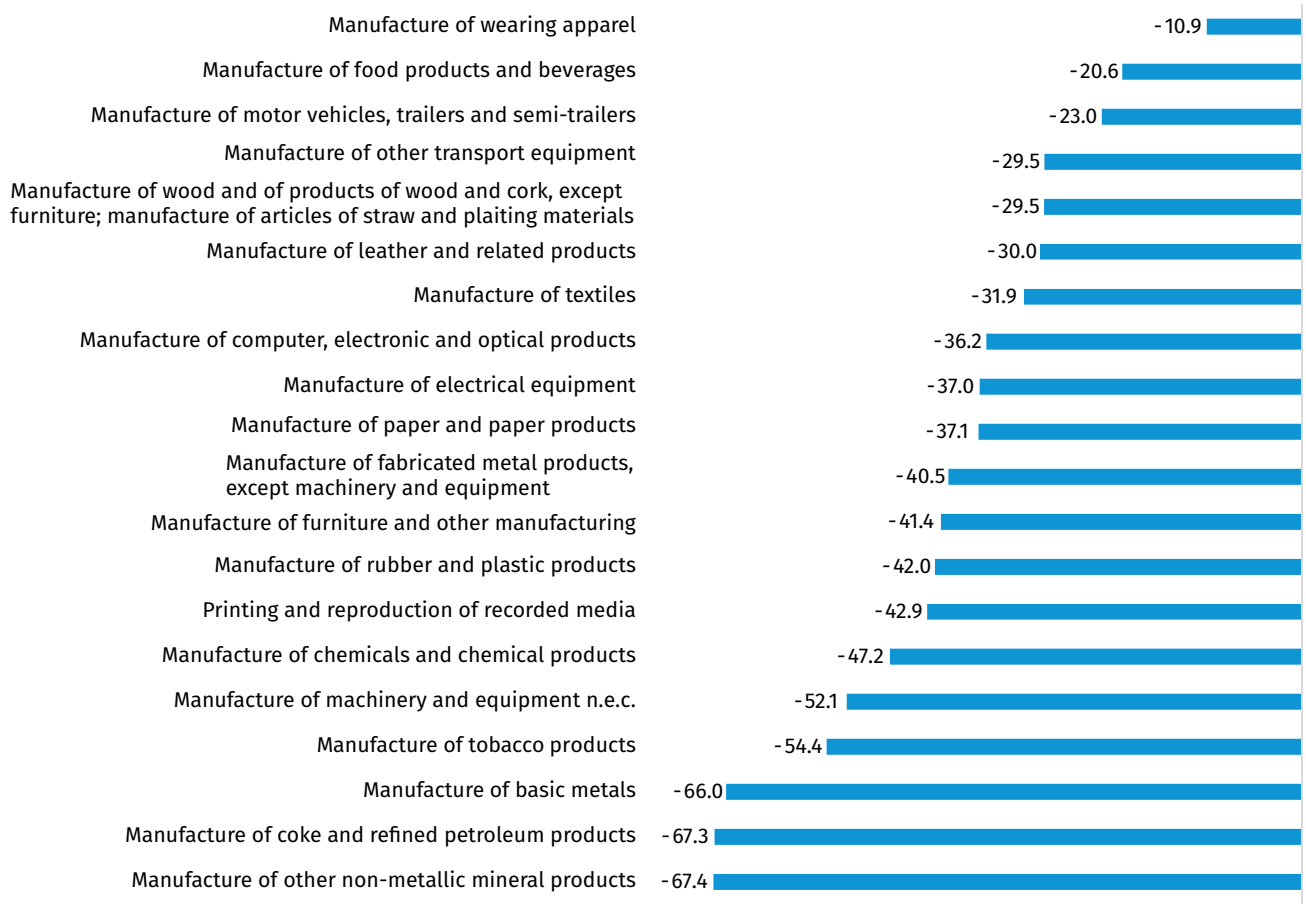
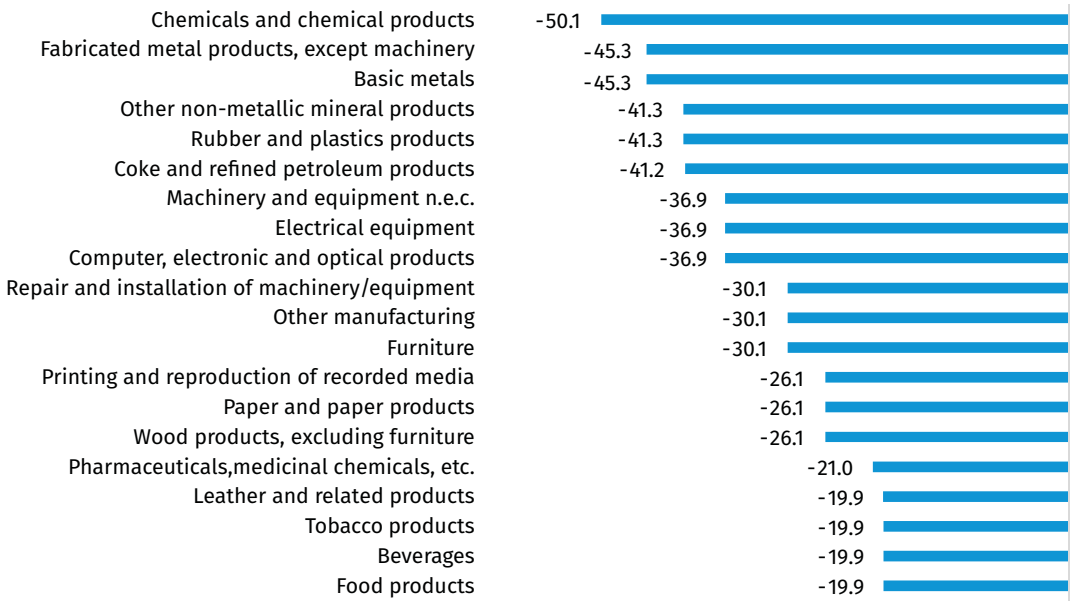


FIGURE C2: LOSSES ON THE INDEX OF INDUSTRIAL PRODUCTION, 2022 VS 2019-2021 AVERAGE, ISIC REV. 4

Source: UNIDO.



APPENDIX D: ADDITIONAL DATA TABLES

TABLE D1: REVEALED COMPARATIVE ADVANTAGE (RCA) IN UKRAINE (II-DIGIT ISIC LEVEL), 2017-2021 AND 2022-2023

Source : United Nations, *UN Comtrade Database* (accessed September 2023).

ISIC REV.3	ISIC DESCRIPTION	RCA		% CHANGE	RCA CLASSIFICATION
		2017-2021	2022-2023		
16	Tobacco products	5.610	2.09	-63%	Advantage
20	Wood and wood products	5.406	5.63	4%	Advantage
15	Food products and beverages	3.810	4.35	14%	Advantage
27	Basic metals	3.518	1.58	-55%	Advantage
21	Pulp, paper and paper products	0.884	0.54	-39%	Disadvantage
31	Electrical machinery and apparatus, n.e.c.	0.666	0.66	-1%	Disadvantage
26	Other non-metallic mineral products	0.622	0.60	-4%	Disadvantage
36	Manufacturing n.e.c.	0.549	0.77	41%	Disadvantage
29	Machinery and equipment, n.e.c.	0.494	0.40	-19%	Disadvantage
28	Fabricated metal, except machinery & equipment	0.475	0.50	6%	Disadvantage
35	Other transport equipment	0.471	0.26	-44%	Disadvantage
18	Wearing apparel, dressing and dyeing of fur	0.468	0.45	-4%	Disadvantage
24	Chemicals and chemical products	0.380	0.22	-41%	Disadvantage
19	Leather, leather products and footwear	0.360	0.32	-11%	Disadvantage
25	Rubber and plastics products	0.341	0.29	-15%	Disadvantage
22	Printing and publishing	0.288	0.16	-45%	Disadvantage
17	Textiles	0.274	0.36	30%	Disadvantage
23	Coke, refined petroleum products & nuclear fuel	0.178	0.07	-59%	Disadvantage
33	Medical, precision and optical instruments	0.105	0.07	-30%	Disadvantage
32	Radio, television and communication equipment	0.053	0.06	7%	Disadvantage
30	Office, accounting and computing machinery	0.051	0.07	40%	Disadvantage
34	Motor vehicles, trailers and semi-trailers	0.039	0.03	-15%	Disadvantage

TABLE D2: REVEALED COMPARATIVE ADVANTAGE (RCA) IN UKRAINE (IV-DIGIT ISIC LEVEL), 2017-2021, 2022, 2023, AND 2022-2023

Source : United Nations, *UN Comtrade Database* (accessed September 2023).

ISIC REV.3	ISIC DESCRIPTION	RCA			
		2017-2021	2022	2023	2022-2023
	PANEL A				
2310	Manufacture of coke oven products	20.06	29.34	40.80	35.07
1514	Manufacture of vegetable and animal oils and fats	18.53	25.00	24.70	24.85
2710	Manufacture of basic iron and steel	8.71	4.54	4.04	4.29
2010	Sawmilling and planing of wood	8.54	5.35	4.57	4.96
2022	Manufacture of builders' carpentry and joinery	6.55	13.22	6.59	9.90
1600	Manufacture of tobacco products	5.61	3.27	0.90	2.09
2923	Manufacture of machinery for metallurgy	4.05	0.99	0.09	0.54
2021	Manufacture of veneer sheets	3.90	6.17	6.32	6.24
1542	Manufacture of sugar	3.50	2.34	6.43	4.38
1541	Manufacture of bakery products	3.34	3.38	3.56	3.47
2023	Manufacture of wooden containers	3.28	1.87	1.69	1.78
2109	Manufacture of other articles of paper and paperboard	2.97	1.45	1.64	1.54
1543	Manufacture of cocoa, chocolate and sugar confectionery	2.50	2.40	2.40	2.40
2029	Manufacture of other products of wood	2.42	3.05	4.94	4.00
3520	Manufacture of railway and tramway locomotives and rolling stock	1.84	0.22	0.26	0.24
1911	Tanning and dressing of leather	1.71	1.50	1.70	1.60
2412	Manufacture of fertilizers and nitrogen compounds	1.71	0.90	0.19	0.54
1511	Production, processing and preserving of meat and meat products	1.64	2.33	1.93	2.13
1544	Manufacture of noodles, couscous and similar farinaceous products	1.60	1.43	1.83	1.63
1553	Manufacture of malt liquors and malt	1.57	0.81	1.09	0.95
1513	Processing and preserving of fruit and vegetables	1.45	2.29	1.50	1.89
2813	Manufacture of steam generators, except central heating water boilers	1.38	0.17	0.09	0.13
2930	Manufacture of domestic appliances n.e.c.	1.38	1.71	2.22	1.96
1532	Manufacture of starches and starch products	1.36	2.66	2.94	2.80
1554	Manufacture of soft drinks	1.36	0.95	1.41	1.18
2699	Manufacture of other non-metallic mineral products n.e.c.	1.32	1.10	1.01	1.06
2212	Publishing of newspapers, journals and periodicals	1.32	0.21	0.04	0.12
2696	Cutting, shaping and finishing of stone	1.26	0.83	0.52	0.67
3610	Manufacture of furniture	1.25	2.11	2.33	2.22
1520	Manufacture of dairy products	1.22	1.46	0.97	1.21
3190	Manufacture of other electrical equipment n.e.c.	1.09	1.18	1.11	1.15

ISIC REV.3	ISIC DESCRIPTION	RCA			
		2017-2021	2022	2023	2022-2023
	PANEL B				
1551	Distilling, rectifying and blending of spirits	0.91	1.07	1.55	1.31
1721	Manufacture of made-up textile articles, except apparel	0.88	0.92	1.62	1.27
2694	Manufacture of cement, lime and plaster	0.81	2.70	2.34	2.52
3693	Manufacture of sports goods	0.74	0.65	2.28	1.47
3150	Manufacture of electric lamps and lighting equipment	0.21	1.30	1.25	1.28
3512	Building and repairing of pleasure and sporting boats	0.05	36.17	0.04	18.11

TABLE D3: EVOLUTION OF RCA ACROSS IV-DIGIT SECTORS WITH AVERAGE 0.3<RCA<1, 2017 – 2023

Source : United Nations, *UN Comtrade Database* (accessed September 2023).

ISIC REV.3	ISIC DESCRIPTION	2017	2018	2019	2020	2021	2022	2023	AVERAGE (2017-2021)
1551	Distilling, rectifying and blending of spirits	1.00	1.01	0.92	0.82	0.81	1.07	1.555	0.9
1721	Manufacture of made-up textile articles, except apparel	0.91	1.04	1.01	0.59	0.86	0.92	1.615	0.9
3693	Manufacture of sports goods	0.91	1.01	0.95	0.55	0.26	0.65	2.281	0.7
2812	Manufacture of tanks, reservoirs and containers of metal	0.77	0.84	0.71	0.80	1.00	0.90	0.675	0.8
2921	Manufacture of agricultural and forestry machinery	1.28	1.09	0.86	0.49	0.53	0.49	0.399	0.8
2692	Manufacture of refractory ceramic products	1.15	0.74	0.98	0.85	0.84	0.26	0.156	0.9
2221	Printing	0.95	0.90	0.78	0.77	0.58	0.41	0.326	0.8
2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	0.79	0.67	0.87	0.78	0.55	0.54	0.517	0.7
2913	Manufacture of bearings, gears, gearing and driving elements	0.84	0.79	0.64	0.62	0.59	0.50	0.487	0.7
2811	Manufacture of structural metal products	0.56	0.59	0.58	0.52	0.52	0.53	0.627	0.6
1549	Manufacture of other food products n.e.c.	0.55	0.61	0.54	0.54	0.47	0.52	0.635	0.5
2899	Manufacture of other fabricated metal products n.e.c.	0.55	0.56	0.52	0.49	0.52	0.51	0.571	0.5
2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds	0.56	0.69	0.64	0.53	0.55	0.36	0.326	0.6
1810	Manufacture of wearing apparel, except fur apparel	0.52	0.55	0.49	0.45	0.37	0.52	0.383	0.5
3530	Manufacture of aircraft and spacecraft	0.48	0.39	0.30	0.54	0.57	0.45	0.326	0.5
2914	Manufacture of ovens, furnaces and furnace burners	0.41	0.51	0.40	0.64	0.53	0.36	0.142	0.5
2925	Manufacture of machinery for food, beverage and tobacco processing	0.49	0.48	0.40	0.51	0.47	0.31	0.3	0.5
3511	Building and repairing of ships	0.60	0.85	0.45	0.47	0.39	0.10	0.024	0.6
2924	Manufacture of machinery for mining, quarrying and construction	0.41	0.45	0.49	0.57	0.43	0.29	0.25	0.5
2691	Manufacture of non-structural non-refractory ceramic ware	0.50	0.47	0.39	0.34	0.35	0.27	0.568	0.4
2520	Manufacture of plastics products	0.40	0.42	0.39	0.38	0.38	0.34	0.374	0.4
2101	Manufacture of pulp, paper and paperboard	0.49	0.50	0.38	0.37	0.43	0.24	0.248	0.4
2912	Manufacture of pumps, compressors, taps and valves	0.48	0.47	0.41	0.43	0.41	0.24	0.214	0.4
3140	Manufacture of accumulators, primary cells and primary batteries	0.70	0.69	0.55	0.22	0.19	0.09	0.136	0.5
2219	Other publishing	0.38	0.30	0.62	0.32	0.34	0.29	0.296	0.4

ISIC REV.3	ISIC DESCRIPTION	2017	2018	2019	2020	2021	2022	2023	AVERAGE (2017-2021)
2424	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparation	0.48	0.47	0.34	0.30	0.29	0.31	0.263	0.4
2720	Manufacture of basic precious and non-ferrous metals	0.51	0.52	0.43	0.33	0.37	0.18	0.092	0.4
1552	Manufacture of wines	0.56	0.53	0.33	0.27	0.31	0.17	0.188	0.4
2695	Manufacture of articles of concrete, cement and plaster	0.34	0.40	0.34	0.33	0.24	0.25	0.457	0.3
2915	Manufacture of lifting and handling equipment	0.37	0.37	0.35	0.34	0.36	0.26	0.192	0.4
3120	Manufacture of electricity distribution and control apparatus	0.34	0.34	0.34	0.34	0.30	0.30	0.27	0.3
2211	Publishing of books, brochures, musical books and other publications	0.45	0.46	0.37	0.19	0.29	0.19	0.212	0.4
1920	Manufacture of footwear	0.37	0.37	0.30	0.27	0.24	0.28	0.27	0.3
2430	Manufacture of man-made fibres	0.32	0.36	0.42	0.32	0.31	0.21	0.153	0.3
2610	Manufacture of glass and glass products	0.31	0.35	0.31	0.34	0.32	0.25	0.193	0.3
3313	Manufacture of industrial process control equipment	0.47	0.33	0.45	0.23	0.21	0.17	0.093	0.3
2919	Manufacture of other general purpose machinery	0.27	0.33	0.28	0.34	0.28	0.21	0.208	0.3
2413	Manufacture of plastics in primary forms and of synthetic rubber	0.23	0.36	0.38	0.28	0.39	0.18	0.022	0.3
3110	Manufacture of electric motors, generators and transformers	0.34	0.32	0.27	0.21	0.18	0.17	0.287	0.3
1512	Processing and preserving of fish and fish products	0.32	0.34	0.37	0.14	0.16	0.21	0.121	0.3

TABLE D4: LATENT UNTAPPED POTENTIAL (LUP), 2012-2021

Source: UNIDO, *INDSTAT* database (accessed September 2023).

ISIC REV.3	ISIC DESCRIPTION	UKRAINE VALUE ADDED PER CAPITA GROWTH	UKRAINE VALUE ADDED PER CAPITA	LMI VALUE ADDED PER CAPITA	LUP CLASSIFICATION
17	Textiles	45.8	3.1	18	Identified
18	Wearing apparel. fur	15.7	5.6	16.3	Identified
19	Leather, leather products and footwear	2.5	3	6.4	Identified
23	Coke, refined petroleum products, nuclear fuel	3.3	9.1	14.4	Identified
34	Motor vehicles, trailers, semi-trailers	60.9	10.4	12.1	Identified
15	Food and beverages	-18.2	131.2	76.8	Unidentified
16	Tobacco products	-21.5	7.5	5.9	Unidentified
20	Wood products (excl. furniture)	57.4	9.6	8.6	Unidentified
21	Paper and paper products	-18.3	10.5	5.8	Unidentified
22	Printing and publishing	-18.5	5.1	3.5	Unidentified
24	Chemicals and chemical products	25.7	38.1	24	Unidentified
25	Rubber and plastics products	-7.3	14.4	10.8	Unidentified
26	Non-metallic mineral products	33.9	29.9	21.7	Unidentified
27	Basic metals	-3.1	68.3	23	Unidentified
28	Fabricated metal products	0.9	19.3	9.3	Unidentified
29	Machinery and equipment n.e.c.	-17	45.9	7.8	Unidentified
30	Office, accounting and computing machinery	-28	9	18.8	Unidentified
31	Electrical machinery and apparatus	-53	14.3	10.3	Unidentified
32	Radio, television and communication equipment	N/A	N/A	1	Unidentified
33	Medical, precision and optical instruments	N/A	N/A	2.5	Unidentified
35	Other transport equipment	-70.6	28.2	7.6	Unidentified
36	Furniture; manufacturing n.e.c.	13.8	9.1	9.5	Unidentified

Note: LMI = lower-middle income.

TABLE D5: UKRAINE'S EMPLOYMENT GENERATION, II-DIGIT ISIC REV. 3, 1992-2021 (NORMALIZED VALUES)

Source: UNIDO, *INDSTAT* database (accessed September 2023).

ISIC REV.3	ISIC DESCRIPTION	UKRAINE	LMI
15	Food and beverages	0.201	0.191
29	Machinery and equipment n.e.c.	0.048	0.137
27	Basic metals	0.039	0.111
26	Non-metallic mineral products	0.065	0.073
28	Fabricated metal products	0.042	0.061
24	Chemicals and chemical products	0.044	0.058
34	Motor vehicles, trailers, & semi-trailers	0.032	0.046
18	Wearing apparel	0.153	0.044
35	Other transport equipment	0.016	0.044
31	Electrical machinery and apparatus	0.036	0.043
36	Furniture; manufacturing n.e.c.	0.043	0.034
17	Textiles	0.087	0.025
25	Rubber and plastics products	0.032	0.023
20	Wood products (excl. furniture)	0.028	0.021
33	Medical, precision and optical instruments	0.008	0.021
22	Printing and publishing	0.018	0.018
23	Coke, refined petroleum products.nuclear fuel	0.008	0.018
21	Paper and paper products	0.017	0.011
19	Leather	0.044	0.008
30	Office, accounting and computing machinery	0.023	0.006
32	Radio, television and communication equipment	0.007	0.006
16	Tobacco products	0.011	0.002

Note: LMI = lower-middle income. Employment generation for Ukraine is defined as the ratio of sector employment to total population (×100). Employment generation for LMI is based on predicted employment generation using equation 1 as specified in the appendix.

TABLE D6: UKRAINE'S EMPLOYMENT GENERATION, IV-DIGIT ISIC REV. 3, 1992-2021

Source: UNIDO, *INDSTAT* database (accessed September 2023).

ISIC REV.3	ISIC DESCRIPTION	UKRAINE	LMI
2710	Basic iron and steel	0.65	0.07
1541	Bakery products	0.22	0.08
1810	Wearing apparel, except fur apparel	0.21	0.28
1520	Dairy products	0.17	0.04
3520	Railway/tramway locomotives & rolling stock	0.16	0.02
3530	Aircraft and spacecraft	0.15	0.02
2921	Agricultural and forestry machinery	0.13	0.03
1511	Processing/preserving of meat	0.13	0.04
2695	Articles of concrete, cement and plaster	0.11	0.04
3610	Furniture	0.1	0.06
2924	Machinery for mining & construction	0.1	0.02
2520	Plastic products	0.09	0.03
1542	Sugar	0.09	0.04
2912	Pumps, compressors, taps and valves	0.09	0.02
2922	Machine tools	0.08	0.02
2412	Fertilizers and nitrogen compounds	0.08	0.01
2221	Printing	0.08	0.03
2411	Basic chemicals, except fertilizers	0.08	0.02
3410	Motor vehicles	0.08	0.02
1543	Cocoa, chocolate and sugar confectionery	0.07	0.02
3511	Building and repairing of ships	0.07	0.02
3110	Electric motors, generators and transformers	0.07	0.03
3120	Electricity distribution & control apparatus	0.07	0.01
3312	Measuring/testing/navigating appliances, etc.	0.07	0.01
2923	Machinery for metallurgy	0.07	0.01
2811	Structural metal products	0.07	0.03
1531	Grain mill products	0.06	0.03
2693	Struct. non-refractory clay; ceramic products	0.06	0.03
2899	Other fabricated metal products n.e.c.	0.06	0.02
2310	Coke oven products	0.06	0.01
2911	Engines & turbines (not for transport equipment)	0.06	0.01
2929	Other special purpose machinery	0.06	0.02
1551	Distilling, rectifying & blending of spirits	0.05	0.02
3190	Other electrical equipment n.e.c.	0.05	0.02
2610	Glass and glass products	0.05	0.04
2212	Publishing of newspapers, journals, etc.	0.05	0.01
2919	Other general purpose machinery	0.05	0.01

ISIC REV.3	ISIC DESCRIPTION	UKRAINE	LMI
1513	Processing/preserving of fruit & vegetables	0.05	0.05
2010	Sawmilling and planing of wood	0.05	0.03
2720	Basic precious and non-ferrous metals	0.05	0.03
2320	Refined petroleum products	0.05	0.01
2915	Lifting and handling equipment	0.05	0.01
2429	Other chemical products n.e.c.	0.05	0.01
1920	Footwear	0.05	0.05
2423	Pharmaceuticals, medicinal chemicals, etc.	0.04	0.02
1711	Textile fibre preparation; textile weaving	0.04	0.06
1514	Vegetable and animal oils and fats	0.04	0.02
2022	Builders' carpentry and joinery	0.04	0.01
1554	Soft drinks; mineral waters	0.04	0.02
2694	Cement, lime and plaster	0.04	0.02

Note: LMI = lower-middle income. Employment generation for Ukraine is defined as the ratio of sector employment to the total population (×100). Employment generation for LMI is based on predicted employment generation using equation 1 as specified in the appendix.

TABLE D7: REGIONS WITH THE HIGHEST RCA, 2017-2021 VS 2022, BY SECTOR

Source: Ukraine Statistics Agency (accessed September 2023).

ISIC DESCRIPTION		RCA (2017-2021)	RCA (2022)	PATTERN
(15-16) Manufacture food and beverages, and tobacco	Kirovograd region	2.9	2.5	Decreased
	Vinnytsia region	2.8	1.8	Decreased
	Zakarpathian region	6.5	5.2	Decreased
(17) Manufacture of textiles and textile products	Chernivtsi region	8.9	4.7	Decreased
	Luhansk region	5.5	0.0	Decreased
	Lviv region	5.5	4.4	Decreased
	Zakarpathian region	5.5	3.4	Decreased
	Zhytomyr region	5.7	5.7	Unchanged
(18) Manufacture of wearing apparel	Chernihiv region	11.2	9.1	Decreased
	Sumy region	7.7	5.9	Decreased
	Zakarpathian region	7.7	5.8	Decreased
	Zhytomyr region	2.0	1.1	Decreased
(19) Tanning and dressing leather	Lviv region	8.7	4.8	Decreased
	Zakarpathian region	5.3	2.9	Decreased
	Zhytomyr region	4.7	6.0	Increased
(20) Manufacture of wood and products of wood	Chernivtsi region	15.2	11.7	Decreased
	Rivne region	23.4	17.3	Decreased
	Zhytomyr region	12.0	N/A	Decreased
(21) Manufacture of paper and paper products	Chernihiv region	7.3	4.6	Decreased
	Kyiv region	5.5	4.0	Decreased
	Luhansk region	35.6	0.0	Decreased
(23) Manufacture of coke, refined petroleums and nuclear fuel	Ivano-Frankivsk region	2.3	0.9	Decreased
	Lviv region	5.5	5.1	Decreased
	Poltava region	2.1	0.3	Decreased
(24) Manufacture of chemicals and chemical products	Ivano-Frankivsk region	4.5	3.8	Decreased
	Luhansk region	5.4	0.6	Decreased
	Mykolaiv region	5.7	2.7	Decreased
(25) Manufacture of rubber and plastic products	Ivano-Frankivsk region	16.0	14.9	Decreased
	Kyiv region	3.2	2.0	Decreased
	Sumy region	4.1	5.9	Increased
(26) Manufacture of other non-metallic mineral products	Kharkiv region	4.8	4.5	Decreased
	Kyiv region	4.3	3.0	Decreased
	Zhytomyr region	13.2	N/A	Decreased
(27-28) Manufacture of basic metals and fabricated metal products	Dnipropetrovsk region	2.0	3.3	Increased
	Donetsk region	3.7	0.3	Decreased
	Zaporizhzhya region	2.6	5.4	Increased

ISIC DESCRIPTION		RCA (2017-2021)	RCA (2022)	PATTERN
(29-32) Machinery (except transport)	Ternopil region	4.6	2.7	Decreased
	Volyn region	5.4	3.2	Decreased
	Zakarpathian region	7.3	6.0	Decreased
(33) Manufacture of medical, precision and optical instruments, watches and clocks	Kharkiv region	8.2	6.6	Decreased
	Luhansk region	10.2	0.0	Decreased
	Zakarpathian region	2.3	4.0	Increased
(34-35) Manufacture of motor vehicles, trailers and semi-trailers, of other transport equipment	Kharkiv region	2.9	3.5	Increased
	Kherson region	6.3	0.7	Decreased
	Odesa region	3.9	16	Increased
(36) Manufacture of furniture; manufacturing n.e.c.	Chernivtsi region	6.3	2.7	Decreased
	Lviv region	6.7	4.9	Decreased
	Rivne region	8.0	3.0	Decreased
	Volyn region	6.3	5.0	Decreased

TABLE D8: LIST OF MEASURES

Source: State Statistics Services of Ukraine, statistical Information, https://ukrstat.gov.ua (accessed September 2023).

1	Assessment of industrial production over the past 3 months
2	Assessment of orders (demand) on the industrial production over the past 3 months
3	Assessment of current order-books (demand) on the industrial production
4	Assessment of current export order-books (export demand) on the industrial production
6	Assessment of current stock of finished products in industry
7	Expected changes of industrial production over the next 3 months
9	Expected changes in selling prices for the products of industry over the next 3 months
10	Expected changes in employment at industrial enterprises over the next 3 months
11	Expected changes in export order-books (export demand) on the industrial production over the next 3 months
13	Assessment of production capacity of industrial enterprises, considering current order books and expected change in demand over the next 3 months
15	Assessment of competitive position industrial enterprises on domestic market over the past 3 months
16	Assessment of competitive position industrial enterprises on the foreign markets inside the EU over the past 3 months
17	Assessment of competitive position industrial enterprises on foreign markets outside the EU over the past 3 months

TABLE D9: SECTOR ALLOCATION OF INVESTMENTS UNDER THE UKRAINE PRIORITY RECOVERY NEEDS FOR 2023, PRESENTED IN AUGUST 2023 BY THE MINISTRY FOR RESTORATION

Source: UNIDO elaboration on data from *Ukraine Priority Recovery Needs for 2023*, Ukrainian Ministry for Restoration.

INVESTMENT	VALUE (US$)	SECTOR(S)	% ALLOCATED TO SECTOR(S)
Energy infrastructure	**4,200,000,000**		
- Reconstruction of substations and other high-voltage equipment	593,500,000	9, 15, 14, 21	40, 20, 20, 20
- Construction of interconnectors jointly with Slovakia and Romania	90,000,000	9, 14, 21	40, 30, 30
- Installation of static synchronous compensators	40,000,000	9, 15, 14, 21	40, 20, 20, 20
- Restoration/repair of thermal generation	177,000,000	15, 9, 14, 21	40, 20, 20, 20
- Restoration/repair of distribution systems	210,000,000	15, 9, 14, 21	40, 20, 20, 20
- Installation of gas turbines	275,000,000	9, 14, 21	40, 30, 30
- Regional heating projects	9,500,000	9, 14, 21	40, 30, 30
- Restoration of boiler houses, networks, ...	6,000,000	15, 9	60, 40
- Protection and reconstruction of 22 energy infrastructure facilities and protection of 150 energy infrastructure facilities	1,062,000,000	14, 9, 15, 21	40, 20, 20, 20
- Purchase of 2 billion cubic metres of gas and imports of up to 1GW of electricity from the EU	1,200,000,000	-	-
Transport	**4,300,000,000**		
- Restoration of destroyed and emergency road bridges	425,000,000	15, 21	80, 20
- Reconstruction of 14 railway traction substations	31,300,000	15, 21, 8	70, 15, 15
- 330 railway bridges	81,700,000	15, 21	80, 20
- Development and maintenance of roads and railway transport	651,000,000	15, 21	80, 20
- Procurement of modular bridges, equipment and materials for emergency repair	50,000,000	8, 15, 21	70, 15, 15
- Procurement of rails, fasteners, fuel, electricity...	220,000,000	-	-
Humanitarian demining	**500,000,000**		
- Provision of equipment for demining	350,800,000	9	100
- Funding of NGO and mine action operators	54,500,000	23	100
- Education and capacity development	50,000,000	23	100
Housing	**1,900,000,000**		
- Restoration of multiapartment buildings	106,500,000	14, 15, 21	70, 15, 15
- Humanitarian response to housing	165,300,000	14, 15, 21	70, 15, 15
- Restoration and modernization of damaged buildings	26,400,000	14, 9, 15, 21	40, 20, 20, 20
- Restoration of housing destroyed by the Kakhovka dam	36,200,000	14, 15, 21	70, 15, 15
- Capital repairs of apartments in Kyiv	17,500,000	14, 15, 21	70, 15, 15
- Purchase of special equipment for dismantling in Kyiv	8,000,000	10	100
- Pilot for processing construction waste	42,300,000	14, 9, 12	60, 30, 10
- Arrangement of housing for IDPs by repairing residential facilities	88,700,000	14, 15, 21	70, 15, 15
- Reimbursement of costs for homeowners for temporary accommodation if 500k IDPs	112,000,000	-	-
- Acquisition of housing for IDPs	46,750,000	-	-
- Acquisition of accommodation for IDPs ...	900,000	-	-
- Subsidy to local budgets for housing purchase for IDPs (military)	89,300,000	-	-

INVESTMENT	VALUE (US$)	SECTOR(S)	% ALLOCATED TO SECTOR(S)
- Provision of temporary housing (modular buildings)	6,800,000	14	100
- Housing emergency recovery support	800,000,000	14, 15, 21	70, 15, 15
- Capital repair of 330 multi-apartment buildings	396,000,000	14, 15, 21	70, 15, 15
- Providing 9,200 certificates to citizens whose homes were destroyed	480,200,000	-	-
- Purchase of special equipment for dismantling, removal and processing of construction waste	149,700,000	10	100
Education	**121,000,000**		
- Bomb shelters in schools and school bus acquisition	68,000,000	10, 14	50, 50
- Renewal of the provision of educational services in the affected communities	39,000,000	23	100
- Establishment of safe digital learning centers and teacher training and education materials	14,000,000	23	100
Healthcare	**216,000,000**		
- Advanced medical equipment and recovery/modernization of other healthcare facilities	100,000,000	9, 14	70, 30
- Creation of mobile brigades and equipping and reconstruction of primary care centers	14,000,000	14, 15, 21	70, 15, 15
- Procurement and installation of advanced medical equipment in hospitals	32,000,000	9	100
- Restoration of 27 hospital facilities	38,000,000	14, 15, 21	70, 15, 15
- Medical equipment, specialized sanitary transport, generators and recovery and modernization of ...		9, 10, 14, 15, 21	30, 20, 20, 20, 10
- KNP of the Izyum City Council Central City Hospital of ...	32,000,000	-	-
Municipal services and cross-sectoral infrastructure	**290,000,000**		
- Restoration of schools, kindergartens, hospitals, administrative buildings	178,000,000	14, 15, 21	70, 15, 15
- Ukraine public buildings energy efficiency	19,000,000	14, 15, 21	70, 15, 15
- Reconstruction/modernization of communal infrastructure facilities	9,000,000	14, 15, 21	70, 15, 15
- Procurement of equipment for the utility sector at the level of local self-government bodies	40,000,000	9	100
- Energy efficiency of public buildings and solid household waste	32,800,000	14, 15, 21	70, 15, 15
- Energy efficiency in communities	2,800,000	14, 15, 21	70, 15, 15
Water and sanitation	**420,000,000**		
- Project "Development of water supply and sanitation system in Mykolaiv"	6,600,000	14, 15, 21	70, 15, 15
- Water in Chernivtsi City	27,200,000	14, 15, 21	70, 15, 15
- Water enterprises equipment	23,000,000	9	100
- Project to improve water supply in Kyiv	31,000,000	14, 15, 21	70, 15, 15
- Construction of arterial water pipelines	41,000,000	14, 15, 21	70, 15, 15
- Urban infrastructure development project	77,000,000	14, 15, 21	70, 15, 15
- Restoration of water supply and sanitation facilities in Kyiv	19,000,000	14, 15, 21	70, 15, 15
- Mikolaiv emergency water project	27,500,000	14, 15, 21	70, 15, 15
Digital infrastructure	**70,000,000**	**9, 21, 14**	**70, 15, 15**

INVESTMENT	VALUE (US$)	SECTOR(S)	% ALLOCATED TO SECTOR(S)
Private sector	**2,800,000,000**		
- Support for export-oriented enterprises	113,500,000	-	-
- Support the processing industry	338,500,000	-	-
- Support of micro-businesses	125,000,000	-	-
- Expanding access to financing for SMEs under the 5-7-9 programme	600,000,000	-	-
- War insurance trust fund	510,000,000	-	-
- Need for additional donor financing from IFC and EBRD	904,000,000	-	-
- Grant support to small farms	120,000,000	-	-
- Energy supply	50,000,000	-	-
- Restoration of the agricultural machinery fleet	50,000,000	10	100
- Modernization, reconstruction and recovery of public irrigation systems to increase the actual irrigation area	30,000,000	14, 15, 21	70, 15, 15

3 Bottlenecks for industrial development

This block identifies the main obstacles to doing business in Ukraine. It assesses Ukraine's governance and policymaking capacities to address these obstacles and to promote the development of the domestic manufacturing sector. The block concludes with a discussion of potential policy solutions and assesses their effectiveness in the Ukrainian context, considering the reality of the ongoing war. To streamline narrative flow and help readers come away with a better grasp of the ideas presented, the main bottlenecks are classified into two groups: (1) factors of production and (2) governance (**Figure 3.1**).

FIGURE 3.1: STRUCTURE OF THE ANALYSIS

Source: UNIDO elaboration.

While the primary focus is identifying significant bottlenecks to business, the block also identifies the most vulnerable types of firms (i.e. large firms versus SMEs, exporters versus non-exporters) and also considers the Ukrainian private sector's regional structure (i.e. east, west, north and south). In addition, it analyses the dynamics of bottlenecks over time. It outlines the leading causes – whether they are due to the macroeconomic situation or political changes – behind the changes in obstacles to doing business, such as corruption and taxes. Finally, the block analyses these changes within the context of the ongoing military conflict that involves a significant part of the country.

The analysis relies on a combination of methods and sources:

- Analysis of the firm-level data set from the World Bank Enterprise Survey (WBES) covering 2008, 2013 and 2019;
- Analysis of the World Bank *Doing Business Report* (World Bank, 2020);
- Analysis of the UNIDO Enterprise Survey 2023;
- Consultations with Ukrainian stakeholders, including public-sector representatives, industry and business associations, and private companies;
- Analysis of related literature, including reports from local and international organizations, academic sources, and relevant statistical data from different sources.

3.1 OVERALL RESULTS

Bottlenecks are identified as problems related to factors that can hurt private firms' performance and production capacities. They include problems related to different factors of production; namely, various forms of capital and labour, infrastructure (i.e. electricity and telecommunications) as well as more general aspects related to the business environment and the quality of institutions and governance. The identified problems are designated *severe* or *significant* concerns by the surveyed firms.[1]

Once main bottlenecks have been identified, we analyse, where available, the follow-up questions from the WBES survey to provide a more detailed analysis of the pressing issues. This analysis is supplemented with the information extracted from additional sources, such as consultations with local stakeholders, national government reports and reports from other relevant local and international organizations and academic literature.

The total number of surveyed firms is 3,190, though numbers differ by year. They are grouped by industry, ownership, technology, export status, firm size and region. Moreover, Ukraine is benchmarked against relevant comparators, such as countries of similar development levels – including Argentina, Poland, Romania and Turkey – as well as the average of the Eastern European EU member states. Grouping and benchmarking are intended to provide a more detailed analysis of the bottlenecks, ensuring a more granular distinction between different types of firms. Table 3.1 illustrates the groups of surveyed firms by year.

TABLE 3.1: FIRM DISTRIBUTION, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey: Ukraine ECA (Eastern Europe and Central Asia).*

	DOMESTIC	FOREIGN-OWNED	M.H. TECH	LOW-TECH	EXPORTERS	NON-EXPORTERS	LARGE FIRMS	SMEs
Total number of firms: 851				**2008**				
Domestically owned	792	0	146	646	151	641	186	606
Foreign-owned	0	59	17	42	30	29	28	31
Medium-high tech	146	17	163	0	72	91	54	109
Low tech	646	42	0	688	109	579	160	528
Exporters	151	30	72	109	181	0	103	78
Non-exporters	641	29	91	579	0	670	111	559
Large firms	186	28	54	160	103	111	214	0
Small and medium-sized enterprises (SMEs)	606	31	109	528	78	559	0	637
Total number of firms: 1,002				**2013**				
Domestically owned	953	0	157	796	177	776	129	824
Foreign-owned	0	49	12	37	31	18	13	36
Medium-high tech	157	12	169	0	67	102	27	142
Low tech	796	37	0	833	141	692	115	718
Exporters	177	31	67	141	208	0	65	143
Non-exporters	776	18	102	692	0	794	77	717
Large firms	129	13	27	115	65	77	142	0
SMEs	824	36	142	718	143	717	0	860

	DOMESTIC	FOREIGN-OWNED	M.H. TECH	LOW-TECH	EXPORTERS	NON-EXPORTERS	LARGE FIRMS	SMEs
Total number of firms: 1,337					**2019**			
Domestically owned	1,249	0	178	1,071	357	892	254	995
Foreign-owned	0	88	12	76	60	28	43	45
Medium-high tech	178	12	190	0	103	87	54	136
Low tech	1,071	76	0	1,147	314	833	243	904
Exporters	357	60	103	314	417	0	158	259
Non-exporters	892	28	87	833	0	920	139	781
Large firms	254	43	54	243	158	139	297	0
SMEs	995	45	136	904	259	781	0	1,040

Note: SMEs = small and medium sized enterprises, 1-99 employees; foreign-owned = more than 50% foreign-owned, exporting firms with a share of direct and indirect exports bigger than zero; M.H. tech = medium-high technology; low-tech = low-technology.[2]

One caveat is that no additional follow-up questions were made for some of the survey questions. Hence, it's impossible to shed further light on some of the identified pressing issues. This caveat is addressed by including additional information from academic studies, reports from international organizations and consultations with local stakeholders.

The overview of the main bottlenecks for Ukrainian businesses, identified as "major" or "very severe" by the surveyed firms, is presented in Table 3.2. The top six major obstacles mentioned by the manufacturing firms are shaded in darker blue in Column 1. Corresponding topics for each subgroup that exceeded the manufacturing average are also highlighted. In relative terms, Ukrainian manufacturing firms stated that corruption (31 percent), access to finance (25 percent), competition from the informal sector (22 percent), political instability (37 percent), tax rates (34 percent) and an inadequately skilled labour force (22 percent) were the most significant obstacles during the period 2008-2019. In most cases, percentages are higher when compared to the respective average of the Eastern European manufacturing firms. However, tax rates (36 percent) and lack of skilled labour (28 percent) seem to pose a more significant problem for Eastern European manufacturers. Looking at individual countries of the comparator set, it appears that the issue of labour regulation is persistent in Argentina, Poland and Romania but not in Turkey (**Table 3.3**).

TABLE 3.2: SUMMARY OF BOTTLENECKS TO DOING BUSINESS IN UKRAINE, AVERAGE OF 2008, 2013, AND 2019

Source: World Bank, *World Bank Enterprise Survey : Ukraine ECA (Eastern Europe and Central Asia).*

Obstacle	Manufacturing	Domestically-owned	Exporter	Foreign owned	Medium-high technology	Large firms	Low technology	Manufacturing East European Union	Non exporter	Non manufacturing	Micro-, small and medium-sized enterprises
Corruption	31%	41%	12%	3%	7%	9%	24%	18%	32%	13%	35%
Courts	15%	20%	7%	2%	4%	6%	11%	12%	15%	7%	16%
Crime	17%	23%	8%	2%	4%	5%	13%	9%	17%	8%	19%
Customs	12%	14%	7%	2%	3%	4%	8%	8%	9%	4%	12%
Electricity	22%	26%	9%	2%	5%	7%	17%	29%	20%	7%	22%
Finance	25%	33%	9%	2%	6%	8%	19%	15%	25%	9%	27%
Informal sector	22%	31%	8%	2%	4%	6%	18%	15%	25%	11%	27%
Labor regulation	10%	13%	5%	1%	2%	3%	8%	16%	9%	4%	10%
Access to land	19%	25%	8%	2%	5%	6%	14%	10%	19%	8%	21%
Licensing	13%	17%	6%	1%	3%	4%	10%	11%	13%	6%	14%
Political instability	37%	50%	14%	3%	9%	11%	29%	23%	39%	16%	42%
Tax administration	17%	22%	7%	2%	4%	6%	13%	21%	16%	7%	18%
Tax rate	34%	46%	12%	3%	8%	10%	26%	36%	37%	15%	38%
Telecommunication	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	0%
Transportation	15%	20%	7%	1%	3%	5%	12%	16%	14%	6%	15%
Inadequate skilled labor force	22%	28%	10%	2%	5%	8%	17%	28%	21%	9%	23%

Note: Share of firms that identified an obstacle as “major” or “very severe”. Each value refers to a percentage of each subset (column). The top six bottlenecks for manufacturing firms are highlighted. Percentages for respective subsets that are higher than the respective manufacturing percentage are also highlighted.

TABLE 3.3: BOTTLENECKS FOR MANUFACTURING FIRMS: UKRAINE VS COMPARATOR COUNTRIES, AVERAGE OF 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

OBSTACLE	UKRAINE	EASTERN EU	POLAND	ROMANIA	TURKEY	ARGENTINA
Corruption	**31%**	18%	11%	19%	18%	**37%**
Courts	15%	12%	9%	11%	8%	**24%**
Crime	16%	9%	7%	9%	6%	15%
Customs	12%	8%	8%	6%	7%	**16%**
Electricity	**22%**	29%	16%	19%	17%	**27%**
Finance	**25%**	15%	10%	12%	11%	24%
Inf. sector	22%	15%	10%	11%	20%	**29%**
Labour regulation	10%	**16%**	**12%**	**16%**	10%	**37%**
Access to land	19%	10%	9%	9%	5%	12%
Licensing	13%	11%	10%	11%	12%	12%
Political instability	**37%**	23%	17%	20%	30%	**42%**
Tax administration	16%	21%	17%	19%	15%	**33%**
Tax rate	**34%**	**36%**	26%	28%	31%	**47%**
Telecommunication	1%	3%	1%	2%	3%	**16%**
Transportation	15%	16%	11%	12%	10%	**16%**
Inadequate skilled labour force	**22%**	**28%**	15%	21%	16%	**31%**

Survey results by subgroups of firms were reported to identify the principal vulnerabilities of different groups of firms (Table 3.2). Thus, if more firms in a specific group report an obstacle as “major” or “very severe”, such subgroups can be considered more affected. Table 3.2 reveals that domestically owned firms, non-exporters and SMEs are relatively more affected by political instability, lack of access to finance, corruption, competition from the informal sector, and tax rates. At the same time, exporters, foreign-owned firms and firms operating in medium high-tech industries are, on average, less affected.

Table A1 reports the differences in bottlenecks reported by respondents located in different regions of Ukraine (Kyiv, western Ukraine, eastern Ukraine, northern Ukraine and southern Ukraine). Results reveal similar patterns across the subgroups of firms regardless of the location. Across regions, the relatively more affected groups include domestically owned firms, low-tech firms, non-exporters and SMEs. Regarding regional differences, Kyiv and eastern regions report overall lower rates of obstacles to business.

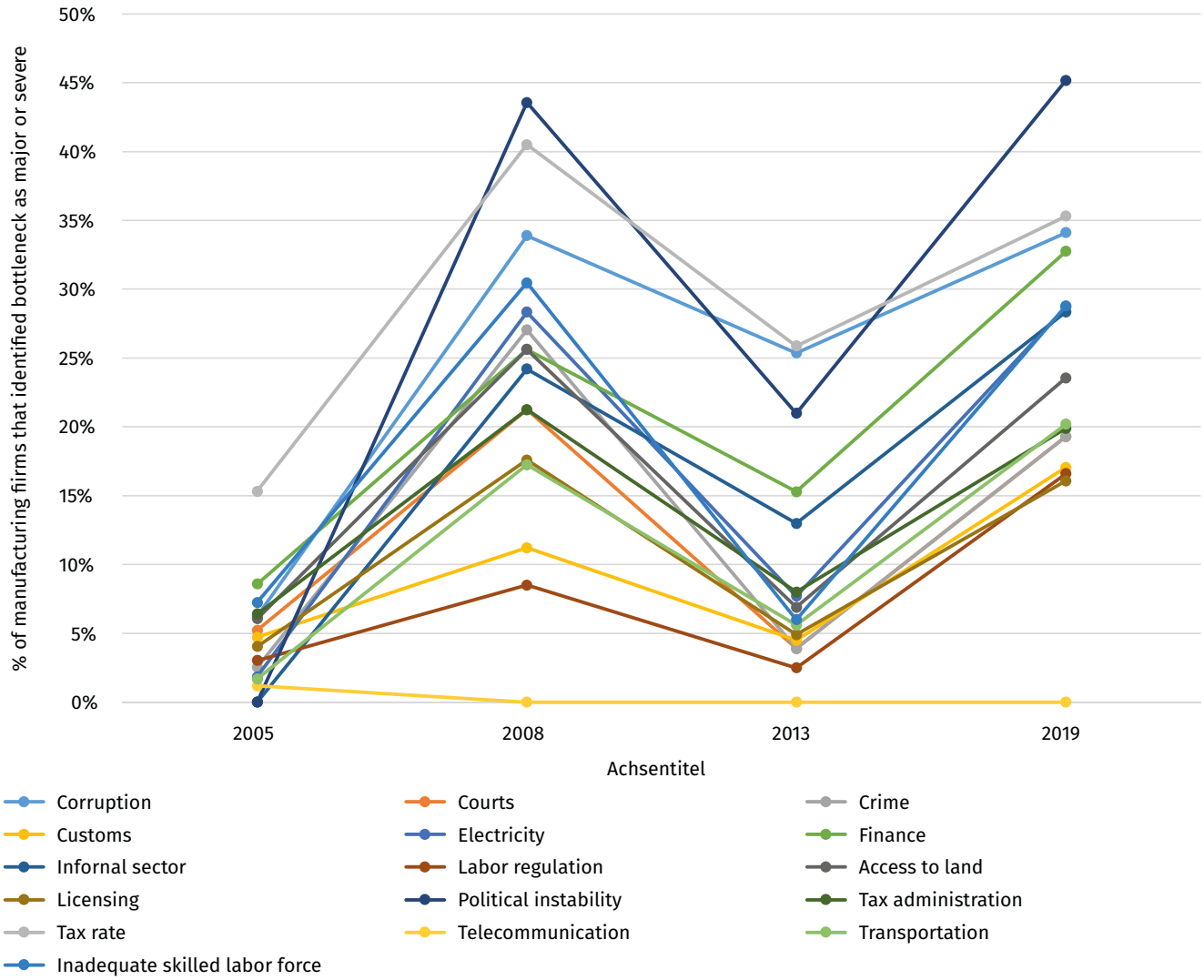
The time dynamics of the main bottlenecks to business for Ukrainian firms presented in **Figure 3.2** shows that over the period 2005-2019, the issues that have persistently occupied the first place in the ranking were (1) political instability, (2) corruption and (3) tax rates. Most bottlenecks exhibit changing patterns, with a decrease between 2009 and 2013, followed by an increase between 2013 and 2019. Such a trend is unsurprising and closely follows the periods of intense political instability in Ukraine during those periods. For example, all the bottlenecks turned to a positive trend in 2013, which coincided with the Revolution of Dignity, followed by the non-recognized annexation of Crimea and the conflict in eastern Ukraine. Indeed, these events might have changed the ranking of the issues faced by Ukrainian firms due to their negative impact on local and international value chains and industrial infrastructure. For instance, several coke-

chemical plants, crucial for steel production, were located in self-declared autonomous republics. These production facilities were cut from the production cycle due to the conflict in eastern Ukraine, which destroyed some production chains and decreased steel exports.

Finally, combinations of obstacles to doing business mentioned by the responding firms reveal that the most often mentioned bottlenecks were political instability and corruption, labour regulation and an inadequately skilled labour force, and tax rates and tax administration. To summarize, given the details of the bottlenecks presented in Table 3.2, not all firms are equally affected and some of the bottlenecks are more connected than others.

FIGURE 3.2: UKRAINE'S BOTTLENECKS IDENTIFIED BY MANUFACTURING FIRMS, 2005-2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*



Note: Share of firms that identified an obstacle as "major" or "very severe".

3.2 BOTTLENECKS IN FACTORS OF PRODUCTION

This section provides a more detailed analysis of the most pressing issues listed in **Table 3.2**. It explores each issue to analyse WBES data to study the time dimension of the issue and provide a comparison of recent developments in Ukraine to those of similar countries, such as Eastern European markets and other emerging markets of similar income levels. To streamline the analysis, bottlenecks are classified into (1) bottlenecks in factors of production and (2) bottlenecks in governance.

3.2.1 BOTTLENECKS IN FACTORS OF PRODUCTION

ACCESS TO FINANCE

Access to finance was one of the six most pressing issues identified by Ukrainian firms. Indeed, the availability of finance and the ability of the country to maintain and enhance sustainable economic growth are closely intertwined. R&D investments and new production capacities increase productivity, making products more accessible to end consumers and aligning supply to increasing demand. A decrease in production costs due to productivity improvements makes it easier to penetrate foreign markets, which results in higher exports. Access to finance is thus essential strategically and as a facilitator of day-to-day firms' activities (i.e. current accounts and lines of credit).

A glance at the Ukrainian financial system reveals that by August 2023, around one-fourth of Ukrainian banks were foreign-owned. Three out of four state-owned banks were the largest in terms of assets, and all four state-owned banks are included in the top-5 banks list and hold around 50 percent of total assets. At the end of 2022, the non-performing loan (NPL) ratio was slightly below 40 percent, with the largest share of non-performing loans residing in state-owned banks. The Ukrainian banking sector has decreased significantly over the last 10 years, with the state-owned PrivatBank being the largest bank in assets (National Bank of Ukraine, 2023). In summary, the biggest challenges for the Ukrainian banking sector included a high share of state-owned banks, a high ratio of non-performing loans, and a relatively large number of banks for a small and distressed market like Ukraine (65 banks in 2023).[3]

Results of the WBES presented in Table 3.3 show that access to finance is not the most pressing issue for Ukrainian firms. However, compared to countries such as Poland, Romania and Turkey, the results still indicate a need for improvement. On average, 25 percent of respondents reported this issue as "major" or "very severe", which is significantly higher than the average for Eastern EU member states (15 percent), as well as the indicators for Poland (10 percent), Romania (12 percent), and Turkey (11 percent). Although the severity of the issue seems to have decreased from 2008 to 2013, the non-recognized annexation of Crimea in 2013 has reversed this trend.

Regarding the financial situation from the firms' point of view, most Ukrainian firms have a current account in a financial institution. However, only one-third of manufacturing firms had a line of credit in 2008, and this share went down to around one-fourth in 2019. A similar tendency can be observed in an overdraft facility. These tendencies reveal a more stringent financial sector regulation following the 2008-2012 global financial crisis and the 2014-2015 Ukrainian financial crisis. Furthermore, there were some heterogeneities among the groups. For example, 70 percent of large firms had an overdraft facility in 2008, while only 50 percent of SMEs stated they had one. However, results indicate that inter-group heterogeneity has decreased between 2008 and 2019 (**Table 3.4**).

TABLE 3.4: UKRAINE'S BOTTLENECKS: FINANCING, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
					2008					
Current account	95%	97%	95%	98%	97%	93%	94%	97%	94%	97%
Line of credit	47%	51%	47%	39%	58%	34%	36%	51%	36%	58%
Overdraft facility	64%	65%	64%	53%	70%	50%	51%	65%	51%	70%
					2013					
Current account	91%	91%	91%	91%	96%	92%	91%	91%	91%	94%
Line of credit	43%	36%	43%	24%	44%	21%	22%	36%	22%	41%
Overdraft facility	61%	45%	61%	31%	48%	35%	34%	45%	34%	44%
					2019					
Current account	100%	99%	100%	99%	99%	98%	98%	99%	98%	99%
Line of credit	27%	35%	27%	25%	34%	24%	25%	35%	25%	34%
Overdraft facility	37%	41%	37%	37%	45%	38%	38%	41%	38%	45%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises. Percentages always refer to the respective subset (column).

TABLE 3.5: SHARE OF FINANCING INSTITUTIONS (AVERAGE) IN UKRAINE, BY TYPE, 2008-2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
Non-bank financial institutions	3%	2%	5%	1%	0%	5%	5%	5%	1%	7%
Private commercial banks	71%	31%	5%	16%	30%	41%	57%	45%	19%	46%
State-owned banks or government agency	24%	6%	2%	2%	7%	16%	18%	23%	8%	19%
Other	3%	1%	2%	0%	1%	1%	1%	3%	5%	3%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises Each percentage refers to the percentage of each subset (column).

Over 50 percent of manufacturing firms receive financing from private commercial banks (**Table 3.5**), although their share has decreased between 2008 and 2019 for most firm subgroups (**Table A2**). One reason may be more stringent banking regulations and tougher loan requirements. Moreover, these factors might have resulted in many firms choosing not to apply for a bank loan in the first place. For example, in 2019, around one-third of manufacturing firms stated the main reason for not applying for a loan was a non-favourable interest rate, which represents a significant issue for all groups of firms apart from foreign-owned enterprises (**Table 3.6**). **Table 3.7** provides an overview of collateral required by banks for the most recent line of credit. Distribution across types of collateral is not even across all firm subgroups, with the most frequently requested type of collateral being machines and equipment.

Lack of access to attractive financing sources, which had been a problem for Ukrainian businesses before the war, has also been discussed in consultations with Ukrainian stakeholders. However, the issue became more pressing during the war as the choice of financing options became more limited and credit conditions became more stringent.

TABLE 3.6: FIRMS' REASONS FOR NOT APPLYING FOR A LOAN, AVERAGE OF 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
Application procedures were complex	5%	1%	0%	2%	1%	2%	4%	4%	2%	5%
Collateral requirements were too high	4%	1%	0%	1%	0%	3%	3%	4%	1%	4%
Did not think it would be approved	2%	1%	0%	0%	0%	2%	2%	1%	0%	2%
Interest rates were not favourable	28%	4%	1%	3%	4%	17%	20%	25%	8%	24%
No need for a loan	33%	9%	2%	6%	6%	17%	23%	26%	12%	29%
The size of the loan and maturity were insufficient	1%	0%	0%	0%	0%	1%	1%	1%	0%	1%
Other	26%	12%	3%	6%	14%	16%	22%	18%	7%	17%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises. Each percentage refers to the percentage of each subset (column).

TABLE 3.7: TYPES OF COLLATERAL IN UKRAINE, AVERAGE OF 2008, 2013 AND 2019[4]

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
2008										
Accounts and inventories	4%	8%	5%	6%	7%	4%	4%	3%	3%	3%
Land and buildings	6%	9%	3%	6%	10%	6%	6%	5%	5%	4%
Machines and equipment	12%	17%	15%	17%	24%	13%	14%	11%	9%	9%
Other	74%	60%	69%	69%	55%	72%	71%	78%	81%	81%
Personal	4%	6%	7%	3%	4%	5%	4%	3%	3%	4%
2013										
Accounts and inventories	1%	4%	0%	2%	4%	2%	2%	1%	1%	1%
Land and buildings	2%	2%	2%	1%	5%	2%	2%	2%	2%	1%
Machines and equipment	5%	10%	14%	7%	16%	6%	7%	5%	4%	4%
Other	89%	80%	78%	85%	72%	88%	87%	90%	92%	91%
Personal	3%	4%	6%	5%	4%	3%	3%	3%	2%	3%
2019										
Accounts and inventories	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%
Land and buildings	4%	6%	2%	4%	7%	4%	4%	3%	3%	3%
Machines and equipment	6%	11%	8%	8%	11%	7%	7%	4%	4%	5%
Other	87%	79%	86%	85%	78%	86%	86%	90%	89%	89%
Personal	2%	3%	2%	2%	2%	2%	2%	2%	2%	2%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises. Each percentage refers to the percentage of each subset (column).

SKILLS AND HUMAN CAPITAL

Human capital is one of the cornerstones of a resilient and sustainable growth strategy. The availability of a specialized workforce is crucial for developing specific industries and sectors. In general, skilled labour plays a vital role at every stage of a production process by raising productivity and, consequently, decreasing production costs. Moreover, the development of new products and processes is only possible with a set of innovative skills.

Ukrainian firms' response to the WBES highlighted the issue of an *inadequately educated workforce* as one of the biggest obstacles to their business activities. Similar to Poland, Romania and Turkey, labour regulation is less of a problem for entrepreneurs. In Ukraine, only 10 percent of firms reported this bottleneck as "major" or "very severe", while 22 percent did so for inadequately skilled labour. **Table 3.2** reveals that the issue is more critical for domestically owned firms (28 percent) and SMEs (23 percent). Consistently, the issue of the lack of skilled labour was raised in most consultations by large industrial enterprises and SMEs, regardless of location and sector of activity. The ongoing war was cited the main reason for lacking a skilled labour force.

The skills-related summary statistics in **Table 3.8** show that the share of skilled workers reported by Ukrainian firms varied between 40 percent and 60 percent from 2008 to 2019. Furthermore, additional

information on workforce education confirms that, on average, manufacturing firms reported to employ 26 percent of workers with university degrees, while 67 percent of employees had a high-school degree. Overall, education statistics reveal a relatively high average of formal educational attainment among the Ukrainian workforce. In 2015, around 53 percent of the active population had a higher education degree than the OECD average of 36 percent (2015). This factor is vital for a successful sustainable industrial strategy and development of high-tech sectors with an aspiration of joining an intensely competitive European market.

TABLE 3.8: SHARE OF SKILLED WORKERS IN UKRAINE, BY FIRM SUBGROUP, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
2008										
Skilled	40%	44%	40%	49%	37%	51%	50%	44%	50%	37%
Unskilled	6%	9%	6%	9%	8%	9%	9%	9%	9%	8%
Training	7%	7%	7%	5%	6%	4%	4%	7%	4%	6%
2013										
Skilled	52%	52%	52%	57%	51%	64%	62%	52%	62%	50%
Unskilled	7%	8%	7%	7%	10%	10%	9%	8%	9%	9%
Training	13%	10%	13%	6%	10%	8%	7%	10%	7%	10%
2019										
Skilled	32%	39%	32%	45%	33%	41%	42%	39%	42%	33%
Unskilled	14%	9%	14%	9%	10%	11%	10%	9%	10%	10%
Training	7%	4%	7%	3%	4%	2%	2%	4%	2%	4%
High-school	65%	65%	65%	65%	66%	65%	67%	65%	67%	66%
University	23%	24%	23%	24%	23%	26%	26%	24%	26%	23%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises. Each percentage refers to the percentage of each subset (column).

According to the ILO (2020), further education does not necessarily lead to better labour-market outcomes, while unemployment rates do not vary significantly across groups with different educational attainment. Furthermore, companies responding to various business surveys regularly highlight the lack of necessary skills among recent graduates. This might be explained by the fact that the economy's structure in an emerging market like Ukraine tends to generate demand for specialized blue-collar jobs. In contrast, the formal education and training system curricula are focused on theory rather than skills relevant to the workplace. Some studies report that corruption in the education sector might harm the quality of relevant skills (Truong, 2020). To address the challenges related to skills mismatch between firms and employees, the Government of Ukraine pursued several initiatives to add more flexibility for employers to hire and dismiss workers (ILO, 2020). However, such changes in labour legislation might lead to a lack of labour protection, especially for vulnerable workers.

In addition, according to the survey results, the percentage of firms in Ukraine that reported offering

training to their employees in the last year is relatively low. It varies between 4 percent and 6 percent for manufacturing firms. There is little heterogeneity among subgroups, with more foreign firms offering employee training. Regarding gender equality, the summary of the results, presented in **Table 3.9**, indicates a relatively successful engagement of women in the labour market. In 2008, around 50 percent of manufacturing firms reported having at least one female owner, and around 30 percent reported having a female manager. However, these numbers fell to 40 percent and 20 percent, respectively, in 2019.

TABLE 3.9: UKRAINE'S GENDER BREAKDOWN, BY FIRM SUBGROUP, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
2008										
Fem. owner	46%	46%	46%	48%	47%	47%	49%	46%	49%	47%
Fem. manager	27%	29%	27%	31%	30%	31%	31%	29%	31%	30%
2013										
Fem. owner	37%	39%	37%	40%	41%	39%	40%	39%	40%	43%
Fem. manager	23%	25%	23%	26%	24%	26%	27%	25%	27%	24%
2019										
Fem. owner	40%	41%	40%	41%	40%	40%	42%	41%	42%	40%
Fem. manager	19%	20%	19%	20%	20%	20%	19%	20%	19%	20%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises. Each percentage refers to the percentage of each subset (column).

COMPETITION FROM THE INFORMAL SECTOR

Another obstacle that Ukrainian firms often mention is related to the competition from the informal sector. It is essential to understand that a high percentage of firms operating in the informal sector shifts the burden of taxes onto the legally registered market players. This can create several distortions in the economy, including stifling investment and innovation, further increase in informal sector activity and, as a result, lower economic growth or even stagnation. According to Polese et al. (2022), in 2018, the size of the Ukrainian shadow economy was estimated at around 38.5 percent, concentrated in agriculture, forestry, fishing, trade, repair of motor vehicles and construction (ILO, 2020). The results of the WBES indicate that around 22 percent of manufacturing firms find this issue a significant obstacle for their business. Across subgroups, domestically owned firms (31 percent), non-exporters (25 percent), and SMEs (27 percent) represent relatively more affected categories. Nevertheless, this issue was not brought up during the consultations with representatives of Ukrainian private businesses and business associations, nor with public-sector representatives.

3.2.2 BOTTLENECKS IN GOVERNANCE

CORRUPTION

Corruption can bear several damaging consequences, especially for a developing country like Ukraine. On the one hand, it can hinder foreign investment, as foreign firms might be reluctant to operate in a business environment characterized by high uncertainty and high share of the informal sector. On the other hand, it can hinder innovation as domestic firms, especially small innovative start-ups, might not have enough resources to bribe government officials regularly, exacerbating disparities between small and large firms and distorting market competition. As a result, the market becomes less attractive for foreign and domestic new entrants. Ukraine ranked 116 of 180 countries in the Corruption Perception Index (Transparency International, 2023) and 85 of 140 countries in the World Economic Forum's *Global Competitiveness Report 2020*. While Ukraine has improved its corruption perception score from 27 to 33 over the last 10 years, there is still significant room for improvement.[5]

According to the WBES results presented in **Table 3.2**, 31 percent of manufacturing firms named corruption a significant bottleneck to doing business in Ukraine. Furthermore, 41 percent of domestically owned firms and 35 percent of SMEs reported corruption as a significant bottleneck. In contrast, only 3 percent of foreign-owned firms reported corruption as a substantial obstacle to doing business. Hence, domestic and small firms are more exposed to the issue. Only 15 percent of manufacturing firms reported the court system as a significant bottleneck, implying a relatively well-functioning court system.

The first lines of **Table 3.10** report the approximate share of the value of a government contract that has been paid as an informal payment to secure the allocation of the contract. Looking at different subgroups, the problem is greater for larger firms, independently of high- or low-tech specialization. Government contracts are usually dedicated to big infrastructural projects designed for larger contractors. However, there are also positive time dynamics: 1 percent of surveyed firms highlighted this issue as a significant bottleneck to doing business in 2019, compared to 6 percent in 2008.

The third and fourth lines of **Table 3.10** report the number of firms that had to provide a gift or an informal payment when applying for import licenses or claiming imported goods. Corruption during the import process was perceived as much higher (above 80 percent) than corruption during import license application (0-1 percent). In this case, a negative trend was observable, with more firms reporting the above-mentioned issues as bottlenecks to business in 2019 than in 2008. Corruption during the import process is often an essential obstacle for a developing country. Delays in imports might hinder domestic production and negatively affect the country's role in GVCs, as local firms might fail to build resilient supply chains with foreign companies. Moreover, this factor can also stall innovation in a country heavily reliant on foreign technologies. According to the World Bank's[6] *Doing Business Report 2020*, Ukraine ranks significantly below the regional average regarding trade across borders due to long and complex customs procedures and document compliance. It is ranked 74 out of 190 countries.

The fifth row of **Table 3.10** reports the percentage of firms that stated that an informal payment or gift was required during a visit of a tax official for an audit during the last year. In this case, a chronological trend in the percentage of firms reporting this issue is not apparent. Only 8 percent of manufacturing firms reported informal payments to tax officials as a significant bottleneck in 2008. The figure rose to 19 percent in 2013, then declined to 14 percent in 2019.

The issue of corruption was brought up several times in the consultations with Ukrainian stakeholders. Most complaints were received from the representatives of large industrial companies in the construc-

tion and heavy industries (e.g. metallurgy, mining and energy). Most of the issues mentioned were related to access to natural resources and unfair rules of tender procedures set by municipalities to favour specific candidates.

Overall, the results presented in this section reveal some positive developments related to some aspects of corruption with significant heterogeneity in the dynamics across firm subgroups. The European Court of Auditors (2021) on corruption in Ukraine concluded that "grand corruption", an abuse of power that benefits the few and seriously harms individuals and society, remains a considerable issue despite some success in fighting petty corruption. The root cause of grand corruption is oligarchs and other vested interests. Grand corruption entangles the state, stifles competition and economic growth, and slows the democratic process. To this end, one of the main goals of the EU's assistance in Ukraine is to prevent and fight grand corruption. Despite significant progress in some areas, many issues still need to be addressed. For example, judicial reform is experiencing delays, and anticorruption institutions are at risk and have low trust among the population, partially due to the low number of convictions related to grand corruption. Most internationally funded technical assistance projects were not exclusively focused on fighting corruption. Hence, a more targeted approach is needed to address this challenging issue (National Agency on Corruption Prevention, 2022).

TABLE 3.10: SHARE OF RESPONDENTS EXPERIENCING CORRUPTION IN UKRAINE, BY FIRM SUBGROUP, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey Ukraine ECA (Eastern Europe and Central Asia).*

AREA OF CORRUPTION	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
2008										
Official contracts	5%	3%	5%	3%	3%	2%	3%	3%	3%	3%
Overall payments	6%	6%	6%	8%	7%	7%	6%	6%	6%	7%
Customs (imports)	86%	87%	86%	85%	84%	82%	83%	87%	83%	84%
Import license	0%	1%	0%	1%	1%	0%	0%	1%	0%	1%
Visits tax officials	15%	15%	15%	12%	13%	10%	8%	15%	8%	13%
2013										
Official contracts	7%	6%	7%	4%	5%	3%	4%	6%	4%	5%
Overall payments	2%	2%	2%	1%	1%	1%	1%	2%	1%	1%
Customs (imports)	94%	89%	94%	85%	82%	83%	82%	89%	82%	82%
Import license	12%	5%	12%	2%	3%	2%	2%	5%	2%	3%
Visits tax officials	20%	16%	20%	15%	14%	15%	19%	16%	19%	14%
2019										
Official contracts	1%	2%	1%	1%	2%	1%	1%	2%	1%	2%
Overall payments	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%
Customs (imports)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Import license	5%	12%	5%	8%	6%	4%	5%	12%	5%	6%
Visits tax officials	17%	21%	17%	16%	14%	13%	14%	21%	14%	13%

Note: M.H. tech = medium and high-technology; Low-tech – low technology; MNF = manufacturing; SMEs = small and medium-sized enterprises. Each percentage refers to the percentage of each subset (column).

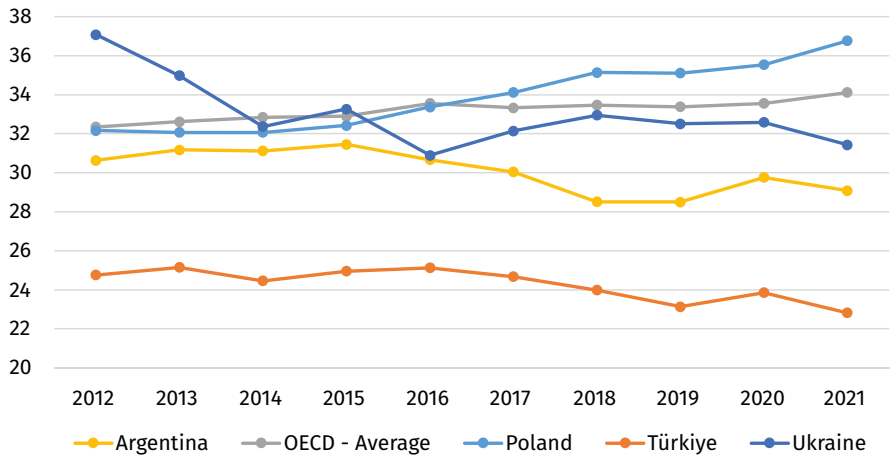
TAX RATES AND TAX ADMINISTRATION

Taxation is a powerful instrument that can affect many dimensions of the economy and help governments shape a country's economic development. Imposing and levying certain taxes can help the government achieve specific targets and stimulate economic activity and technology adoption in particular sectors. For example, reduced VAT rates may be applied for the producers of solar panels and wind turbines to foster the adoption of sustainable energy production. However, despite many positive externalities – such as promoting modern technologies and providing financial support to large infrastructural projects – taxes can have several adverse effects on economic growth. First, as with any government intervention, taxes can create market distortions, as firms affected by taxes might lose competitiveness. Second, an overly complex and bureaucratic tax system might create inefficiencies as firms must allocate significant resources to manage their tax payments. Moreover, complicated and unclear tax systems might incentivize some firms to switch to the informal sector.

Figure 3.3 shows Ukraine's tax-to-GDP ratio against a set of comparator countries and the OECD average. Ukraine's tax-to-GDP has declined slightly from 2012-2021, from 37 percent to 31 percent, and is in line with that of Poland and the OECD average. At the same time, Ukraine's tax-to-GDP ratio is significantly higher than Turkey's.

FIGURE 3.3: TAX-TO-GDP RATIO, UKRAINE VS COMPARATORS, 2012-2021

Source: OECD, *Global Revenue Statistics database*, 2022.



Taxes could be perceived as positive market externalities by some firms due to, for example, large infrastructure projects. On the other hand, they can create a significant administrative and financial burden for others. The results of the WBES reveal that taxation rates are mentioned as a significant bottleneck to business by 34 percent of manufacturing firms. Moreover, domestic firms (46 percent), SMEs (38 percent), and non-exporters (37 percent) are affected relatively more. Given that the standard corporate income tax in Ukraine is set at a rate of 18 percent, domestic firms and SMEs may perceive it as an obstacle due to their lower profits relative to exporters and foreign-owned firms.

Furthermore, 16 percent of manufacturing firms see tax administration as a major obstacle, while domestic non-exporters and SMEs are affected relatively more. This may be explained by the complexity of tax administration and the need for more special resources to deal with it, which is more pronounced in small firms. However, this issue was not brought up in consultations with Ukrainian stakeholders.

POLITICAL INSTABILITY

A stable political environment is crucial for sustainable economic growth. It is essential to understand that political stability requires an effective legal framework and efficient law enforcement strategy. The booming economic development of Asian countries, including South Korea and Singapore, shows the importance of political stability in achieving sustainable growth. On the other hand, countries in Latin America, such as Brazil, Mexico and Venezuela, are examples of the negative impact of political instability on economic growth and development. Uncertainty is one of the primary mechanisms through which political instability may affect economic growth. It can lower domestic and foreign investment, stifle innovation due to lower rates of R&D and create other negative externalities that can eventually lead to lower economic growth or, in some cases, economic stagnation (Shepotylo, 2013).

The results of the WBES indicate that around 37 percent of Ukrainian manufacturing firms consider *Political instability* a major obstacle to doing business, while domestic firms (50 percent), non-exporters (39 percent) and SMEs (38 percent) are affected even more. **Figure 3.2** shows that political stability, similar to other obstacles to business, declined until 2013, the year of the Revolution of Dignity. Marking a rapid change in the Ukrainian political system and a flight of incumbent president Viktor Yanukovich, the Revolution of Dignity was followed by the non-recognized annexation of Crimea and the conflict in eastern Ukraine. The political scene remains extremely unstable. It is also likely that uncertainty has decreased after the election of the current president, Volodymyr Zelensky, in 2019 due to the number of policies implemented in relation to the EU-Ukraine Association agreement. However, the current armed conflict has most likely offset most effects of these efforts as the latest FithRating (2023) estimate gave Ukraine a *real possibility of default* (CC) rating.

Nevertheless, *political instability* was not mentioned much during the consultations with Ukrainian stakeholders in September 2023. The reality of the war might have shifted the attention of firms operating in Ukraine to more pressing day-to-day issues of electricity supply or lack of skilled labour.

3.3 EFFECTS OF THE WAR ON THE BOTTLENECKS TO DOING BUSINESS

The main goal of this section is to analyse the findings from the most recent survey implemented by UNIDO in autumn 2023. The survey results cover the conflict period and disentangle the effects of the war on the main challenges and issues faced by different groups of Ukrainian firms in their everyday activity. Information provided by national consultants supplements the analysis of the latest survey data and includes qualitative and quantitative evidence to help explore the war period. Qualitative evidence has been gathered via interviews and consultations with different groups of Ukrainian stakeholders, including ministries, associations and private-sector representatives. At the same time, quantitative evidence on the regional value added, employment, electricity consumption and other economic indicators have been collected from the corresponding Ukrainian statistical offices. This evidence provides a first-hand assessment of structural changes that are taking place in the Ukrainian economy as a result of the war and will supplement the analysis of the survey data mentioned earlier in this block on the bottlenecks to business. Combining these two data sources allows us to highlight the most pressing issues Ukrainian businesses face in light of current structural changes and other effects of the ongoing military conflict.

3.3.1 OVERALL IMPACT OF THE WAR ON THE UKRAINIAN ECONOMY

The war has had a devastating impact on many aspects of the Ukrainian economy. During 2022, the economy suffered heavy losses, contracting by 30 percent. The country has suffered significant damage to its infrastructure, which will need large-scale reconstruction efforts. Targeted policy interventions, such as the UN-brokered Black Sea Grain Initiative, mitigated some effects of the war. However, uncertainty regarding the conflict's scale and duration means that food-supply challenges will likely persist. Moreover, the temporary military control by the Russian Federation has had a devastating effect not only on Ukraine's production but also on its participation in GVCs. Finally, mass migration, combined with unstable political and economic situations and high inflation in areas that are not under the temporary military control of the Russian Federation, has led to a decline in national consumption (Mykhnenko, 2020).

3.3.2 INFRASTRUCTURE

Ukraine has already suffered damage to its infrastructure not seen in Europe since World War II. Consequently, significant adverse effects are observed on Ukraine's production and international trade. Annual sea transportation volume decrease was highest at 85 percent in 2022. The volume of rail freight transportation decreased by 52.1 percent and road freight transportation decreased by 21.7 percent. A port blockade was critical to the failure of maritime logistics. Before the war, 75 percent of cargo was sent by sea. Since the start of the war, the main flow of freight has been directed through Polish and German ports, as well as the ports of the Baltic countries. As a result, the logistics leverage increased, leading to an increase in the waiting period for trans-shipment to 14 days (11 days as of May 2023) and an increase in costs due to additional logistics operations.

Re-routing of exports and imports increased the load on railways and motor vehicles. More than 30 million tons of imported goods were delivered to Ukraine in 2022; a third (about 11 million tons) was transported by motor vehicles; 9.89 million tons were imported by rail, and 7.16 million tons were transported by sea. Sea transport continued to dominate in exports due to the action of the "grain initiative." With its help, 53.86 million tons (-55 percent) of goods were exported. Railways took second place, with 33.73 million tons (+3.4 percent or +1.1 million tons compared to 2021). Twelve million tons (+32.4 percent) of goods were exported by road transport.

The transformation of the petrochemical industry was crucial for the country's war effort and winter sustainability. Refineries and oil depots destroyed by enemy shelling, as well as the cessation of supplies of petroleum products from Russia and Belarus, led to a transformation of fuel logistics: fuel shortages were avoided by increasing its price by 65 percent and increasing imports via land routes with neighbouring western countries.

3.3.3 IMPACT OF WAR ON MICRO, SMALL AND MEDIUM-SIZED ENTERPRISE (MSMEs)

Prior to the war, micro, small and medium-sized enterprises (MSMEs) provided production for more than half of all products and were the place of work for three-quarters of the employed population. Thus, in 2020, MSMEs accounted for approximately 99.9 percent of economic entities in the country (almost 83 percent of them are micro-enterprises) and generated around 63 percent of gross sales (UNDP in Ukraine, 2022).

The largest share of MSMEs is regionally registered within large urban agglomerations: Kyiv and Kyiv region, Dnipropetrovsk, Odesa, Kharkiv and Lviv regions. At the beginning of the full-scale invasion, 65 percent of the enterprises were located in regions affected by the war to one degree or another. The share of these enterprises in the gross volume of sales of Ukrainian MSMEs is 73 percent. At the same time, the contribution of MSMEs to the total gross sales in the areas that are no longer under temporary military control of the Russian Federation is around 61 percent (UNDP in Ukraine, 2022).

MSMEs have suffered the most from the war. Based on the results of the quantitative and qualitative analysis conducted by the EBRD, only 57 percent of SMEs in production and services maintain operation, while the remaining 43 percent reduced output or suspended operation (6 percent).

The consequences of the invasion for MSMEs were a significant reduction in the volume of activity. According to the government-backed poll data, 8 percent of enterprises stopped their activities completely, and 18.5 percent worked at less than half capacity. Only 50.1 percent of enterprises experienced a 40-90 percent workload, which is similar to pre-war levels.

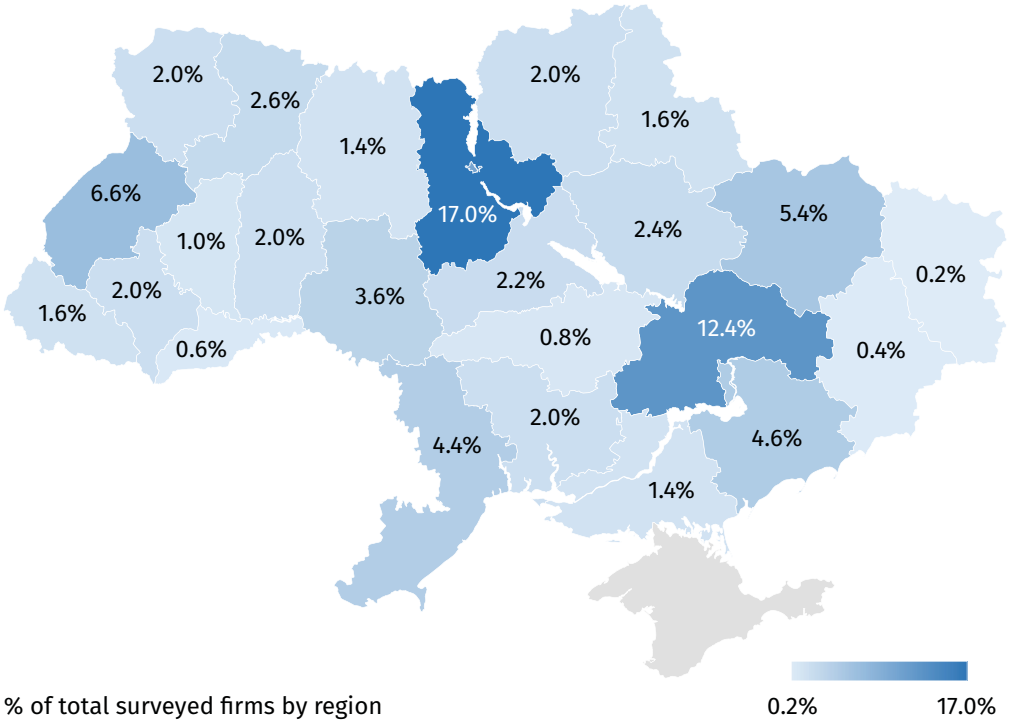
3.3.4 RESULTS OF THE UNIDO ENTERPRISE SURVEY 2023

This section presents an overview of the survey results run in Ukraine by UNIDO in October 2023. Survey questions aligned with the WBES to ensure an adequate comparison between the results.

The survey covered a representative sample of Ukrainian manufacturing and service firms (501 respondents) located in six macro-regions of Ukraine, including the north (8 percent), south (8 percent), centre (12 percent), east (23 percent), west (12 percent), and Kyiv region and Kyiv capital (27 percent).[7] A more detailed geographical distribution of the survey sample is presented in **Figure 3.4**.

FIGURE 3.4. GEOGRAPHICAL DISTRIBUTION OF RESPONDENT FIRMS: % OF TOTAL SURVEYED FIRMS BY REGION

Source: UNIDO Enterprise Survey, 2023.



Note: Total number of survey respondents = 501.

The survey covered most of the manufacturing as well as construction, information and communication, and transportation and storage sectors. Manufacturing firms represent around 80 percent of the sample. The survey coverage is representative of the structure of Ukrainian manufacturing sectors. In particular, columns (11)-(13) of **Table 3.11** indicate, respectively, the share of firms operating in each sector in the overall number of Ukrainian firms (column 11), the share of each sector in the total number of firms that took part in the UNIDO survey (column 12), and the difference between the two (column 13). The differences between these shares are negligible for all manufacturing sectors.

Around 90 percent of surveyed firms belong to the MSME category, which, as noted earlier, reflects the structure of the Ukrainian economy and aligns with

the survey's focus on SMEs. Moreover, the sample structure represents technological intensity, size, international activity and type of ownership. In particular, the survey includes several foreign-owned and state-owned enterprises. Around 60 percent of surveyed firms are fully domestically oriented, while approximately 40 percent exported their goods/services before or during the war. About 50 percent of surveyed firms belong to medium high-tech sectors, 26 percent belong to medium low-tech manufacturing sectors, and non-manufacturing firms constitute the remaining 24 percent (**Table 3.11**).

The structure of this survey reveals some overlaps with the WB Business Pulse Survey conducted during March-July 2023 (Avdeenko et al., 2023). In particular, similar to the WB Business Pulse Survey, the UNIDO questionnaire addressed questions related to the impact of war, firm responses to war-related changes and issues related to government support policies.

At the same time, the survey focuses on manufacturing firms and SMEs. Hence, 80 percent of the survey sample consists of manufacturing sectors. Next, the UNIDO 2023 survey represents a more detailed national and local government support measures analysis. Finally, it explores firms' views regarding the most effective current and future policy responses.

The first section of the survey included general information, such as size and type of ownership, location, sector of activity, age of the firm, and percentage of exports and imports. The second section explored the impact of the war on Ukrainian business. It included questions about war-related disruptions to regular operations, relocation and factors influencing firms' decision to relocate, and current operating capacity. The next set of questions, closely aligned to the WBES, uncovers the main bottlenecks to doing business before the war and identifies those that have deteriorated and new ones that have surged during the war. Further questions explore the impact of the war on different aspects of firm activity, including sales, employment, liquidity and profits. The third section included questions about the Ukrainian firms' responses to war, including changes in day-to-day activity, investment, international operations and integration with the European market. Finally, the fourth section included several questions about current and desired government support measures at the national and local levels.

Overall, the results of the survey indicate that before the war, the six main bottlenecks for Ukrainian business were mainly aligned with those identified by the WBES and included corruption, cost of energy, access to finance, availability of skilled personnel, as well as the complexity of the tax system, bureaucracy and tax rates. At the same time, the areas most frequently cited by the Ukrainian firms as having deteriorated as a result of the war include the bottlenecks related to the factors of production such as availability and cost of energy, availability and cost of materials, and availability of skilled and non-skilled personnel (**Table 3.12**).

The most pressing problems that have surged during the war are presented in **Table 3.13**. These include a decrease in purchasing power (i.e. clients are buying less), lack of personnel (workers unable to work due to conscription into the armed forces of Ukraine), unstable energy supply (interruptions of energy supply, including rising costs of energy such as gas and oil), liquidity issues (difficulty in securing operating capital), increase in the cost of production (production costs have increased) and lack of government support (lack of support from the state and local authorities).

The war has had a significant negative impact on Ukrainian business (**Table 3.14**). Almost 30 percent of manufacturing firms and 34 percent of SMEs had to suspend their business activity temporarily due to the war. At the same time, Ukrainian businesses showed remarkable resilience to war-related disruptions. Around 75 percent of manufacturing firms and 86 percent of SMEs reported full or partial on-site operations during the survey (September 2023). Regarding relocation and damages, the overwhelming majority (90 percent) of responding firms were not relocated, while around 60 percent of manufacturing firms and over 70 percent of SMEs were reported to have suffered war-related damages.

Regarding input and liquidity shortages, around 60 percent of manufacturing and SMEs have experienced some input shortages, while over 70 percent of manufacturing firms and over 70 percent of SMEs reported experiencing cash flow shortages due to the war. Most firms dealt with liquidity problems by cutting expenditures or delaying investments, taking personal or family loans, delaying payments to suppliers or workers, or taking loans from commercial banks. Around half of the responding firms have reported a need for additional funding for either capital investment of day-to-day operations.

Interestingly, the survey results show a swift recovery of sales following the start of the war. For example, when asked to compare their sales in 2021 (before the war) and 2023 (after the war), half of manufacturing firms and 60 percent of SMEs reported decreased sales. However, when comparing sales in 2022 and 2023 (i.e. during the war), only around one-fourth of manufacturing and one-third of SMEs have reported decreased sales. At the same time, around one-third of manufacturing firms and 40 percent of SMEs reported a rise in sales in 2022. Finally, when asked about their business prospects for the next twelve months, 36 percent of manufacturing firms and 40 percent of SMEs claimed to be “optimistic” (or “moderately optimistic”).

Most responding firms reported a profit decrease of around 50 percent in the first year of the war. However, this share declined to approximately 40 percent in the period 2022-2023. Moreover, about 30 percent of manufacturing firms reported a profit rise in 2022-23. Around half of the firms (manufacturing firms and SMEs) reported increased costs due to the war. The main drivers of the cost increase included materials, energy, labour and transportation expenses. The main losses experienced by the responding firms during the war were workers, business contacts and relations, inventory, buildings and infrastructure. Average losses reported by the respondents were around US$900,000 per firm.

In terms of employment, around 50 percent of manufacturing firms and over 60 percent of SMEs reported to have fired at least one worker because of the war. The share of female employees in these layoffs was around 20 percent for manufacturing and 30 percent for SMEs, respectively. About half of the sample reported to employ people with disabilities and 12 percent of the responding firms have reported disabilities acquired by their employees because of the war.

TABLE 3.11: UNIDO ENTERPRISE SURVEY 2023, RESPONDENTS BY SECTOR

Source: UNIDO Enterprise Survey, 2023.

SECTOR	DOM.	FOREIGN-OWNED	M.H.-TECH	M.L.-TECH	EXPORTERS	NON-EXPORTERS	LARGE FIRMS	SMEs	TOTAL SURVEY	TOTAL IN UKRAINE	SECTOR SHARE IN UKRAINE	SECTOR SHARE IN ANSWERS	DIFFERENCE WRT SHARE IN UKRAINE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Manufacturing							Share	in total	77%	20%			
Basic metals	5	0	5	0	1	4	0	5	5	863	0.16%	1.00%	0.84%
Beverages	4	0	4	0	0	4	0	4	4	1,051	0.19%	0.80%	0.61%
Chemicals and chemical products	15	1	16	0	5	11	1	15	16	2,591	0.47%	3.19%	2.72%
Coke and refined petroleum products	1	0	1	0	1	0	0	1	1	137	0.03%	0.20%	0.17%
Computer, electronic and optical products	6	0	0	6	3	3	2	4	6	1,298	0.24%	1.20%	0.96%
Electrical equipment	25	1	0	26	6	20	2	24	26	1,505	0.28%	5.19%	4.91%
Fabricated metal products, except machinery and equipment	24	0	24	0	13	11	1	23	24	10,848	1.98%	4.79%	2.81%
Food products	43	2	45	0	16	29	9	36	45	15,109	2.76%	8.98%	6.22%
Furniture	25	0	25	0	7	18	5	20	25	8,412	1.54%	4.99%	3.45%
Leather and related products	2	0	2	0	0	2	0	2	2	1,838	0.34%	0.40%	0.06%
Machinery and equipment (not elsewhere classified).	49	1	0	50	34	16	6	44	50	3,690	0.67%	9.98%	9.31%
Medical and dental instruments and supplies	6	0	0	6	1	5	0	6	6	1,187	0.22%	1.20%	0.98%
Motor vehicles, trailers and semi-trailers	5	0	0	5	1	4	1	4	5	462	0.08%	1.00%	0.91%
Other manufacturing	48	1	49	0	28	21	4	45	49	3,706	0.68%	9.78%	9.10%
Other non-metallic mineral products	9	0	9	0	6	3	2	7	9	9,012	1.65%	1.80%	0.15%
Other transport equipment	6	0	0	6	2	4	0	6	6	550	0.10%	1.20%	1.10%
Paper and paper products	11	0	11	0	5	6	1	10	11	1,690	0.31%	2.20%	1.89%
Pharmaceuticals and medicinal chemicals	2	0	0	2	1	1	1	1	2	278	0.05%	0.40%	0.35%
Printing and reproduction of recorded media	13	0	0	13	9	4	3	10	13	4,564	0.83%	2.59%	1.76%
Repair and installation of machinery and equipment	17	0	0	17	3	14	0	17	17	12,957	2.37%	3.39%	1.02%
Rubber and plastic products	25	0	25	0	10	15	2	23	25	3,890	0.71%	4.99%	4.28%
Textiles	6	0	6	0	3	3	0	6	6	2,806	0.51%	1.20%	0.68%

SECTOR	DOM.	FOREIGN-OWNED	M.H.-TECH	M.L.-TECH	EXPORTERS	NON-EXPORTERS	LARGE FIRMS	SMEs	TOTAL SURVEY	TOTAL IN UKRAINE	SECTOR SHARE IN UKRAINE	SECTOR SHARE IN ANSWERS	DIFFERENCE WRT SHARE IN UKRAINE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Tobacco products	0	0	0	0	0	0	0	0	0	46	0.01%	0.00%	-0.01%
Wearing apparel	15	0	15	0	10	5	2	13	15	9,979	1.82%	2.99%	1.17%
Wood and products of wood and cork, except furniture; articles of straw and plaiting materials	18	0	18	0	12	6	2	16	18	13,111	2.40%	3.59%	1.20%
Non-manufacturing							Share	in total	23%	80%			
Construction	78	0	0	0	7	71	5	73	78	56,627	10.35%	15.57%	5.22%
Information and communication	26	0	0	0	8	18	2	24	26	284,141	51.95%	5.19%	-46.76%
Transportation and storage	11	0	0	0	5	6	0	11	11	94,633	17.30%	2.20%	-15.11%

Note: MH tech = medium-high technology; ML = medium-low technology; SMEs = small and medium-sized enterprises. Total number of respondents = 501. Columns (1) – (9) represent number of respondents in a corresponding category. Tables (11) – (13) - represent the share of a category in a corresponding total number of firms.

TABLE 3.12: MAIN BOTTLENECKS TO DOING BUSINESS IN UKRAINE, BEFORE THE WAR DUE TO IMPACT OF THE WAR

Source: UNIDO Enterprise Survey, 2023.

BOTTLENECK	BEFORE THE WAR			DURING THE WAR		
	ALL	MNF	SMEs	ALL	MNF	SMEs
High bureaucracy	53%	40%	47%	54%	41%	49%
Complexity of the tax system	52%	41%	48%	56%	44%	50%
Tax rates	50%	40%	45%	47%	36%	43%
Availability of skilled personnel	43%	34%	40%	82%	64%	72%
Corruption	40%	29%	36%	47%	33%	41%
Cost of energy	38%	32%	34%	75%	61%	66%
Access to finance	37%	29%	34%	62%	49%	56%
Cost of materials	35%	29%	31%	78%	61%	70%
Political instability	34%	26%	31%	57%	43%	50%
Courts	32%	24%	29%	31%	22%	28%
Competition with the informal sector	24%	19%	22%	33%	25%	30%
Customs	24%	18%	22%	34%	27%	31%
Access to land	21%	15%	19%	24%	18%	22%
Availability of non-skilled personnel	21%	16%	19%	74%	57%	66%
Availability of energy	20%	17%	18%	69%	56%	62%
Availability of materials	19%	16%	17%	64%	51%	56%
Blocking of accounts	18%	13%	17%	29%	22%	26%
Labour regulations	18%	13%	16%	26%	19%	23%
Commercial license permits	17%	12%	16%	19%	14%	17%
Logistics and transportation	14%	12%	12%	55%	44%	48%
Crime	13%	10%	13%	21%	15%	19%
Telecom infrastructure	6%	4%	6%	14%	10%	13%

Note: Total number of respondents is 501. Columns “Before the war” contain a share of respondents that indicated these issues as “Very serious” or “Major” before the war. “During the war” columns include shares of respondents who stated these issues deteriorated during the war. All = responding firms; MNF = manufacturing firms; SMEs = small and medium-sized enterprises.

TABLE 3.13: UKRAINE'S 'MOST PRESSING' WAR-RELATED PROBLEMS, MANUFACTURING FIRMS AND SMES

Source: UNIDO Enterprise Survey, 2023.

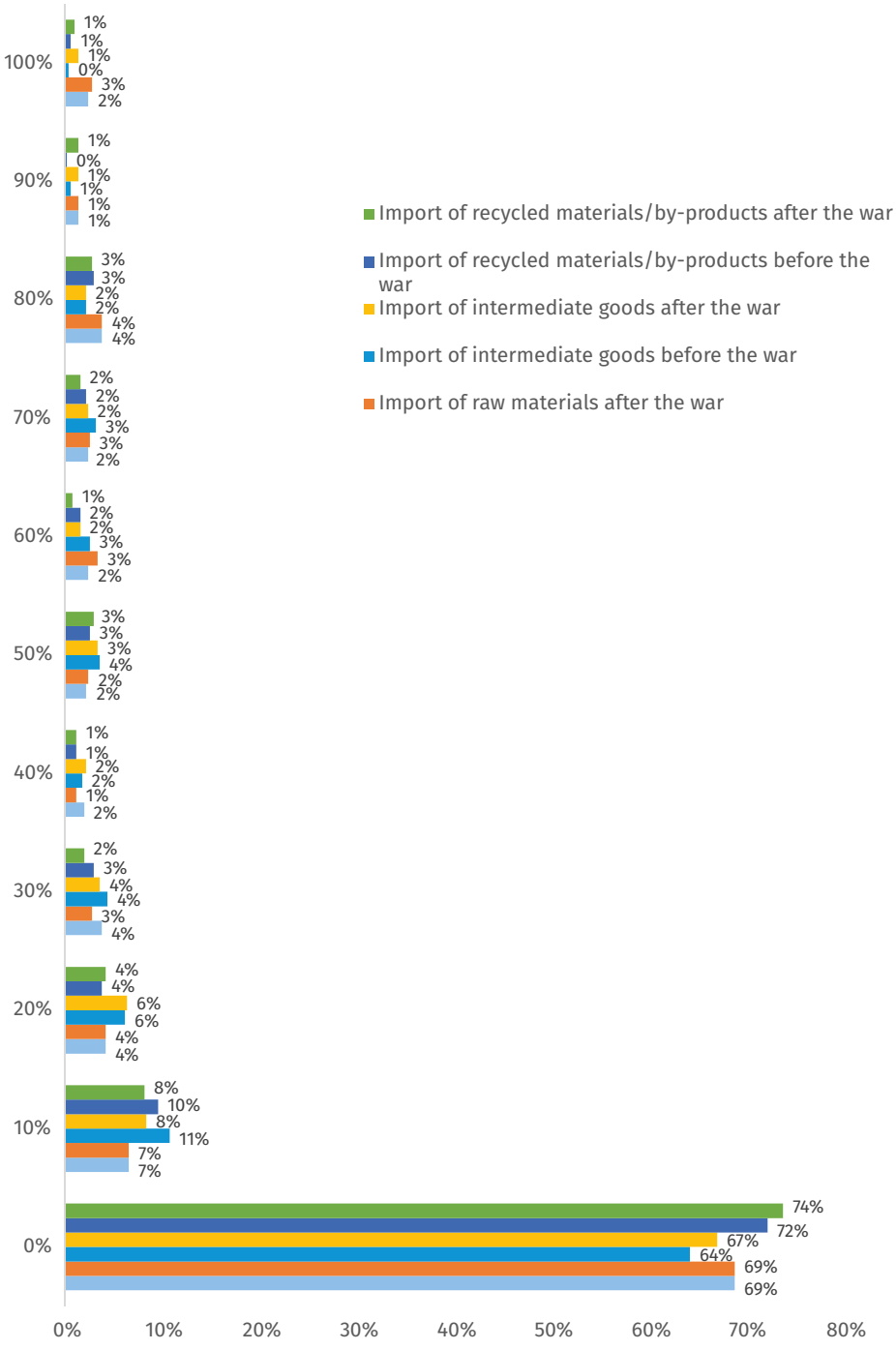
NEW WAR-RELATED PROBLEM	FIRST			SECOND			THIRD		
	All	MNF	SMEs	All	MNF	SMEs	All	MNF	SMEs
Clients are buying less	41%	32%	37%	7%	5%	7%	7%	5%	6%
Workers are unable to work due to conscription into the armed forces of Ukraine	14%	10%	12%	18%	13%	16%	13%	10%	11%
Production costs have increased	11%	9%	9%	22%	19%	20%	8%	7%	8%
Difficulty in securing operating capital	6%	4%	5%	6%	5%	5%	8%	5%	7%
Other	6%	5%	6%	1%	1%	1%	3%	1%	3%
Interruptions of energy supply, including rising costs of energy, such as gas and electricity	5%	5%	5%	11%	9%	9%	11%	9%	9%
Lack of support from the state and local authorities	4%	2%	4%	4%	2%	4%	8%	6%	8%
Foreign business-trips ban for men	3%	2%	3%	4%	3%	4%	9%	7%	8%
The firm's property is lost (destroyed), partially lost	2%	2%	2%	2%	1%	2%	2%	2%	2%
Supply and distribution chains are disrupted	2%	1%	2%	4%	4%	4%	2%	2%	2%
Foreign partner firms refuse to continue cooperation	1%	1%	1%	3%	2%	3%	3%	2%	3%
Logistics and transport	1%	1%	0%	3%	3%	3%	7%	6%	5%
Existing orders cannot be delivered	1%	1%	1%	2%	2%	1%	2%	1%	1%
New or higher taxes	1%	1%	1%	3%	2%	3%	4%	3%	4%
International transactions are restricted	1%	0%	0%	1%	1%	1%	1%	1%	1%
Workers are unable to work due to destroyed infrastructure or forced relocation	0%	0%	0%	3%	2%	3%	2%	1%	1%
Workers are unable to work due to illness/injury	0%	0%	0%	1%	0%	1%	1%	1%	1%

Note: Total number of respondents = 501. Columns contain a share of respondents that indicated these issues as "First," "Second," or "Third" most pressing. All = responding firms; MNF = manufacturing firms; SMEs = small and medium enterprises.

Interestingly, the war has had a relatively minor effect on the share of exports of Ukrainian firms. Respondents reported a decrease in exports between 2-4 percentage points. On average, the share of exports in total sales was reported to have declined from 11 to 10 percent because of the war. A similar picture can be observed regarding imports of intermediate goods, raw materials and by-products. Most of the surveyed firms reported only minor changes in their import structure (**Figure 3.5**).

FIGURE 3.5: IMPORTS OF INTERMEDIATE INPUTS, RAW MATERIALS AND BY-PRODUCTS, BEFORE AND DURING THE WAR

Source: UNIDO Enterprise Survey, 2023.



Note: Total number of respondents = 501.

In terms of investment activity, the main areas affected by the war included new equipment and machinery, employee training, infrastructure and the latest software. Unfortunately, only around 15 percent of firms (manufacturing and SMEs) reported some re-orientation of business activity towards the EU because of the war. The main bottlenecks to closer integration of Ukrainian businesses with the EU include a *lack of clients and partners*, financial resources, *access to information, and language barriers*.

Next, we analyse firm responses to the ongoing military conflict. **Table 3.15** summarizes the main changes in operations implemented by Ukrainian firms in response to the war. The main changes in the day-to-day business activity of Ukrainian firms include changing of adjusting prices (43 percent), efficient use of resources (41 percent), increased remote work arrangements for employees (38 percent), the release of new products to meet changing market demands (34 percent), search for grant funding (34 percent), upgrading current products and services (28 percent), and an increase in online business activity (26 percent). Logically, changes related to the rise in online activity, home deliveries and remote work arrangements are likely associated with the difficulties of on-site work in the presence of continuous shelling, possible building damage, war-related workforce migration and other issues. At the same time, the issues related to changing prices, efficient use of resources and the search for grant funding are likely associated with liquidity problems that surged during the war.

A considerable percentage of firms have reported changes in production processes (20.5 percent), firm organization (29.5 percent) or energy infrastructure (25 percent) that were introduced to cope with war-related energy shortages. These findings resonate with the fact that around 50 percent of responding firms reported introducing different resource efficiency measures before or during the war (**Figure 3.6**). About 15 percent of the firms in the survey reported an increase in the use of digital technologies, while 9 percent introduced a new digitalization technology because of the war.

Moreover, **Figure 3.6** indicates that between 20 percent and 50 percent of firms introduced some kind of circular economy activity before or during the war. This further evidences positive patterns in investment in circular economy activities among Ukrainian firms. All the above, coupled with a swift sales and profits recovery, points to the significant dynamism, adaptability and resilience of Ukrainian businesses.

At the same time, the main obstacles to implementing circular economy activities and new technologies cited by Ukrainian businesses include lack of government support, lack of access, the high price of technology, and lack of skilled labour (**Figure 3.7**). These results indicate the lack of dynamism in these areas and the need for technology transfers and government support.

TABLE 3.14: IMPACT OF WAR ON FIRM ACTIVITY, BY FIRM SUBGROUP

Source: UNIDO Enterprise Survey, 2023.

IMPACT	ALL FIRMS	MNF	DOMESTIC	EXPORTERS	FOREIGN-OWNED	M.H.-TECH	LARGE FIRMS	M.L.-TECH	NON-EXPORTERS	NON-MNF	SMES
Cash flow	80%	63%	79%	32%	1%	42%	8%	21%	48%	18%	73%
Closure	38%	30%	38%	16%	1%	22%	4%	8%	22%	8%	34%
Cost decrease wrt 2021	33%	24%	33%	14%	0%	14%	2%	10%	19%	9%	31%
Cost decrease wrt 2022	16%	11%	16%	6%	0%	7%	1%	4%	10%	5%	15%
Cost increase wrt 2021	55%	46%	55%	22%	0%	32%	8%	14%	34%	10%	48%
Cost increase wrt 2022	60%	49%	59%	26%	1%	34%	7%	15%	34%	11%	53%
Damages	83%	63%	81%	34%	1%	41%	9%	23%	49%	19%	74%
In operation	96%	75%	95%	38%	1%	50%	10%	25%	58%	21%	86%
Inputs	71%	57%	70%	29%	1%	38%	8%	19%	42%	14%	62%
Layoffs	70%	53%	70%	30%	1%	34%	7%	19%	40%	18%	63%
Outlook	47%	36%	46%	19%	1%	23%	5%	13%	28%	11%	41%
Profits decrease wrt 2021	76%	56%	75%	30%	1%	36%	8%	21%	46%	19%	68%
Profits decrease wrt 2022	40%	30%	39%	16%	0%	19%	3%	11%	24%	10%	37%
Profits increase wrt 2021	15%	14%	15%	6%	0%	11%	1%	3%	9%	1%	14%
Profits increase wrt 2022	37%	29%	36%	16%	0%	20%	5%	9%	21%	7%	32%
Relocation	13%	10%	12%	8%	1%	7%	2%	3%	5%	3%	11%
Reorientation	18%	15%	18%	15%	0%	11%	4%	4%	3%	3%	14%
Sales decrease wrt 2021	64%	48%	63%	25%	1%	30%	6%	18%	39%	16%	58%
Sales decrease wrt 2022	36%	26%	35%	14%	0%	16%	3%	10%	21%	9%	32%
Sales increase wrt 2021	22%	29%	36%	14%	0%	21%	4%	8%	22%	7%	32%
Sales increase wrt 2022	43%	35%	43%	18%	1%	24%	5%	11%	25%	8%	39%
Share of women in layoffs	20%	21%	20%	24%	20%	17%	33%	17%	24%	21%	33%

Note: Total number of respondents = 501. Columns contain shares of respondents in each category that responded positively to having experienced the impact indicated in the first column. MNF = manufacturing; M.H. tech = medium-high technology; Low tech = low technology; Non MNF = non-manufacturing; SMEs = small and medium-sized enterprises.

TABLE 3.15: FIRMS' RESPONSE TO THE WAR, MANUFACTURING FIRMS AND SMES

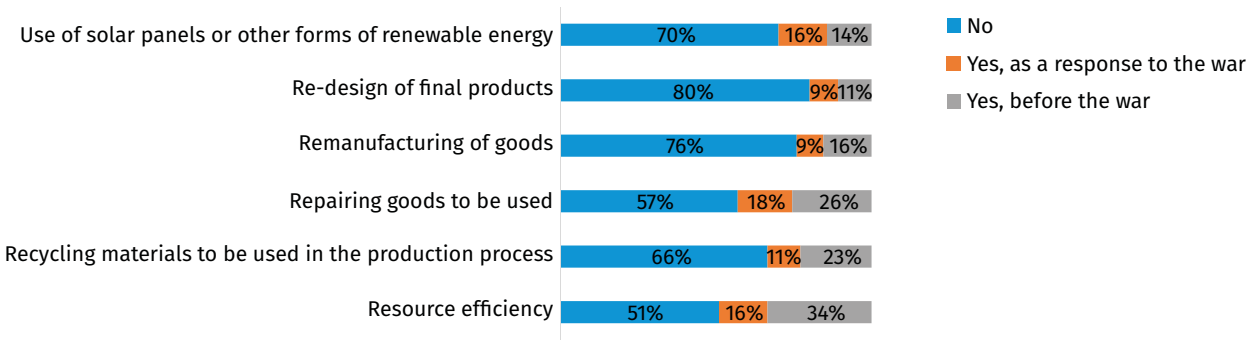
Source: UNIDO Enterprise Survey, 2023.

CHANGE IMPLEMENTED IN RESPONSE TO THE WAR	ALL	MNF	SMEs
Changing or adjusting pricing	43%	44%	43%
Efficient use of resources	41%	44%	40%
Started or increased remote work arrangements for its workforce	38%	37%	37%
Released new products to meet changing market demands	34%	38%	32%
Searching for grant funding	34%	37%	32%
Upgrading current products/services	28%	31%	27%
Started or increased business activity online (e.g. online sales)	26%	28%	25%
Domestic market expansion	25%	27%	25%
More cooperation among domestic firms	24%	25%	24%
Expanding promotion or advertising	21%	24%	20%
Administrative and safety measures	17%	18%	16%
Research and development	17%	19%	16%
Business diversification (e.g. change industry/sector)	17%	18%	17%
Expanding the market for exports or expanding imports to replace inputs	14%	15%	12%
Converted, partially or fully, final products to address the impacts of the war	13%	15%	13%
Shift to high-value-added products/services	12%	14%	12%
Import substitution of products or components	10%	11%	10%
Started or increased delivery or carry-out of goods or services	9%	10%	8%
Not changed	9%	6%	10%
Introduced new equipment to reduce the number of workers needed on the shop floor	8%	9%	8%
Relocation	8%	8%	8%
Online platform penetration (domestic or international)	4%	4%	4%
Environmental protection	1%	1%	1%

Note: Total number of respondents = 501. Columns contain shares of respondents in each category that implemented the change. MNF = manufacturing; SMEs = small and medium-sized enterprises.

FIGURE 3.6: INTRODUCTION OF CIRCULAR ECONOMY ACTIVITIES IN UKRAINE, BEFORE AND DURING THE WAR

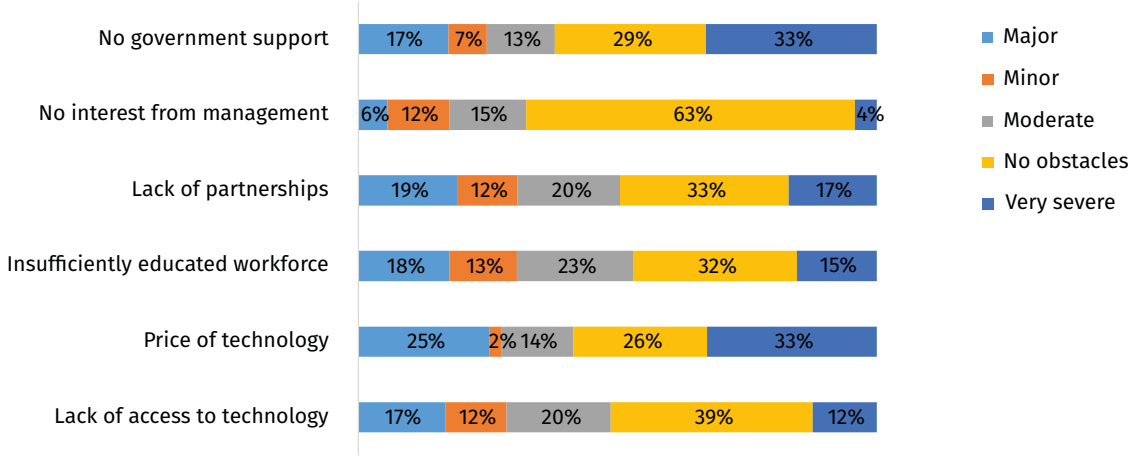
Source: UNIDO Enterprise Survey, 2023.



Note: Total number of respondents = 501. Each percentage represents a share of respondents indicating the introduction of circular economy activities.

FIGURE 3.7: OBSTACLES TO IMPLEMENTING CIRCULAR ECONOMY ACTIVITIES IN UKRAINE

Source: UNIDO Enterprise Survey, 2023.



Note: Total number of respondents = 501. Each percentage represents a share of respondents indicating obstacles to implementing circular economy activities.

Next, we analyse the primary sources of external funding and main policy measures introduced by various funding bodies in response to the war. **Table 3.16** lists leading organizations that supported Ukrainian firms before or during the war. The table suggests that most support was provided by the national government, followed by international organizations, non-governmental organizations and the domestic private sector.

TABLE 3.16: FUNDING AND POLICY ORGANIZATIONS SUPPORTING BUSINESS IN UKRAINE

Source: UNIDO Enterprise Survey, 2023.

ORGANIZATION	SHARE OF FIRMS
National government	17%
Local government, e.g., municipality, rayon, district, and oblast	5%
Non-governmental organization	7%
International organization	10%
Domestic private sector	10%
Foreign private sector	5%

Note: Total number of respondents = 501. Each percentage represents a share of respondents receiving support from a corresponding organization.

The types of policy measures presented in **Tables A4 and A5**[8] of the Appendix indicate an overall increase in policy support during the war. The main types of support measures targeted financial aspects of firm activity, such as deferral of credit payments, rent or mortgages, and providing access to new credit. Most of the support was received from the national government, offering tax exemptions and reductions. Non-government organizations (NGOs) and the domestic private sector have also increased their support, providing deferral of different types of payments and access to new credit. Additionally, Panel A in **Table A4** indicates that non-governmental organizations have increased their support in expanding

into new markets and marketing consulting and training. At the same time, the results indicate negligible levels of support from local government, international organizations and foreign private companies.

The list of the most effective policy measures implemented by different funding bodies during the war is presented in **Table 3.17**. The results indicate that the firms' view is mainly aligned with the main types of support measures introduced (**Table A5**). Most measures related to financial aspects of activity, such as deferral of credit payments, rent or mortgage, access to new credit, tax exemptions, reductions or deferral of tax payment, and preferential loans and grant support, are found most helpful by manufacturing firms and SMEs.

TABLE 3.17: UKRAINE'S MOST HELPFUL POLICY MEASURES, BY FIRM TYPE

Source: UNIDO Enterprise Survey, 2023.

MEASURE	FIRST			SECOND			THIRD		
	All	MNF	SMEs	All	MNF	SMEs	All	MNF	SMEs
Tax exemptions or reductions	10%	9%	10%	10%	10%	10%	6%	6%	6%
Grant support	10%	12%	10%	7%	8%	7%	3%	3%	3%
Access to new credit	7%	8%	8%	5%	5%	5%	5%	5%	5%
Deferral of credit payments	9%	9%	7%	4%	4%	3%	3%	4%	3%
Preferential loans	5%	6%	5%	5%	5%	5%	4%	3%	4%
Deferral of rent or mortgage	5%	5%	5%	5%	5%	5%	2%	2%	1%
Cash transfers for business	5%	5%	5%	2%	2%	2%	2%	3%	2%
Deferral of tax payments or temporary suspensions (e.g., VAT suspension)	2%	2%	2%	4%	3%	3%	3%	3%	4%
Assistance in upgrading the production	2%	2%	2%	4%	4%	4%	3%	3%	3%
Help with finding customers	2%	2%	2%	1%	2%	1%	4%	3%	4%
R&D or innovation subsidies/grants	1%	1%	1%	3%	4%	4%	1%	1%	1%
Lowering the administration burden	2%	1%	2%	2%	2%	2%	2%	2%	2%
Participation in international exhibitions	0%	1%	0%	1%	1%	0%	4%	5%	4%
Wage subsidies	1%	1%	1%	2%	2%	2%	2%	2%	2%
Import and export regulations to support your industry	2%	2%	2%	1%	1%	1%	1%	2%	2%
Promoting Ukrainian businesses in foreign markets	1%	1%	1%	1%	1%	1%	2%	3%	2%
Rent cancellation or compensation	1%	0%	1%	1%	1%	1%	2%	2%	2%
Assistance in export activities	0%	1%	0%	1%	1%	1%	2%	2%	2%
Updating legislation	1%	1%	1%	1%	0%	1%	2%	2%	2%
Cooperation with foreign businesses	1%	1%	1%	1%	1%	1%	1%	1%	1%
Assistance in expanding sales markets	1%	1%	0%	1%	1%	1%	2%	2%	2%
Other	1%	1%	1%	0%	0%	0%	1%	1%	1%
Marketing consulting/training	0%	0%	0%	1%	0%	1%	1%	1%	1%
Legal advice and accounting	0%	0%	0%	0%	0%	0%	1%	1%	2%
Marketing research of foreign markets	0%	0%	0%	1%	1%	0%	1%	1%	1%
Advice on finding a new niche	0%	0%	0%	0%	1%	0%	0%	0%	0%
Support for strategy development	0%	0%	0%	0%	0%	0%	1%	1%	1%

MEASURE	FIRST			SECOND			THIRD		
	All	MNF	SMEs	All	MNF	SMEs	All	MNF	SMEs
Staff retraining	0%	0%	0%	0%	1%	0%	0%	0%	0%
Assistance in relocation	0%	0%	0%	0%	0%	0%	0%	0%	0%
Consulting on expanding sales markets and searching for customers	0%	0%	0%	0%	0%	0%	0%	0%	0%
Technology transfer facilitation	0%	0%	0%	0%	0%	0%	0%	0%	0%
Consultation on the documentation required for export	0%	0%	0%	0%	0%	0%	0%	0%	0%
Copyright protection	0%	0%	0%	0%	0%	0%	0%	0%	0%
Providing information (statistical and marketing) for conversion purposes	0%	0%	0%	0%	0%	0%	0%	0%	0%
Training on how to sell on international platforms	0%	0%	0%	0%	0%	0%	0%	0%	0%
If Other, please specify	0%	0%	0%	0%	0%	0%	0%	0%	0%

Note: Total number of respondents = 501. Each percentage represents a share of respondents indicating each policy measure as the "First," "Second," or "Third" most helpful policy measure. MNF = manufacturing firms, SME = small and medium-sized enterprises.

Next, when asked about the areas where the recovery support would be needed most, both manufacturing firms and SMEs indicated financial sources, dealing with red-tape, exploration and access to new international and domestic markets, management of government public procurement orders, and development of new products (**Table 3.18**).

TABLE 3.18: AREAS NEEDING SUPPORT FOR RECOVERY IN UKRAINE, BY FIRM TYPE

Source: UNIDO Enterprise Survey, 2023.

AREA	ALL	MNF	SMEs
	(1)	(2)	(3)
Financial sources	58%	60%	57%
Dealing with red tape	45%	43%	45%
Exploration and access to new international markets	34%	39%	33%
Management of government public procurement orders	22%	20%	23%
Exploration and access to new domestic markets	20%	20%	21%
The firm will not need government support	13%	11%	13%
Development of new products	13%	14%	13%
Digitalization of the firm	12%	11%	12%
R&D and innovation	11%	12%	10%
Reorganization of supply chains	9%	10%	7%
Development of business continuity plans	7%	6%	7%
Development of new skills	4%	2%	4%
Other	0%	0%	0%

Note: Total number of respondents = 501. Each percentage represents a share of respondents indicating an area that needs the most support. MNF = manufacturing firms; SME = small and medium-sized enterprises.

Regarding support from local governments, the most desired measures for all types of firms included support for better infrastructure and buildings, access to finance, recruitment, regional/national cooperation and sustainable measures (**Table 3.19**). Overall, these findings once again confirm the need for support in the post-war recovery and reparation of the infrastructural damages and employment losses suffered by businesses as a result of the war.

TABLE 3.19: DESIRED LOCAL GOVERNMENT SUPPORT MEASURES, BY FIRM TYPE

Source: UNIDO Enterprise Survey, 2023.

MEASURE	ALL	MNF	SMEs
Support for better infrastructure	41%	42%	40%
Advice and support for access to finance	37%	38%	37%
Support for finding employees	27%	29%	26%
Support for regional/national cooperation	27%	26%	26%
Support for sustainable measures	24%	25%	23%
Active promotion of your production	21%	22%	20%
Support for property/building	20%	23%	21%
Advice and support in achieving international	17%	17%	17%
Support for promoting foreign investment	15%	16%	15%
Support for new, sustainable products	11%	12%	11%
Support on clustering to enable collection	2%	2%	2%

Note: Total number of respondents = 501. Columns contain shares of respondents in each category that indicated the policy support measure as desired. MNF = manufacturing firms, SME = small and medium-sized enterprises.

Finally, the potentially most effective policy support measures include tax exemptions and reductions, preferential loans, access to new credit, grant support, assistance in upgrading production, public procurement, and promotion of Ukrainian businesses in the foreign markets (**Table 3.20**).

TABLE 3.20: MOST POTENTIALLY EFFECTIVE POLICY SUPPORT MEASURES, BY FIRM TYPE

Source: UNIDO Enterprise Survey, 2023.

MEASURE	ALL	MNF	SMEs
	(1)	(2)	(3)
Grant support	45%	50%	45%
Tax exemptions or reductions	41%	42%	42%
Preferential loans	39%	41%	38%
Assistance in upgrading the production	32%	38%	30%
Promotion of Ukrainian businesses in the foreign markets	30%	33%	29%
Access to new credit	28%	30%	27%
Public procurement	27%	26%	27%
Lowering the administration burden	23%	22%	23%
Updating legislation	23%	22%	23%
Participation in international exhibitions	21%	24%	19%
Deferral of tax payment (e.g. VAT suspension)	20%	21%	20%
Cooperation with foreign businesses	20%	22%	20%
Import and export regulations to support industry	18%	21%	17%
Assistance in expanding sales markets	17%	19%	17%
Help with finding customers	17%	16%	18%
Deferral of credit payments	17%	18%	16%
R&D or innovation subsidies/grants	16%	18%	15%
Marketing research of foreign markets	15%	17%	15%
Assistance in arranging export activities	14%	17%	14%
Wage subsidies	13%	14%	13%
Deferral of rent or mortgage	12%	12%	13%
Consulting on the documentation required for export	12%	13%	13%
Rent cancellation or compensation	12%	13%	12%
Consulting on expanding sales markets and searching for customers	11%	13%	11%
Copyright protection	10%	10%	11%
Cash transfers for business	10%	10%	10%
Marketing consulting/training	9%	11%	9%
Legal advice and accounting	7%	7%	7%
Support to strategy development	7%	7%	7%
Staff retraining	7%	7%	6%
Advice on finding a new niche	6%	6%	6%
Training on how to sell on international platforms	6%	7%	6%
Providing information (statistical and marketing) for conversion purposes	5%	5%	4%
Technology transfer facilitation	4%	4%	4%

Note: Total number of respondents = 501. Each percentage represents a share of respondents indicating potentially most effective policy support. MNF = manufacturing firms, SME = small and medium-sized enterprises.

In summary, the analysis of the results of the UNIDO survey conducted in Ukraine in October-November 2023 indicates that, as a result of the war, the bottlenecks to business in Ukraine have shifted towards issues related to factors of production, such as energy, transportation and lack of labour force, and issues related to the financial aspects of firm activity, including problems with liquidity and access to finance.

Ukrainian businesses demonstrated remarkable resilience in adjusting their daily activities to the realities of the war by moving to online operations, introducing flexible remote-working arrangements, and new products and services. Furthermore, a significant share of firms has reported an increase in the efficient use of resources and the implementation of energy-saving and digitization technologies before or during the war. Yet, despite some positive dynamics, some areas still show the need for financial and technical assistance and margins of improvement.

Regarding policy support, the national government, non-governmental organizations and the domestic private sector have been most active in supporting Ukrainian businesses. The most frequently implemented support measures included a deferral of credit payments, rent or mortgage; access to new credit; tax exemptions, reductions or deferral of tax payment; preferential loans and grant support.

The policy support measures mentioned above are closely aligned with the issues brought up by the Ukrainian businesses as the most crucial for recovery. These included financial sources, dealing with red tape, exploration and access to new international and domestic markets. At the same time, the support sought the most from municipalities included issues related to infrastructure improvements, assistance with the recruitment of personnel and measures related to regional and national cooperation. These results reveal the need for a more active role of local governments in the post-war recovery process.

Overall, the main demands coming from Ukrainian businesses can be classified into three broad areas: (1) financial assistance and support with liquidity problems; (2) regulatory improvements and reduction in bureaucracy; and (3) technical assistance related to the expansion into new markets, adoption of new technologies, and implementation of circular economy activities. When the role of municipalities is concerned, the demands of Ukrainian businesses are concentrated chiefly on targeted measures to support the recovery of war-related damages, including infrastructure, buildings and personnel.

The primary policy responses initiated by the Ukrainian government and international funding bodies are aligned with the demands of Ukrainian manufacturing firms and SMEs. At the same time, results of the UNIDO survey indicate that most of the support is currently concentrated on the financial aspects of firm activity, while other issues remain slightly overlooked. Hence, one of the main recommendations from this section is the need for stronger involvement of local municipalities in the recovery process and a higher number of technical assistance programmes in market expansion and technology adoption.

3.3.5 IMPACT ON SECTORS

Two of the sectors affected most by the war according to survey respondents are the metallurgy and the mining industries. The war has particularly badly hit these two for several reasons. First, most of the production capacities of these sectors are in south-eastern Ukraine, a significant part of which is at the front line or under temporary military control of the Russian Federation. Furthermore, due to rapid migration, these sectors are struggling with a deficit of skilled labour. Other sector-specific issues include blocked export infrastructure - seaports; deficit of locomotives and wagons for metal and ore transportation; damaged vertically integrated value chains due to the temporary military control of the Russian Federation; and direct destruction of production facilities.

Potential solutions include the restoration of old and the development of new infrastructure to restore and improve the export potential and reduce transportation costs. This should be accompanied by the development of a climate policy that would stimulate producers to decarbonize during Ukraine's recovery.

The main issues mentioned by Ukrainian stakeholders during consultations conducted by national consultants on behalf of UNIDO in September 2023 demonstrate a shift towards bottlenecks in infrastructure and bottlenecks in factors of production.

The top two bottlenecks include access to energy and transport infrastructure. WBES data shows that these issues did not pose significant problems to Ukrainian businesses before the war. However, after the start of hostilities on Ukrainian energy and transport infrastructure coupled with a blockade of Ukrainian seaports, these issues became significant obstacles to Ukrainian firms.

The lack of a skilled labour force was already a problem for Ukrainian businesses and has been further aggravated by the military conflict in the country. The issue was mentioned by large industrial companies and by MSMEs across different sectors. Companies in the south and eastern regions are more severely affected due to their proximity to the front lines.

The issue of corruption has been a long-standing problem in Ukraine and came up again during consultations with stakeholders. Representatives of large industrial companies mentioned it mainly in relation to access to natural resources and unfair practices in public procurement.

Issues related to finance access were discussed several times in the consultations. Indeed, lack of access to attractive sources of financing was already a problem for Ukrainian businesses. The issue has become more pressing during the war as the choice of financing options became limited, and loan/credit conditions became more stringent, with many firms relying on government transfers or foreign aid.

Additionally, several stakeholders brought up issues related to the declining internal market. Indeed, high emigration, combined with uncertainty and high inflation rates, is suppressing domestic consumption, leading to the decline of the internal market for Ukrainian firms. While some companies have successfully expanded to foreign markets to compensate for depressed domestic demand, others (e.g. the construction sector) have struggled with declining demand for their products and services.

Finally, several representatives of Ukrainian MSMEs mentioned the lack of knowledge about international trade as one of the key obstacles. Indeed, as mentioned in the *Consultation Report*, while some manufacturing companies have tried to expand into the European market, they still face problems due to the differences in standards, classification requirements and business ethics. Hence, export promotion, information and support campaigns are emerging as priorities for the Ukrainian manufacturing sector.

Regional aspects of war-related factors may evolve in some regions. Most of the production facilities in mining and metallurgy are in the front-line regions

or are in the areas that are or have been under temporary military control of the Russian Federation. At the same time, the relocation of mining and metallurgy companies is impossible because the critical factors for the economic viability of such enterprises are access to resources (ore) and sophisticated production infrastructure that does not exist in other parts of the country.

Some production facilities, such as Azovstal, are under the temporary military control of the Russian Federation and have been demolished. This has significantly damaged the vertically integrated value chains within large corporations, and companies are currently searching for new supplies to cover their production needs.

3.3.6 EXPECTATIONS OF BUSINESS

The full-scale invasion of Ukraine has resulted in significant changes in consumer and producer expectations dynamics. Overall, the changes in producer expectations have trended downward throughout 2022, with a recovery beginning in the first quarter of 2023. Regarding consumers, after the initial spike in consumer confidence in early 2022, most indices remained relatively stable.

Throughout 2022, consumers were more optimistic than the producers. With the start of the invasion, the situation began to deteriorate gradually and continued to decline until May 2022. Expectations of entrepreneurs in almost all industries in Ukraine have remained significantly less optimistic than those of the general consumer. However, regarding sectoral distribution, entrepreneurs from the retail sector are generally more favourable than those from the construction and manufacturing sectors. The services sector demonstrated the average level of optimism, likely to be explained by the damage incurred by the population reduction.

3.4 ANALYSIS OF POLICY OPTIONS THAT SHOULD AID INDUSTRIAL RECOVERY AND SUPPORT PRIVATE-SECTOR DIVERSIFICATION STRATEGIES

This section discusses the main policy options that could target business obstacles while considering the compounding effects of the ongoing war in Ukraine. In recent years, Ukraine has placed a lot of importance on policies aimed at improving governance and public administration to ensure its alignment with OECD and EU standards as part of its EU integration process. According to the OECD (2022), Ukraine achieved 57 percent of its performance targets detailed in its Public Administration Reforms Strategy and finalized 87 percent of planned actions in the accompanying Action plan.

The main priorities of the Public Administration Reform Strategy included (1) delivering high-quality public service to businesses and citizens, (2) building a professional and politically neutral public service, and (3) building effective and accountable public institutions. Ukraine also established a basic legal framework for policy development and coordination and strategic planning (IMF, 2022).

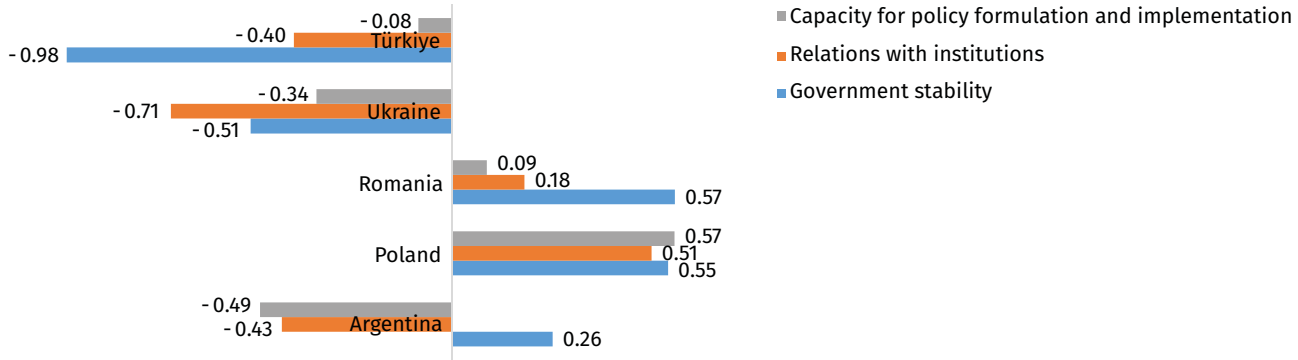
After the 2014 Revolution of Dignity, Ukraine has created a stable infrastructure of anti-corruption bodies, including the National Agency for Corruption Prevention (NACP), responsible for the development of anti-corruption policy and coordination of implementation of anti-corruption strategy, as well as two law-enforcement bodies, the National Anti-Corruption Bureau of Ukraine (NABU) and the Special Anti-Corruption Prosecution Office (SAPO). The NABU is an independent police department dealing with the detection and investigation of high-level corruption, while the SAPO is an autonomous body inside the Prosecutor General's Office (PGO) responsible for prosecuting NABU's cases.

To explore the country's overall governance in more detail, we use the Word Bank Worldwide Governance Index, which relies on various sources, including think tanks, NGOs, business information providers and firm-level and household survey data. The original data set contains six indicators, each with a score ranging between -2.5 (weak) and 2.5 (strong). We then follow the UNIDO 2020 PCP Industrial Diagnostics Study for Cote d'Ivoire[9] and combine six indicators into three topics, where the topic score is obtained by taking an average of two indicators.

As shown in **Figure 3.8**, Ukraine still scores lower in terms of all three topics when compared to Eastern European countries like Poland and Romania. At the same time, Ukraine is much closer to Turkey and Argentina regarding its capacity for policy implementation and relations with institutions.

FIGURE 3.8: UKRAINE'S GOVERNANCE PERFORMANCE VS SELECTED COMPARATOR COUNTRIES, BY TOPIC, 2021

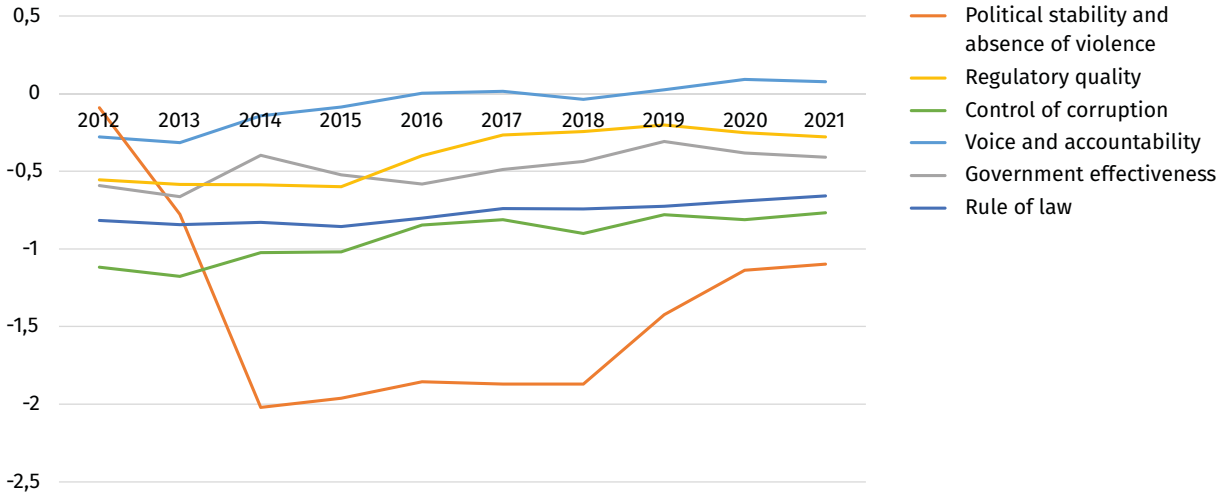
Source: World Bank, Worldwide Governance Index.



The trends of all six indicators between 2012 and 2021 are presented in **Figure 3.9**. The trends indicate that most indicators, apart from the Political stability and absence of violence indicator, show slight improvements. Political stability and lack of violence sharply declined around 2013 and stayed at low levels until 2018. This fall can be explained by the political instability related to the 2014 Revolution of Dignity and a consequent military conflict in the eastern part of the country.

FIGURE 3.9: UKRAINE'S ESTIMATED GOVERNANCE SCORES, BY INDICATOR, 2012-2021

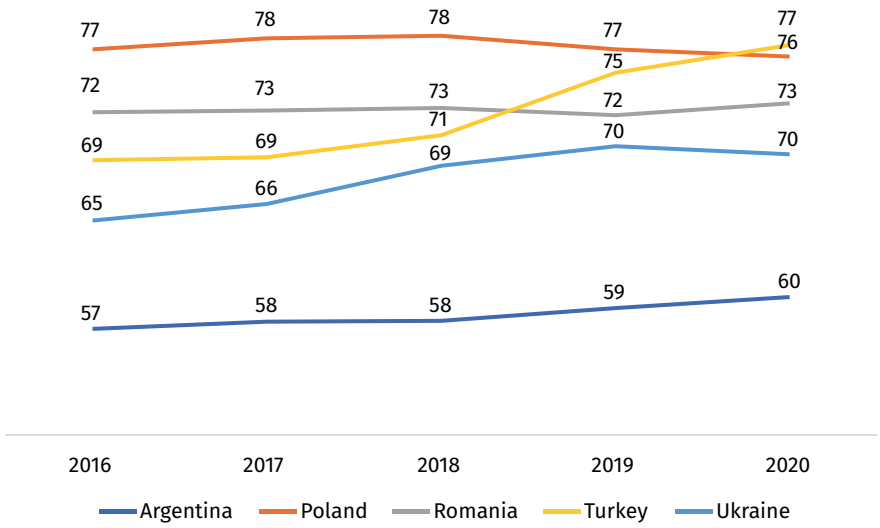
Source: World Bank, Worldwide Governance Index.



At the same time, Ukraine's performance on the World Bank Doing Business Index exhibit a positive trend over the last five years, bringing the country closer to Eastern European countries like Romania and Poland (**Figure 3.10**). This might be due to the latest government initiatives positively impacting the perception of the business environment by local and international firms operating in Ukraine.

FIGURE 3.10: UKRAINE'S DOING BUSINESS SCORES VS COMPARATOR COUNTRIES, 2015-2020

Source: World Bank, *Doing Business Report*. (accessed 11 September 2023)



3.4.1 POLICY INITIATIVES IN TIMES OF WAR

Most policy initiatives implemented during the war targeted supporting the production sector through relocation, subsidies, tax reductions and other means.

RELOCATION

Some relocation programmes have turned out to be successful. According to the data from the Ukrainian Ministry of Economy published at the end of 2022, 772 enterprises were relocated from dangerous regions, which allowed them to save more than 35,000 jobs.

Overall, the state's business relocation programme showed moderate results. During the first 10 months of the war, 16.4 percent of enterprises were relocated (2.2 percent of them abroad). Another 3.3 percent were planning to relocate but had not yet decided where. At the same time, more than 80.4 percent of enterprises did not relocate their business.

In total, 790 enterprises relocated, and 623 of them have resumed work at their new location. More than 650 enterprises that planned to relocate their production facilities refused to relocate because the areas where they were located are no longer under the temporary military control of the Russian Federation. Regionally, the largest number of enterprises moved to Lviv region (24 percent), Zakarpattia (14.5 percent), Chernivtsi (9.8 percent), Ivano-Frankivsk (8.3 percent), Khmelnytskyi (7.3 percent) and Ternopil (6.3 percent). The largest share of enterprises that moved their production facilities naturally (nearly 38 percent) came from the eastern regions. For the northern regions, this share is 16.7 percent; western regions, 15.4 percent; and southern regions, 11.8 percent. The fewest enterprises (just 7.1 percent) relocated from the central regions.

Looking at the sectoral breakdown, relocating enterprises in the professional services sector included marketing and consulting (41.6 percent, of which 16.6 percent were abroad), mechanical engineering (30.8 percent) and wholesale trade (25.5 percent). The share of relocating enterprises operating in the agricultural sector was only 14.3 percent; retail trade, 15.7 percent; IT, 19.4 percent (of which 2.8 percent were abroad); and food production, 15.8 percent.

OTHER BUSINESS-SUPPORT POLICIES IN TIMES OF WAR

Promotion of Ukrainian trade: Numerous countries abolished trade barriers with Ukraine to show their support. The United States, Canada, the EU, the United Kingdom and Australia have temporarily removed import duties for Ukrainian steel products.[10] The Government of Ukraine played a significant role in advocating for the interests of the Ukrainian economy. Future priorities in the area should promote Ukrainian products to other markets to foster the removal of tariff and non-tariff trade barriers while organizing export information and promotion campaigns at home to prepare domestic producers for foreign market expansion better.

Deregulation: The Ministry of Economy has significantly reduced the number of replicating permissions and licensing procedures, while the Ministry of Environment has been able to digitize licensing procedures.[11] The government has been crucial in deregulating land management in the mining industry, which required the approval of many stakeholders (including local governments). It is now unnecessary and fully managed and approved by just one agency, Derzhgeonadra.

Improvement of transport infrastructure: State-owned Ukrzaliznytsia has enabled 30 private companies to construct over 100 terminals on the western border to trans-ship on the border, mainly with Po-

land. Other projects have been focused on improving the railway system. Improvement of railway infrastructure – including (1) restored railroads on the Rava-Ruska-state border, (2) Khyri-Starzawa-State border, (3) Kovel-Yagudin-State border, and (4) electrified and reconstructed railroad on the Kovel-Izov-State border – has led to an increase in the export capacities of Ukrainian products. At the same time, infrastructure remains a critical bottleneck today. The key interventions that could help further improve the situation include (1) enabling private locomotive transport development;[12] (2) further development of transport infrastructure in western Ukraine by modernizing the railway system and improvement of management in the western railway system; (3) deblocking of ports, which would allow the use of traditional and economically viable sea routes (Boston Consulting Group, 2023).

Access to energy: The most significant breakthrough was synchronization with the ENTSO-E on 23 February 2022. Another important milestone was reached in January 2023 when the Government of Ukraine ensured a constant supply of imported electricity from the EU to industrial consumers. This allowed many companies to continue or even renew their operations.[13]

Financial measures: As discussed extensively in Section 3.3.4 financial assistance measures are the ones most frequently introduced by the national government and other funding bodies. These measures include: tax exemptions, grant support, access to new credit, preferential loans and cash transfers to business, among others. The UNIDO 2023 survey results show that Ukrainian firms consider financial types of policy support the most helpful ones.

3.4.2 POLICY INTERVENTIONS THAT COULD IMPROVE THE OVERALL SITUATION AND HELP IN GREEN RECOVERY

The government has made few efforts to develop climate policy. There is a risk that the Carbon Border Adjustment Mechanism (CBAM) will be imposed on Ukrainian products, although Ukraine has not yet formed any clear position on CBAM. As part of the EU integration process, Ukraine is committed to establishing the Emission Trading Scheme (ETS),[14] ensuring the equal treatment of producers in the EU and Ukraine. The introduction of the ETS implies that significant costs will be collected and allocated towards decarbonization, which means that specific funds should be established to allocate those finances effectively (European Commission, 2023).[15]

3.5 SUMMARY OF RESULTS AND IMPLICATIONS FOR INDUSTRIAL POLICY IN UKRAINE

This section provides a general discussion of the implications for the most effective policies to tackle issues faced by Ukrainian businesses, considering the effect of the ongoing military conflict in a large part of the country.

Overall, the analysis of the results of the WBES shows that before the war, the most critical issues for Ukrainian businesses were (1) corruption, (2) access to finance, (3) competition from the informal sector, (4) political instability, (5) tax rate, and (6) lack of skilled labour force. The list of the most pressing issues in Ukraine differs from that of other developing countries, where the prevalent problems are those related to infrastructure, such as access to electricity, telecommunications and land.

Ukraine is not a typical low-income developing country. As one of the transition economies, it inherited a well-developed industrial infrastructure that was built during the time of the Soviet Union. Hence, relative to most African and Latin American countries, such obstacles as access to telecommunications or electricity do not constitute a pressing issue for Ukrainian businesses. Like many developing countries, however, the Ukrainian private sector lacks financing due to high interest rates or stringent financing conditions. Another issue highlighted by Ukrainian businesses is informality. In 2019, according to the Ukrainian National Office of Statistics (2020), informal employment accounted for around 21 percent of total employment.[16] Such high informality (compared to just 10 percent for the EU28) is detrimental to productivity growth (ILO, 2020) and other aspects of successful industrial development. A higher tax burden and competition from the informal sector, in turn, hurt firms' investment in new technologies and human capital. Finally, the informal sector significantly limits fiscal space for public administration.

Another set of bottlenecks to business frequently mentioned by surveyed firms was related to governance, including political instability, tax rates and tax administration, and corruption. Bottlenecks in governance were among the top three issues voiced by the respondents of the WBES, as the Ukrainian political and business environment has been unstable for the last 10 years, starting with the Revolution of Dignity in 2013, followed by the non-recognized annexation of Crimea and the conflict in eastern Ukraine and finally, by the full-scale invasion of Ukraine and the ongoing conflict covering large parts of the country.

Since the beginning of the full-scale invasion of Ukraine that has resulted in significant damage to the Ukrainian infrastructure, issues related to infrastructure and factors of production have become more prominent. In contrast, issues related to governance have lost their importance. Political instability was not mentioned much during the consultations that took place in September 2023. One possible explanation is that political unrest is not considered an issue by the businesses that still operate in Ukraine, as the reality of the war has shifted theit attention to more pressing, day-to-day issues of electricity supply or lack of skilled labour. Indeed, this premise is confirmed by the results of consultations with private companies currently operating in Ukraine and by the results of the UNIDO survey that was run in Ukraine in autumn 2023. Survey respondents identified bottlenecks to business that have significantly deteriorated since the outbreak of the war, namely: (1) lack of reliable energy supply, a direct result of the bombings of energy infrastructure; (2) labour shortages due to a wave of migration and conscription into military service; (3) high cost of factors of production, including shortages and rising costs of materials; and (4) problems with liquidity and access to finance. A majority of firms indicate infrastructure for logistics and transportation as a

bottleneck that has deteriorated during the war and infrastructure as one of the priorities for local Governments action.

Considering current events and that the government policymaking capacity is limited, the Ukrainian government has implemented several policies that Ukrainian businesses view positively. The first and most immediate policy was assistance in relocating businesses to areas that were not under the temporary military control of the Russian Federation. During the first 10 months of the war, 16.4 percent of enterprises were relocated (2.2 percent of them abroad). **Other policy initiatives aimed at helping the private sector during this period were related to deregulation and reducing the taxation burden and other financial measures.** In particular, the Ministry of Economy has significantly reduced the number of replicating permissions and licensing procedures, while the Ministry of Environment has been able to digitize licensing procedures. These steps have been essential in deregulating land management in the mining industry, which formerly required approval from many stakeholders (including local governments). Land management is now fully managed and approved by Derzhgeonadra, Ukraine's State Service on Geology and Mineral Resources. Additionally, results of the UNIDO survey indicate that many firms have been granted tax exemptions or reductions. **Third, significant efforts were made recently to improve transport infrastructure.** State-owned Ukrzaliznytsia has enabled 30 private companies to construct over 100 terminals on the western border to trans-ship on the border, mainly with Poland. Other projects have been focused on improving the railway system. **In addition, improving the situation with access to energy following significant damage to the country's energy infrastructure has brought positive results.** The most important breakthrough has been synchronization with the ENTSO-E, which occurred on the 23 February 2022. In January 2023, the Government of Ukraine ensured a constant supply of imported electricity from the EU to industrial consumers. This allowed many companies to continue or even renew their operations. **Lastly, the Ukrainian government has played a significant role in promoting Ukrainian trade. As a result of numerous negotiations and meetings**, many countries abolished trade barriers with Ukraine to show their support.

To summarize, the results of the current study reveal that as a result of the war, the attention of Ukrainian firms has shifted from the bottlenecks in governance to bottlenecks in infrastructure, factors of production and issues related to liquidity and financing. Currently, the most pressing issues include transport infrastructure, lack of access, high cost of energy and lack of labour. The government is implementing several policy initiatives to improve the business environment, including direct financial support, reduction of the tax burden, deregulation, upgrading transport infrastructure, ensuring continuous energy supply, and promoting Ukrainian products internationally. However, there are many areas of potential improvement, such as (1) regulation and support to the penetration of new markets; (2) strengthening public/private partnerships; (3) involvement of relevant policy actors at all level and promotion of their coordination; (4) ensuring the widest coverage of support to firms in need; and (5) policy making capacity.

NOTES

[1] Survey response options include: “no obstacle”, “minor obstacle”, “moderate obstacle”, “major obstacle” or “very severe obstacle” to determine whether an issue constitutes an obstacle to a surveyed firm business. Key bottlenecks are identified as the obstacles mentioned as “major” or “very severe” by a responding firm. The complete list of questionnaires for 2008, 2013 and 2019 can be downloaded from the following website: Enterprise Surveys Portal Datasets - World Bank Group.

[2] The Hatzichronoglou (1997) method was used to construct the OECD technological industry classification. The full list of NACE Rev.1 industries corresponding to the OECD technology classification can be found at: https://www.oecd.org/sti/ind/48350231.pdf.

[3] See: Ukrainian Banking Sector In 2022: How Has It Changed? (linkedin.com).

[4] Ukraine's reasons for not applying for a loan for 2008, 2013 and 2019 separately are given in **Table A3**.

[5] For more details on the Corruption Perception Score please visit: 2022 Corruption Perceptions Index: Explore the... - Transparency.org

[6] For more details please visit: Doing Business 2020 (worldbank.org).

[7] 10% of respondents indicated their location as “All of Ukraine” or “All Ukraine”.

[8] The questionnaire contains two questions about the total number of support measures firms received. Responses may not necessarily be completely consistent for the two questions. **Tables A4 and A5** contain answers of firms about the number of support measures that may not necessarily be fully consistent, whereas **Tables A6 and A7** contain consistent answers implying a lower number of total support measures. The majority of firms in the sample claim they received some form of support in one of the two questions.

[9] The Ivory Coast Industrial Diagnostics can be found here: https://www.unido.org/sites/default/files/files/2022-02/PCP_diagnostics_Ivory_Coast_English.pdf

[10] In 2022 the US Department of Trade stopped the duty for Ukrainian metallurgy products, which was 25 percent. The European Parliament issued a regulation № 2022/870 which halts the import tariffs on industrial products from Ukraine.

[11] The Ministry of Economy established an inter-ministerial group that focused on deregulation of all areas of public services, to ensure the smooth operation of business during war time. Since the start of the working group in 2022, the ministry has digitized over 500 regulatory instruments and over 230 have been canceled.

[12] Currently only state-owned monopoly Ukrzaliznytsia can provide locomotives, and these locomotives are outdated (slow) and there is a deficit of locomotives based on growing demand. On the other hand, both national private companies and foreign transport companies would be willing to enter the market with their wagons and locomotives.

[13] During the active attacks on the energy infrastructure of Ukraine, a significant number of energy generation and distribution capacities were destroyed, creating a deficit of electricity in the energy system, which implied unexpected power outages. Power outages can significantly damage equipment and lead to financial losses due to spoiled raw materials.

[14] Emission Trading System, a policy instrument to regulate free allowances for $C0_2$ emissions and payment for excessive $C0_2$ emissions (alternative taxation instrument that stimulates decarbonization by providing free allowances, the volume of which shrinks each year).

[15] Currently environmental and carbon taxes are directed towards different issues, including covering social needs, which implies that allocation of climate finance is not tracked and these finances are not allocated towards tackling climate issues.

[16] For more information, see: ukrstat.org/en/operativ/operativ2017/rp/eans/eans_e/Arch_nzn_smpsz_e.htm.

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APPENDIX

TABLE A1: UKRAINE'S BOTTLENECKS BY REGION, AVERAGE OF 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey.*

KYIV										
	MNF	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M. H. TECH	LARGE FIRMS	LOW TECH	NON-EXPORTER	NON MNF	SMEs
Corruption	37%	50%	13%	4%	8%	9%	29%	41%	17%	44%
Courts	19%	27%	7%	3%	4%	7%	15%	23%	11%	23%
Crime	19%	25%	7%	3%	4%	4%	15%	21%	8%	23%
Customs	14%	17%	7%	3%	4%	4%	10%	13%	6%	16%
Electricity	26%	29%	9%	4%	7%	7%	19%	24%	7%	25%
Finance	29%	38%	8%+	3%	6%	7%	23%	32%	12%	34%
Inf. sector	28%	38%	8%	3%	4%	7%	24%	33%	13%	34%
Labour regulation	9%	12%	2%	1%	1%	2%	8%	11%	4%	11%
Access to land	21%	28%	7%	3%	5%	7%	16%	23%	10%	24%
Licensing	14%	19%	5%	2%	3%	4%	11%	17%	7%	17%
Political instability	40%	55%	12%	4%	7%	10%	33%	48%	20%	49%
Tax administration	22%	30%	6%	3%	4%	6%	18%	26%	10%	27%
Tax rate	39%	56%	10%	3%	8%	11%	32%	49%	19%	48%
Telecommunication	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Transportation	20%	25%	6%	2%	4%	5%	16%	21%	7%	22%
Inad. skilled l.f.	22%	30%	8%	3%	5%	6%	18%	25%	11%	27%
EAST										
	MNF	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M. H. TECH	LARGE FIRMS	LOW TECH	NON-EXPORTER	NON MNF	SMEs
Corruption	31%	41%	9%	2%	7%	8%	24%	33%	11%	35%
Courts	12%	16%	5%	1%	4%	5%	9%	13%	5%	12%
Crime	13%	19%	4%	0%	3%	4%	10%	15%	6%	16%
Customs	7%	9%	4%	0%	2%	3%	5%	6%	2%	7%
Electricity	20%	25%	6%	1%	4%	6%	15%	20%	6%	20%
Finance	18%	23%	4%	1%	5%	5%	13%	20%	6%	19%
Inf. sector	18%	26%	3%	0%	3%	4%	15%	23%	9%	23%
Labour regulation	9%	11%	2%	0%	2%	2%	6%	9%	3%	9%
Access to land	16%	22%	5%	1%	4%	5%	12%	18%	7%	18%
Licensing	11%	16%	3%	1%	3%	4%	8%	14%	5%	13%
Political instability	33%	45%	10%	1%	9%	9%	24%	36%	13%	37%
Tax administration	13%	17%	4%	1%	3%	5%	10%	14%	5%	13%
Tax rate	34%	45%	10%	2%	8%	9%	26%	37%	13%	38%
Telecommunication	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Transportation	13%	17%	5%	1%	3%	6%	9%	12%	5%	12%
Inad. skilled l.f.	18%	25%	6%	1%	4%	6%	14%	20%	8%	20%

WEST										
	MNF	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M. H. TECH	LARGE FIRMS	LOW TECH	NON-EXPORTER	NON MNF	SMEs
Corruption	32%	38%	18%	4%	7%	11%	25%	24%	11%	31%
Courts	19%	23%	13%	2%	4%	7%	15%	12%	6%	18%
Crime	24%	28%	15%	4%	5%	9%	19%	17%	8%	23%
Customs	18%	21%	12%	2%	4%	6%	13%	10%	5%	16%
Electricity	29%	32%	19%	5%	5%	10%	24%	18%	8%	27%
Finance	34%	39%	18%	3%	7%	10%	27%	25%	8%	31%
Inf. sector	33%	41%	17%	3%	6%	10%	27%	27%	11%	34%
Labour regulation	18%	19%	12%	2%	4%	6%	14%	9%	4%	15%
Access to land	24%	28%	15%	3%	6%	7%	19%	16%	7%	24%
Licensing	17%	20%	11%	2%	4%	5%	13%	11%	5%	16%
Political instability	36%	43%	19%	4%	7%	12%	29%	28%	11%	34%
Tax administration	18%	21%	12%	3%	4%	6%	14%	11%	6%	17%
Tax rate	35%	43%	17%	3%	7%	12%	28%	29%	11%	34%
Telecommunication	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Transportation	18%	21%	13%	2%	4%	6%	14%	10%	5%	16%
Inad. skilled l.f.	29%	33%	17%	4%	6%	10%	23%	20%	8%	27%
SOUTH										
	MNF	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M. H. TECH	LARGE FIRMS	LOW TECH	NON-EXPORTER	NON MNF	SMEs
Corruption	26%	36%	9%	2%	7%	9%	19%	29%	12%	28%
Courts	8%	13%	3%	1%	2%	3%	6%	10%	5%	10%
Crime	10%	17%	4%	1%	3%	3%	7%	14%	7%	15%
Customs	7%	10%	3%	1%	3%	2%	5%	7%	3%	9%
Electricity	19%	24%	5%	1%	5%	5%	15%	20%	6%	20%
Finance	26%	34%	7%	1%	6%	9%	20%	28%	9%	26%
Inf. sector	15%	23%	4%	0%	3%	3%	12%	20%	9%	20%
Labour regulation	5%	7%	2%	0%	1%	1%	4%	5%	3%	6%
Access to land	16%	22%	5%	1%	4%	5%	11%	18%	7%	17%
Licensing	7%	11%	3%	0%	2%	3%	5%	9%	5%	8%
Political instability	42%	60%	15%	2%	11%	13%	31%	47%	19%	48%
Tax administration	10%	16%	5%	1%	4%	3%	6%	12%	7%	13%
Tax rate	29%	43%	9%	2%	7%	9%	21%	36%	16%	35%
Telecommunication	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Transportation	10%	16%	3%	1%	2%	4%	8%	13%	7%	13%
Inad. skilled l.f.	20%	25%	6%	1%	5%	7%	15%	20%	7%	19%

	NORTH									
	MNF	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M. H. TECH	LARGE FIRMS	LOW TECH	NON-EXPORTER	NON MNF	SMEs
Corruption	31%	42%	13%	3%	8%	10%	22%	33%	15%	35%
Courts	16%	22%	7%	2%	5%	8%	11%	17%	8%	17%
Crime	16%	25%	9%	2%	5%	7%	11%	17%	11%	20%
Customs	12%	15%	9%	2%	4%	5%	8%	9%	5%	12%
Electricity	14%	20%	6%	2%	3%	6%	10%	16%	8%	16%
Finance	19%	29%	8%	2%	4%	7%	15%	23%	12%	24%
Inf. sector	17%	26%	7%	2%	4%	5%	13%	21%	11%	23%
Labour regulation	9%	14%	5%	1%	2%	4%	7%	10%	6%	11%
Access to land	17%	27%	7%	1%	5%	7%	12%	21%	11%	20%
Licensing	16%	23%	8%	2%	3%	7%	12%	16%	9%	18%
Political instability	37%	50%	15%	3%	10%	12%	27%	39%	17%	42%
Tax administration	22%	30%	11%	2%	5%	9%	16%	21%	10%	23%
Tax rate	31%	43%	13%	3%	8%	10%	23%	34%	16%	36%
Telecommunication	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Transportation	13%	20%	7%	1%	3%	6%	10%	14%	8%	15%
Inad. skilled l.f.	20%	28%	11%	2%	5%	9%	14%	19%	10%	21%

Note: Total number of respondents = 501. MNF = manufacturing; M.H. tech = medium-high technology; Low tech = low technology; Non MNF = non-manufacturing; SMEs = small and medium-sized enterprises.

TABLE A2: TYPES OF FINANCING INSTITUTIONS IN UKRAINE, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey.*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
2008										
Non-bank financial institutions	3%	3%	14%	3%	3%	5%	4%	4%	3%	4%
Private commercial banks	89%	89%	71%	89%	86%	87%	88%	86%	86%	88%
State-owned banks or government agency	8%	8%	14%	8%	10%	8%	8%	9%	11%	7%
2013										
Non-bank financial institutions	7%	7%	24%	3%	2%	11%	9%	10%	9%	12%
Private commercial banks	77%	71%	48%	80%	77%	74%	75%	77%	72%	73%
State-owned banks or government agency	11%	20%	19%	15%	18%	13%	14%	8%	7%	10%
Other	4%	3%	10%	3%	3%	2%	2%	6%	13%	6%
2019										
Non-bank financial institutions	2%	3%	0%	4%	0%	1%	2%	1%	1%	2%
Private commercial banks	62%	73%	67%	71%	70%	62%	64%	54%	60%	60%
State-owned banks or government agency	34%	21%	25%	23%	27%	35%	32%	44%	36%	36%
Other	2%	3%	8%	2%	3%	2%	2%	2%	3%	2%

Note: Total number of respondents = 501. MNF = manufacturing; M.H. tech = medium-high technology; Low tech = low technology; Non MNF = non-manufacturing; SMEs = small and medium-sized enterprises.

TABLE A3: FIRMS' REASONS FOR NOT APPLYING FOR A LOAN IN UKRAINE, 2008, 2013 AND 2019

Source: World Bank, *World Bank Enterprise Survey.*

	DOM. OWNED	EXPORTER	FOREIGN-OWNED	M.H. TECH	LARGE FIRMS	LOW TECH	MNF	NON EXPORTER	NON MNF	SMEs
2008										
Application procedures were complex	3%	4%	5%	3%	2%	3%	3%	3%	3%	3%
Collateral requirements were too high	5%	2%	3%	4%	2%	5%	5%	6%	5%	6%
Did not think it would be approved	1%	1%	2%	1%	0%	1%	1%	1%	1%	1%
Interest rates were not favourable	19%	7%	5%	15%	11%	21%	20%	21%	15%	21%
No need for a loan	32%	30%	31%	27%	21%	28%	28%	33%	42%	36%
Size of the loan and maturity were insufficient	1%	1%	2%	1%	0%	1%	1%	1%	1%	1%
Other	39%	56%	53%	49%	62%	41%	43%	36%	34%	33%
2013										
Application procedures were complex	7%	6%	6%	8%	4%	6%	7%	7%	9%	8%
Collateral requirements were too high	5%	6%	6%	5%	1%	5%	5%	5%	5%	6%
Did not think it would be approved	3%	3%	2%	2%	3%	3%	3%	2%	2%	2%
Interest rates were not favourable	25%	20%	27%	24%	25%	27%	26%	27%	23%	25%
No need for a loan	37%	32%	29%	39%	31%	33%	35%	38%	42%	37%
Size of the loan and maturity were insufficient	1%	2%	2%	1%	1%	2%	1%	1%	2%	1%
Other	22%	30%	29%	21%	35%	23%	23%	20%	20%	20%
2019										
Application procedures were complex	5%	5%	5%	8%	4%	4%	5%	5%	4%	5%
Collateral requirements were too high	4%	4%	5%	5%	4%	4%	4%	4%	4%	4%
Did not think it would be approved	1%	2%	3%	2%	0%	1%	1%	1%	0%	1%
Interest rates were not favourable	34%	23%	16%	27%	28%	33%	32%	38%	35%	34%
No need for a loan	34%	39%	41%	35%	36%	35%	35%	32%	34%	35%
Size of the loan and maturity were insufficient	1%	1%	0%	1%	1%	1%	1%	1%	1%	1%
Other	21%	26%	31%	21%	26%	21%	21%	19%	22%	20%

Note: Total number of respondents = 501. MNF = manufacturing; M.H. tech = medium-high technology; Low tech = low technology; Non MNF = non-manufacturing; SMEs = small and medium-sized enterprises.

TABLE A4: NUMBER OF SUPPORT MEASURES, BY SUPPORTING INSTITUTIONS, BEFORE AND DURING THE WAR

Source: UNIDO Enterprise Survey 2023.

MEASURE	NATIONAL GOVERNMENT		LOCAL GOVERNMENT		NGO		INTERNATIONAL ORGANIZATION		DOMESTIC PRIVATE SECTOR		FOREIGN PRIVATE SECTOR	
	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR
Deferral of tax payments or temporary suspensions (e.g. VAT suspension)	0	16	0	0	0	0	0	0	0	0	0	0
Tax exemptions or reductions	0	15	0	1	0	0	0	0	0	0	0	0
Preferential loans	3	14	0	0	0	0	0	1	0	0	0	0
Grant support	0	12	0	0	0	3	0	4	0	0	0	0
Access to new credit	2	11	0	0	1	2	0	0	0	4	0	0
Deferral of credit payments	0	8	0	0	2	8	0	0	0	4	0	0
Deferral of rent or mortgage	0	6	0	2	2	10	0	0	0	6	0	1
Lowering the administration burden	0	5	0	2	1	1	0	0	0	0	0	0
Updating legislation	0	5	0	0	0	0	0	0	0	0	0	0
Assistance in upgrading production	0	4	0	0	1	3	0	0	0	0	0	0
Cash transfers for business	1	3	0	0	1	1	0	1	1	1	0	1
Import and export regulations to support your industry	1	3	0	0	0	0	0	0	0	0	0	0
Rent cancellation or compensation	0	3	0	2	0	1	0	0	0	2	0	0
Assistance in export activities	1	3	0	0	1	1	0	0	0	1	0	1
Promoting Ukrainian business in foreign markets	1	3	0	0	0	3	0	0	0	1	0	1
Marketing research of foreign markets	0	3	0	0	0	0	0	0	1	0	0	0
Wage subsidies	1	2	0	0	0	0	0	0	0	0	0	0
R&D or innovation subsidies/grants	0	2	0	0	1	2	0	3	0	0	0	0
Consultation on the documentation related to EU exports	0	2	0	0	1	2	0	0	0	1	0	1
Legal advice and accounting	0	2	0	0	0	1	0	1	1	0	0	0
Assistance in relocation	1	1	0	1	1	1	0	0	0	0	0	0
Assistance in expanding sales markets	0	1	0	0	0	1	0	0	0	1	0	1
Marketing consulting/training	1	1	0	0	2	2	1	1	2	1	0	0
Copyright protection	0	1	0	0	2	2	0	0	0	0	0	0

MEASURE	NATIONAL GOVERNMENT		LOCAL GOVERNMENT		NGO		INTERNATIONAL ORGANIZATION		DOMESTIC PRIVATE SECTOR		FOREIGN PRIVATE SECTOR	
	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR
Providing information (statistical and marketing) for conversion purposes	0	1	0	0	0	1	0	0	1	0	1	0
Support for strategy development	0	1	0	0	1	0	0	0	1	1	0	0
Staff retraining	0	1	0	0	1	1	0	0	1	1	0	0
Technology transfer facilitation	0	1	0	0	0	0	0	0	0	0	0	0
Other	1	1	1	1	1	1	0	0	0	0	0	0
Help with finding customers	1	0	0	0	0	2	0	0	0	0	0	0
Participation in international exhibitions	0	0	0	0	0	2	0	1	0	2	0	0
Cooperation with foreign business	0	0	0	0	1	2	0	0	0	2	0	1
Training on how to sell on online platforms	0	0	0	0	0	1	0	0	1	1	0	0
Consulting on expanding sales markets and searching for customers	0	0	0	0	2	3	0	0	1	0	0	0
Advice on finding a new niche	0	0	0	1	0	0	0	0	0	1	0	0
Total	**14**	**131**	**1**	**10**	**22**	**57**	**1**	**12**	**10**	**30**	**1**	**7**

Note: Total number of respondents = 501, NGO = non-governmental organiz. The table contains the numbers of respondents who declared to have received support measures from a corresponding organization.

TABLE A5: TOTAL NUMBER OF SUPPORT MEASURES, BEFORE AND AFTER THE WAR

Source: UNIDO Enterprise Survey 2023.

MEASURE	BEFORE THE WAR	AFTER THE WAR
Deferral of rent or mortgage	11	73
Deferral of credit payments	20	61
Tax exemptions or reductions	6	39
Grant support	2	38
Deferral of tax payments or temporary suspensions (e.g., VAT suspension)	4	36
Preferential loans	14	31
Rent cancellation or compensation	3	31
Access to new credit	29	29
Cash transfers for business	33	24
R&D or innovation subsidies/grants	8	22
Lowering the administration burden	7	19
Cooperation with foreign business	13	16
Updating legislation	3	16
Promoting Ukrainian business in foreign markets	7	15
Participation in international exhibitions	10	15
Marketing consulting/training	13	15
Assistance in upgrading production	6	14
Consultation on the documentation related to EU exports	7	14
Legal advice and accounting	11	14
Import and export regulations to support your industry	6	13
Assistance in export activities	7	13
Marketing research of foreign markets	10	13
Consulting on expanding sales markets and searching for customers	8	13
Wage subsidies	7	12
Help with finding customers	4	11
Advice on finding a new niche	6	11
Training on how to sell on online platforms	5	10
Staff retraining	7	10
Assistance in expanding sales markets	6	9
Support for strategy development	6	9
Assistance in relocation	4	8
Providing information (statistical and marketing) for conversion purposes	5	6
Copyright protection	11	5
Technology transfer facilitation	4	4
Other	9	2
Total	**312**	**671**

Note: Total number of respondents = 501. The table contains the numbers of respondents who declared to have received a corresponding support measure.

TABLE A6: NUMBER OF SUPPORT MEASURES BY SUPPORTING INSTITUTION (CONSISTENCY OF ANSWERS), BEFORE AND DURING THE WAR

Source: UNIDO Enterprise Survey 2023.

MEASURE	NATIONAL GOVERNMENT		LOCAL GOVERNMENT		NGO		INTERNATIONAL ORGANIZATION		DOMESTIC PRIVATE SECTOR		FOREIGN PRIVATE SECTOR	
	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR
Grant support	0	12	0	0	0	2	0	4	0	0	0	0
Access to new credit	1	8	0	0	0	1	0	0	0	2	0	0
Tax exemptions or reductions	0	8	0	0	0	0	0	0	0	0	0	0
Preferential loans	2	8	0	0	0	0	0	1	0	0	0	0
Deferral of tax payments or temporary suspensions (e.g. VAT suspension)	0	6	0	0	0	0	0	0	0	0	0	0
Deferral of credit payments	0	4	0	0	1	5	0	0	0	2	0	0
Deferral of rent or mortgage	0	4	0	0	2	4	0	0	0	3	0	1
Assistance in upgrading production	0	3	0	0	1	1	0	0	0	0	0	0
Lowering the administration burden	0	3	0	0	1	1	0	0	0	0	0	0
Assistance in export activities	1	3	0	0	1	1	0	0	0	1	0	1
Updating legislation	0	3	0	0	0	0	0	0	0	0	0	0
Cash transfers for business	0	2	0	0	1	1	0	1	0	1	0	1
Wage subsidies	0	2	0	0	0	0	0	0	0	0	0	0
Import and export regulations to support your industry	0	2	0	0	0	0	0	0	0	0	0	0
R&D or innovation subsidies/grants	0	2	0	0	1	1	0	3	0	0	0	0
Promoting Ukrainian business in foreign markets	1	2	0	0	0	0	0	0	0	1	0	1
Marketing research of foreign markets	0	2	0	0	0	0	0	0	1	0	0	0
Assistance in relocation	0	1	0	0	1	1	0	0	0	0	0	0
Rent cancellation or compensation	0	1	0	0	0	0	0	0	0	2	0	0
Consultation on the documentation related to EU exports	0	1	0	0	1	1	0	0	0	1	0	1
Assistance in expanding sales markets	0	1	0	0	0	0	0	0	0	1	0	1
Marketing consulting/training	1	1	0	0	1	1	1	1	2	1	0	0
Legal advice and accounting	0	1	0	0	0	0	0	1	1	0	0	0
Copyright protection	0	1	0	0	1	0	0	0	0	0	0	0

MEASURE	NATIONAL GOVERNMENT		LOCAL GOVERNMENT		NGO		INTERNATIONAL ORGANIZATION		DOMESTIC PRIVATE SECTOR		FOREIGN PRIVATE SECTOR	
	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR	BEFORE THE WAR	DURING THE WAR
Providing information (statistical and marketing) for conversion purposes	0	1	0	0	0	0	0	0	1	0	1	0
Support for strategy development	0	1	0	0	0	0	0	0	1	1	0	0
Staff retraining	0	1	0	0	1	1	0	0	1	1	0	0
Technology transfer facilitation	0	1	0	0	0	0	0	0	0	0	0	0
Help with finding customers	1	0	0	0	0	0	0	0	0	0	0	0
Participation in international exhibitions	0	0	0	0	0	0	0	1	0	2	0	0
Cooperation with foreign business	0	0	0	0	0	0	0	0	0	2	0	1
Training on how to sell on online platforms	0	0	0	0	0	0	0	0	1	1	0	0
Consulting on expanding sales markets and searching for customers	0	0	0	0	1	1	0	0	1	0	0	0
Advice on finding a new niche	0	0	0	0	0	0	0	0	0	1	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0
Total	**7**	**85**	**0**	**0**	**14**	**22**	**1**	**12**	**9**	**23**	**1**	**7**

Note: Total number of respondents = 501, NGO = non-governmental organization. The table contains the numbers of respondents who declared to have received corresponding support measures from a corresponding organization.

TABLE A7: TOTAL NUMBER OF SUPPORT MEASURES PROVIDED (CONSISTENCY OF ANSWERS), BEFORE AND IN RESPONSE TO THE WAR

Source: UNIDO Enterprise Survey 2023.

MEASURE	BEFORE THE WAR	IN RESPONSE TO THE WAR
Deferral of rent or mortgage	4	38
Deferral of credit payments	7	36
Grant support	1	33
Tax exemptions or reductions	3	21
Access to new credit	14	20
Cash transfers for business	13	19
Preferential loans	8	19
Deferral of tax payments or temporary suspensions (e.g. VAT suspension)	1	17
R&D or innovation subsidies/grants	3	16
Rent cancellation or compensation	2	12
Cooperation with foreign business	5	12
Assistance in upgrading production	5	11
Lowering the administration burden	4	10
Assistance in export activities	5	10
Participation in international exhibitions	7	10
Updating legislation	2	10
Promoting Ukrainian business in foreign markets	4	9
Wage subsidies	1	8
Import and export regulations to support your industry	2	8
Marketing research of foreign markets	6	8
Marketing consulting/training	10	8
Assistance in relocation	2	7
Help with finding customers	2	7
Consultation on the documentation related to EU exports	4	7
Training on how to sell on online platforms	3	7
Consulting on expanding sales markets and searching for customers	5	7
Assistance in expanding sales markets	3	6
Legal advice and accounting	5	6
Staff retraining	5	6
Support for strategy development	4	5
Advice on finding a new niche	4	4
Copyright protection	4	2
Providing information (statistical and marketing) for conversion purposes	4	2
Technology transfer facilitation	2	2
Other	1	0
Total	**155**	**403**

Note: Total number of respondents = 501. The table contains the numbers of respondents who declared to have received a corresponding support measure.

4 Diversifying and rebuilding the Ukrainian economy: Application of the DIVE Tool

Economic growth and prosperity rely heavily on the structural transformation of economies, a dynamic and evolving process that expands the array of products a nation can export and refines its production capacities. Historically, the evolution of the production and export basket has not merely stemmed from 'natural progress' (or adherence to what economists generally call "static comparative advantage"). Instead, it has been significantly influenced by active policy interventions that have promoted the expansion of an economy's productive capabilities, especially in response to market stimuli such as pricing dynamics and emerging opportunities or challenges.

In well-functioning and stable economic environments, private enterprises are the primary agents of structural change, through new investments, specialized training and cost-discovery operations. But even in such contexts, market failures can stall the shift from existing specializations, rendering structural changes challenging or impossible. This is where the role of active public policies, encompassing diversification, industrial strategies and innovation drives, becomes paramount. Such policies can catalyse sustainable diversification, ensuring that an economy remains adaptable and resilient.

The full-scale invasion of Ukraine has underscored the importance of economic diversification, but equally crucial is the need to rebuild and reconstruct its industrial capacities. The damages inflicted have resulted in the loss of critical industrial capabilities and resources; for Ukraine to bounce back robustly, it must focus on diversifying its economic structure and rebuilding its lost capabilities.

Successful stories of industrial development do not trace back to a common and unique path. Some countries leverage "horizontal policies" – sector-neutral strategies designed to cultivate new productive skills, such as fostering human capital or entrepreneurial expertise, eliminating trade barriers, reducing bureaucratic red tape, or enhancing credit accessibility. These policies promote cost-discovering activities in new areas and foster diversification.

In contrast, "vertical policies" – specifically designed to bolster products or sectors – have been cautiously approached. The intricacies and potential pitfalls of identifying promising sectors and crafting the right policies discourage many governments. Nevertheless, while horizontal policies are pivotal in creating an economic environment conducive to diversification, they might not be sufficient to guarantee comprehensive diversification when market failures – such as those that emerge in the aftermath of a severe conflict – are pervasive.

For Ukraine, the lesson is clear. While pursuing economic diversification is vital, it is equally crucial to reconstruct and upgrade its industrial and specialized capabilities. Numerous studies highlight that trade diversification can offer multiple advantages, ranging from economic resilience to risk mitigation (Agosin, 2007; Hesse, 2008; Cadot, et al 2011). Therefore, a balanced blend of horizontal and vertical policies tailored to Ukraine's unique needs will be paramount for its future growth and prosperity.

In this block, we apply UNIDO's DIVE (Diversifying Industries and Value Chains for Exports) Tool to help the Ukrainian government select potential targets for vertical and horizontal industrial policies to diversify and strengthen its economic base. Our analysis is based on three critical premises. First, we consider how the current conflict has impacted current production and trade specialization, using DIVE in conjunction with qualitative analysis (primarily interviews with experts)[1] and recent trade data. A second important consideration is the changing geopolitical context in which the post-conflict Ukrainian economy will emerge. The trend of westward orientation and deeper integration within the European Union will most likely accelerate. This consideration implies that diversification policies (and industrial recovery in old specializations such as metallurgical products) must be tailored to deeper regional integration with the European market. Our targeting exercise for identifying opportunities to diversify the Ukrainian export basket (DIVE targets) considers the potential demand from EU countries weighted by both their "economic dimension" (i.e. size of GDP) and distance from Ukraine.[2]

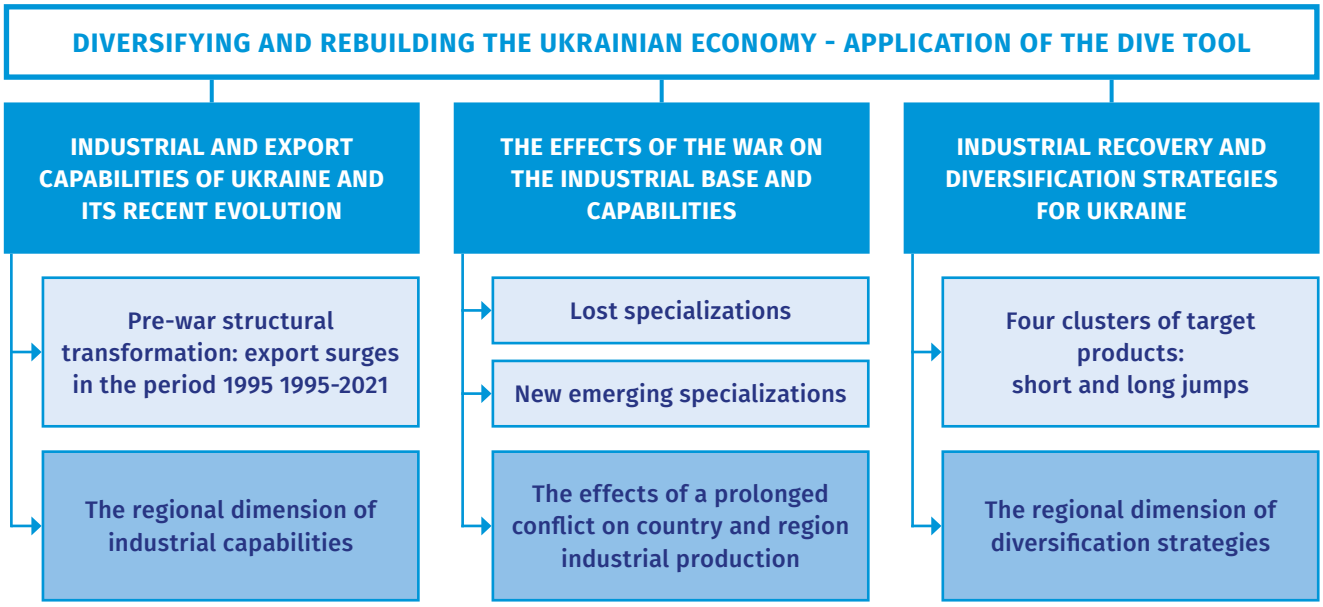
The third and last premise on which we base our analysis is the changing nature of the within-country economic geography of Ukraine. The war is affecting Ukrainian regions in a highly asymmetric and heterogeneous way. Regions bordering Russia have suffered the most from direct damage, loss of human capital and a deep decline in cross-border economic relations. Industrial recovery efforts should explicitly consider the need to avoid a future of Ukraine with deep regional imbalances.

The DIVE Tool employs a three-step analysis[3] to produce findings that inform diversification policy strategies. In step 1, we assess the current specialization basket to analyse its level of complexity and vulnerability, and (for the main specializations) provide a qualitative assessment of war-related damages and the potential for industrial recovery. In step 2, we briefly study the characteristics of recent changes in the composition of Ukraine's production basket. We focus on "export surges", labeled in this chapter as New Entries (NE) in the export basket. This allows us to assess the country's recent (pre-war) ability to diversify away from its initial specialization relative to other countries with a similar level of development (LMIs). In the last step, we apply the DIVE methodology to identify sets of products/sectors representing desirable and feasible targets for diversification policy. The DIVE Tool identifies so-called "short jumps" – or products that are not yet being exported with a strong specialization but require productive capabilities that are likely to be already available in the Ukrainian economy – as well as "long jumps" – products that represent novel areas of structural transformation. The DIVE Tool considers the degree to which a country's diversification strategy is feasible for this latter set of products, which generally represents a more interesting pathway towards structural change (Hausmann et al. 2007; Coniglio et al. 2021). Given its strategic importance, and considering the need to avoid the war from ushering in deep territorial inequalities, we explicitly consider the regional dimension for all these steps. In addition, we use expert opinion collected through in-depth interviews to validate and enrich the DIVE analysis.

Several key points emerge from the analysis. In **Figure 4.1** we provide a snapshot, organized into three main themes: (1) structural change before the conflict, (2) effect of the conflict, and (3) the way forward for sustainable and effective diversification policies. Specific sections offer details and insights.

FIGURE 4.1: STRUCTURE OF BLOCK 4

Source: UNIDO elaboration.



PRE-WAR DIVERSIFICATION AND PRODUCTION CAPABILITIES

Generally, the pre-war pattern of structural change was dominated by a limited degree of diversification confined to resource-based and extractive industries. Two macrosectors account for the largest share of the export basket and new additions (or export surges): agriculture and metals. Interesting cases of successful diversification supported by collective actions emerged. Still, according to most expert opinions, several bottlenecks – such as inefficient credit allocation, corruption and political instability – led to an inadequate structure, and thus a "raw materials economy" with a relatively high share of low-tech production. Specific specializations have evolved – food industry, light industry, furniture production, and the production of metal wares, as well as some still limited but important machinery productions – but a need to diversify toward more sophisticated and complex products is evident from the analysis presented in this chapter. Due to data limitations, one promising sector that is not extensively covered in this chapter is ICT. Necessary capabilities have been accumulated in this sector, which accounts for 14 percent of Ukraine's total exports, and might be deployed to strengthen the comparative advantage in other high-tech industries in the manufacturing sector.

EFFECTS OF THE FULL-SCALE INVASION OF UKRAINE

The non-recognized annexation of Crimea and the conflict in Eastern Ukraine have severely affected the industrial potential of Ukraine – not only disrupting the supply side of the economy through direct and indirect destructions but also impacting the demand side through severed economic relations with Russia, Belarus and other countries for which trade costs have exploded. As highlighted in the analysis, the conflict has had highly heterogeneous effects on production capabilities. All sectors have been affected, but some sectors/industries have suffered the most. In addition, the prospect of recovery seems heterogeneous. The supply and demand disruptions have been or are likely temporary for some industries predominantly located or relocated during the conflict in western regions. A great effort is required to rebuild the production capabilities of most metals and machinery specializations in regions bordering Russia and Belarus (such as Kharkiv, Zaporizhzhia, Sumy, Kherson and Mykolaiv). Productive agricultural land will need extensive interventions (e.g. de-mining) to recover to pre-war capacity. As discussed in this block, reconstruction efforts should direct resources and productive capabilities to new potential sectors/products that might be in demand in the internal market and the global economy. Fundamental in this respect will be strategic re-orientation of exports toward the EU market, as the future of Ukraine in the changing geopolitical landscape is that of a west-ward shift in economic and political relationships.[4]

A profound and problematic effect of the full-scale invasion of Ukraine is that of a change in the geography of production. Both northern and eastern Ukraine are suffering from multiple shocks to industrial capacity: loss of capital and infrastructure, loss of population and human resources, severed economic ties and, not less importantly, the effect of uncertainty about the future. Many industries (and individuals) are relocating to western regions that were less affected by the war.

WAY FORWARD: INTERLINKED NEEDS TO REBUILD, DIVERSIFY AND CLOSE EMERGING TERRITORIAL DISPARITIES.

There is a compelling need for a reconstruction effort with an explicit goal to reduce and mitigate these growing inequalities. This block offers national and international policymakers' and stakeholders' indications of possible targets for diversification and reconstruction efforts. It should be noted that industrial and diversification policy cannot disregard the need to avoid one possible future, that of a Ukraine with significant territorial disparities spurred by the war.

The geography of production will inevitably be reshaped after the war. The relocation of industries from northern and eastern areas toward western oblasts has led to the transfer and recombination of capabilities in the hosting regions. Some of the population has also moved west (or abroad) and is employed in old and relatively new specializations. New specializations such as the production of weapons (drones are a notable example) have already emerged. These products might likely represent new export specializations after the conflict. The scaling back of some industrial capabilities now focused on the war effort will probably release resources – capital, knowledge and human resources – that might boost productivity in other related sector that are essentially capital- and knowledge-intensive.

Future diversification and industrial policies shall intersect regional policies. Some strategic sectors are unlikely to return to the most affected regions. For instance, some defense-industrial complexes – the production of construction materials, the recovery of capital-intensive industries damaged in the war-torn regions as well as light industries (such as those related to agricultural processing) could be promoted and incentivized in these areas. In other words, future industrial strategies should explicitly consider the risk that war-related geographical disparities might consolidate and become a permanent feature of the Ukrainian economy.

This block is structured as follows. After summing up the main findings and results, **Section 4.1** presents the main features of Ukraine's export basket in the immediate pre-war period and offers a qualitative assessment of the impact of the war on industrial capabilities. This section also analyses products added to the Ukrainian export basket since 1995, enabling us to assess Ukraine's pre-conflict ability to diversify towards relatively unrelated goods compared to the economy's initial comparative advantage (i.e. structural dynamism). **Section 4.2** offers a qualitative assessment of the changes in industrial capacity due to the ongoing war – primarily based on expert opinions gathered through interviews. **Section 4.3** outlines potential targets for future diversification policies identified using the DIVE Tool. These targets are categorized into four groups based on a battery of identification criteria described in the section. Finally, **Section 4.4** concludes the block by drawing some policy remarks.

SNAPSHOT OF THE MAIN FINDINGS AND RESULTS

Recent dynamics on industrial and export capabilities

The Ukrainian export basket – identified as the set of products with an RCA higher than unity for at least two years out of three – **consists of approximately 200 products** in the Harmonized System 4-digit nomenclature, characterized by an **intermediate level of product sophisticatedness**, which is a proxy for the level of productivity associated with export of products, equal to US$ 12,847.[5] This value is below the world average (US$ 15,064) but higher than that of LMI countries (US$ 10,991).

The export basket is **highly concentrated in a few capital-intensive industrial sectors belonging to the metallurgical macrosector** – (2601) iron ores and concentrated, with a share of almost 10 percent of total exports; (7207) semifinished products of iron (5.8 percent of total exports); (7208) flat-rolled iron, width >600mm, hot rolled, not clad (5 percent); (7201) pig iron (2.3 percent); and other metal products – **and agricultural products** such as (1512) sunflower seed oil (9.2 percent); and (1001) wheat and meslin and (1005) corn (both 8.5 percent of total exports). Only two products in the electronic industry enter the list of top specializations: (8544) insulated electric wires (US$ 1.6 billion of exports in 2021, equal to 2.3 percent of total exports) and (8516) electric heaters (US$ 639 million). Limited space in the export basket is occupied by chemical products and machinery. One exception is (8411) gas turbines.

For 2021, year of last available data, Ukraine's **Index of Structural Vulnerability (ISV) was 0.67, slightly**

lower than the median value in the world economy (0.69). Thus, by ranking economies from the most vulnerable to external competition to the least one, Ukraine is in the 134th place in over 219 countries.

The ability of a country to diversify its economy by adding new and more complex products to the export portfolio is a fundamental ingredient of structural change, socioeconomic progress and, ultimately, well-being. **The Ukrainian economy experienced stable and relevant export surges – i.e. new specialization products – in 54 products.** These new entries in the export basket accounted for approximately US$ 6 billion, equivalent to 8.7 percent of total exports in 2021. On average, 3.4 new export specializations were developed each year, a number that is slightly below the LMI country mean.

Most new entries (42 of 54) were registered in the agricultural sector, accounting for US$ 4.13 billion in 2021 (more than two-thirds of the export values of new entries). **Only one significant export surge was registered in the electronics sector**, (HS8544) insulated electrical wire, with a rapid export expansion between 2000 and 2005 and now accounting for more than US$ 1.6 billion in exports. **Entries in other sectors were relatively marginal.**

Global demand for new Ukrainian specializations was particularly dynamic in the last few years, with an average of +26 percent between 2019 and 2021. This is encouraging with respect to the possibility of further strengthening Ukraine's international position in the global market.

The ability to defy the initial comparative advantage was relatively lower for the Ukrainian economy. Product relatedness to pre-existing Ukrainian export basket measures to what extent the new entries were short jumps over the potential production space (i.e. high values of relatedness) or longer jumps (i.e. lower relatedness). The average "proximity", or relatedness, was equal to 0.48, a value higher than an average new entry in the world economy (0.46) and the average new entry experienced by LMI countries (0.45).

Qualitative analysis reveals **interesting cases of successful diversification**, e.g. (HS0207) poultry, (HS0811) fruits and nuts, and wood products such as (HS4408) and (HS4418). Still, expert opinion converges on the limited ability of the Ukrainian economy to deploy old and new capabilities toward emerging sectors. The most relevant bottlenecks mentioned by experts are inefficient credit markets, red tape and corruption, ineffective taxing system and political instability.

EFFECTS OF THE WAR ON THE INDUSTRIAL BASE AND CAPABILITIES

The ongoing war has substantially affected some of the strategic sectors on which the Ukrainian export basket is based, with extensive damages and a rather extensive relocation of some industrial plants toward regions less affected by the war. Still, expert opinion suggests that industrial capabilities have not been completely lost, and a certain degree of optimism on potential recovery prevails. Damages inflicted by the war on the competitiveness and specialization in minerals and metal sectors have been generally high as most of these industries are localized in areas affected mainly by the war and areas that are or have been under the temporary military control of the Russian Federation. The industrial recovery potential in most metal products will require a sizeable financial effort and a coherent mid-term strategy.

Damages to agricultural production are extensive due to the war, the intensive shelling and the disruption of logistic and transport infrastructures. However, interviewees assessed the potential for a full recovery as high. The agriculture supply-side potential of 20 of 25 regions of Ukraine did not change significantly.

The next section reports some highlights on the effects of the full-scale invasion of Ukraine in terms of "lost specializations" and "new emerging" ones, considering evidence that emerged during UNIDO consultations and by analysing export data for 2022.

LOST SPECIALIZATIONS AND RESILIENCE

Some of the past specializations Ukraine acquired are "suspended" and/or "lost" due to the conflict. As the war is ongoing, assessing whether the status quo will be temporary or permanent is difficult. **In the metal and chemical macrosectors, important plants are currently damaged and not operational** (e.g. iron and steel, agricultural machinery, aviation, soda and glass production).

By comparing the export specializations emerging from the application of the DIVE tool and the export patterns in 2022 – the first full year affected by the conflict following the full-scale invasion of Ukraine – we have **identified 33 lost HS4-digit specializations**.[6] The most affected sectors are metals (9 lost specializations), agriculture (8 lost specializations) and chemicals (7 lost specializations). Export reduction in the affected product is remarkable and ranges from a minimum of -41 percent for (7215) other bars and rods of iron or unalloyed steel to the zeroing of exports in (2844) uranium.

To have an overall picture of the destroyed specializations, it is sufficient to notice how the 33 products had an average RCA of 1.78 in 2021 that collapsed to 0.59 in 2022. In absolute terms, these lost specializations totaled about US$ 2.17 billion in 2021 and fell to US$ 675 million after one year.

Although damages are severe, **in the most affected areas of Ukraine, the core of the production and resource base still exists or is largely re-deployable with a coordinated effort and a strategic vision**. Diversification policies in these territories might target products that are likely to have a high potential demand in the short-to-medium term and for which capabilities already exist (for instance, agricultural machinery, de-mining tools and vehicles, household appliances, household energy appliances, security and protection systems, building materials, etc.).

NEW EMERGING SPECIALIZATIONS AND REGIONAL EFFECTS

New specializations have emerged, such as the production of drones and components for them or other military equipment. These specializations are in Ukrainian regions far from the war zone and have prospects for entering foreign markets.

By analysing export data for the year 2022 and symmetrically assessing the lost specializations, we can identify 36 **new products for which Ukraine has an RCA>1**. Among these, 24 recorded an increase in export values. Among the new specializations – most of which are agriculture products (11), metals (7), chemicals (6) and textiles (6) – those with the highest export growth between 2021 and 2022 have been (1701) sugarcane and sucrose (+596 percent); (1703) molasses (+473 percent); (7227) bars of other alloy steel (+373 percent); (9005) binoculars and telescopes (+338 percent); and (5502) artificial filament tow (+224.8 percent). The 36 new export specializations have experienced an increase in export volumes from $US 630 million to US$ 813.5 million.

The **leading regions in terms of volumes of industrial production** sold in 2013 and 2022 were Dnipropetrovsk, Donetsk, Kharkiv and Zaporizhzhia regions and Kyiv City. According to the **Index of industrial production**, it is possible to identify **three clusters to classify Ukrainian regions:**

Cluster I. Regions that developed most dynamically and whose industrial production indices in 2021 were as high as in 2013. They include Vinnytsia, Zhytomyr, Odesa, Ternopil, Rivne, Lviv, Volyn, Mykolaiv, Kyiv and Kherson regions.

Cluster II. Regions that experienced a decline in industrial production indices lower or equal to 50 percent of initial industrial production. They include Ivano-Frankivsk, Kirovohrad, Zaporizhzhia, Poltava, Cherkasy, Khmelnytskyi, Sumy, Kharkiv, Chernivtsi, Dnipropetrovsk, Kyiv, Chernihiv and Zakarpattia regions.

Cluster III. Regions where the industrial production indices decreased by more than 50 percent. They include Donetsk and Luhansk regions, i.e. regions where military operations have been conducted since 2014.

Dnipropetrovsk, Donetsk, Kharkiv, Zaporizhzhia regions and the city of Kyiv were the Ukrainian leaders in terms of industrial sales in both 2013 and 2021. During the same time frame, Vinnytsia, Zhytomyr, Odesa, Ternopil, Rivne, Lviv, Volyn, Mykolaiv, Kyiv and Kherson regions have been the most dynamic on industrial production indices. The performances of Odesa, Mykolaiv and Kherson regions were due to the development of the agricultural sector and processing enterprises, along with port infrastructure, while those of Vinnytsia, Zhytomyr, Ternopil, Rivne, Lviv and Volyn regions came from the development of new industries, such as woodworking and furniture production.

Industrial production in the Donetsk and Luhansk regions suffered the greatest decline due to the impact of the conflict in eastern Ukraine and the destruction of the industrial output. These actions also hurt several regions in the second cluster (Zaporizhzhia, Poltava, Cherkasy, Sumy, Kharkiv and Dnipropetrovsk regions).

4.1 INDUSTRIAL AND EXPORT CAPABILITIES OF UKRAINE AND THEIR RECENT EVOLUTION

The main goal of this section is to assess pre-war industrial and export specialization of the Ukrainian economy and the impact of the conflict on industrial capabilities. Any sound diversification policy should be based on current production capabilities, the "roots" on which new export specializations could realistically emerge in the post-conflict scenario. The analysis is based on disaggregated export data, which has the fundamental advantages of being widely available and more reliable than production data. At the same time, it is also a reliable proxy for production baskets. The Ukrainian export basket – identified as the set of products with an RCA higher than unity for at least two out of three years – consists of approximately 200 products in the Harmonized System 4-digit nomenclature, characterized by an intermediate level of product sophisticatedness – a proxy for the level of productivity associated with the export of products – equal to US$ 12,847,[7] which is below the world average (US$ 15,064) but higher than LMI country average (US$ 10,991).

The level of sophistication of Ukraine's export basket is attributable to its presence in the export basket of mineral, metals and agriculture products with a relatively discrete level of product-specific sophisticatedness (ProdY). **Table 4.1** reports Ukraine's top specializations – products with an average export value above US$ 500 million in 2021 – representing US$ 47 billion (approximately 68 percent of total exports). An inspection of the data reveals a concentration of the export basket in a few capital-intensive industrial sectors belonging to the metallurgical macrosector – (2601) iron ores and concentrated, with a share of almost 10 percent of total exports; (7207) semifinished products of iron (5.8 percent of total exports); (7208) flat-rolled iron, width >600mm, hot rolled, not clad (5 percent); (7201) pig iron (2.3 percent); and other metal products – and agricultural products – such as (1512) sunflower seed oil (9.2 percent) and (1001) wheat and meslin and (1005) corn (both 8.5 percent of total exports). The industrial production base largely relies on resource and land abundance; exports are mainly limited to primary products with no or limited capacity to sell high-value products in international markets. Only two products in the electronics industry enter the list of top specializations: (8544) insulated electric wires (US$ 1.6 billion of exports in 2021, equal to 2.3 percent of total exports) and (8516) electric heaters (US$ 639 million). Limited space in the export basket is occupied by chemical products and machinery. One exception is (8411) gas turbines.

TABLE 4.1: MOST ESSENTIAL PRODUCTS IN THE UKRAINIAN EXPORT BASKET

Source: UNIDO elaboration, based on BACI, Centre d'Études Prospectives et d'Informations Internationales, World Bank, *World Development Indicators* database (accessed September 2023), and UNIDO consultations with Ukrainian stakeholders.

HS CODE	HS DESCRIPTION	PRODUCT SECTOR	EXPORTS IN 2021 (MILLION US$)	RCA - BALASSA INDEX (2021)	PRODY (2017-19; US$)	COUNTRIES WITH PRODUCT IN EB (2019-21)	LOW-MIDDLE-INCOME COUNTRIES WITH PRODUCT IN EB (2019-2021)	NR. NEW ENTRIES (PERIOD 1995-2021)	NR. OF NEW ENTRIES IN LOW-MIDDLE-INCOME COUNTRIES (PERIOD 1995-2021)	% OF PATH-DEPENDENT NEW ENTRIES	INDEX OF STRUCTURAL VULNERABILITY	RCA WAR-DAMAGE	INDUSTRIAL RECOVERY POTENTIAL
2601	Iron ores and concentrates	Minerals	6,830	9.4	15,189	20	6	10	4	40	0.627	HIGH	INTERMEDIATE
1512	Sunflower seed oil	Agriculture	6,335	114.6	5,380	29	8	15	6	100	0.713	INTERMEDIATE	HIGH
1001	Wheat and meslin	Agriculture	5,870	28.9	15,631	22	1	8	2	100	0.463	INTERMEDIATE	HIGH
1005	Corn	Agriculture	5,857	34.1	8,869	22	5	12	4	50	0.661	INTERMEDIATE	HIGH
7207	Semifinished products of iron or nonalloy steel	Metals	4,082	29.4	10,307	26	6	19	3	44	0.734	HIGH	INTERMEDIATE-LOW
7208	Flat-rolled iron, width > 600mm, hot-rolled, not clad	Metals	3,549	14.7	16,756	24	4	2	0	100	0.476	HIGH	INTERMEDIATE-LOW
8544	Insulated electrical wire	Electronics	1,642	3.3	9,091	36	11	14	7	100	0.749	INTERMEDIATE	INTERMEDIATE-HIGH
7201	Pig iron	Metals	1,607	68.4	6,528	9	2	4	1	40	0.472	HIGH	INTERMEDIATE-LOW
1205	Rape or colza seeds	Agriculture	1,367	29.5	16,233	20	2	5	0	100	0.374	INTERMEDIATE	HIGH
2306	Solid vegetable oil and fat residues	Agriculture	1,294	40.6	6,410	37	12	11	1	91	0.770	LOW	HIGH
1003	Barley	Agriculture	1,175	33.7	16,421	20	1	6	1	33	0.512	LOW	HIGH
7202	Ferroalloys	Metals	1,122	7.9	4,890	32	7	14	3	46	0.805	HIGH	INTERMEDIATE-LOW
207	Poultry	Agriculture	704	7.0	16,033	23	2	13	1	82	0.708	INTERMEDIATE	HIGH
4407	Wood sawn lengthwise	Agriculture	684	3.7	10,735	50	14	9	3	88	0.710	LOW	HIGH
7213	Hot rolled bars of iron	Metals	676	10.8	11,232	34	9	10	4	63	0.641	HIGH	INTERMEDIATE
7304	Tubes, seamless, of iron or steel	Metals	668	9.4	16,745	25	1	10	1	83	0.546	HIGH	INTERMEDIATE
1201	Soya beans	Agriculture	668	2.6	9,121	15	3	7	2	25	0.505	INTERMEDIATE	HIGH

HS CODE	HS DESCRIPTION	PRODUCT SECTOR	EXPORTS IN 2021 (MILLION US$)	RCA - BALASSA INDEX (2021)	PRODY (2017-19; US$)	COUNTRIES WITH PRODUCT IN EB (2019-21)	LOW-MIDDLE-INCOME COUNTRIES WITH PRODUCT IN EB (2019-2021)	NR. NEW ENTRIES (PERIOD 1995-2021)	NR. OF NEW ENTRIES IN LOW-MIDDLE-INCOME COUNTRIES (PERIOD 1995-2021)	% OF PATH-DEPENDENT NEW ENTRIES	INDEX OF STRUCTURAL VULNERABILITY	RCA WAR-DAMAGE	INDUSTRIAL RECOVERY POTENTIAL
2818	Aluminum oxide	Chemicals	641	12.9	8,170	16	4	5	2	0	0.556	INTERMEDIATE	INTERMEDIATE-HIGH
8516	Electric heaters	Electronics	639	2.8	18,824	24	3	4	1	100	0.378	LOW	HIGH
7209	Flat-rolled iron, width > 600mm, cold-rolled, not clad	Metals	634	8.7	19,063	27	8	11	6	67	0.629	HIGH	INTERMEDIATE-LOW
3102	Nitrogenous fertilizers	Chemicals	633	5.3	13,330	41	10	14	6	90	0.734	INTERMEDIATE	HIGH
8411	Gas turbines	Machinery	513	1.2	24,997	15	2	8	1	40	0.628	INTERMEDIATE	HIGH

Note: Products are ranked by export value (above US$ 500 million) in 2021. LMI = lower-middle income, EB = export basket.

By examining product-level vulnerability and its weight in Ukraine's export basket, we can compute the export basket's vulnerability to external competition.[8] Given the large concentration of the export basket in the primary sector or related industries, the structural vulnerability of the Ukrainian export basket is lower than that of the average country in the world economy, with an average index of vulnerability of 0.67. In contrast, the world average equals 0.69 (38th percentile of the distribution). This is because the set of products Ukraine specializes in consists of goods with a relatively limited number of competing countries and high entry barriers. The products in which Ukraine is specialized with RCA[9]>1 are in the specialization pattern of about 26 countries while, worldwide, a product specialization is in the export basket of 19.24 countries (of which, on average, 5.78 are LMI). In 1995-2019, the recorded number of new entries (new competing countries) for an average Ukrainian specialization product was equal to 8.5. On average, globally traded products have experienced 6.35 new entries, 1.7 in LMI countries.

Regarding Ukraine's specializations, **Table 4.1** sheds light on the percentage of path-dependent new entries, i.e. how frequently a product signifies export diversification linked to existing capabilities.[10] Agricultural products representing Ukraine's primary export specializations have relatively high percentages of path dependence. In other words, it is unlikely that countries not specializing in related industries have developed a comparative advantage in these products. For instance, from 1995–2021, in all cases in which a country established a new specialization in sunflower seed oil or wheat and meslin, this happened relatedly, meaning that the capabilities for developing the new specialization were based on existing ones. On the other hand, the share of path-dependent new entries is lower for most metallurgical products in Ukraine's export portfolio (HS 2601; HS7207; HS7201), for which pre-existing capabilities seem less relevant.

In sum, the Ukrainian export basket features a very high degree of concentration in two main macrosectors – agriculture and metals – but with a discrete level of diversification within these sectors. Agriculture products in which the country is highly specialized – see, for instance, the RCA Balassa indexes – exhibit mixed levels of sophisticatedness. For example, corn and sunflower seed oil and other vegetable oils, the most exported products in the pre-war period, denote a low level of sophisticatedness. Different emerging specializations within the agricultural and agroprocessing industries – for instance, (HS207) poultry and (HS1003) barley – are associated with higher levels of the ProdY index of sophisticatedness.

Except for rape or colza seeds, wheat and meslin and flat-rolled pig iron, the core products in Ukrainian export baskets are vulnerable to external competition. Based on the product-level Index of Structural Vulnerability (ISV), we can compute an aggregate measure that considers the relative importance of each specialization in the Ukrainian export basket. For the last available data, 2021, the **ISV for Ukraine was 0.67 against a median value in the world economy of 0.69**, placing the country in the 134th place in terms of vulnerability to external competition (from the most vulnerable to the least one) out of 219 countries for which information on vulnerability in 2021 is available.

By considering the qualitative assessments derived from UNIDO consultations with Ukrainian stakeholders (hereafter, UNIDO consultations), ICT emerges as a strategic sector for the Ukrainian economy. Exports in the ICT sector in 2021 amounted to US$ 12.6 billion and were highly diversified: Content Management System and Customer Relationship Management software for large corporates and marketplace software for online sales and other online services; mobile applications for online banking; optimization of work processes in business and in the life activities of individual users; computer games; etc.). Export indicators reflect the industry's growth rate and the number of IT specialists increased from 244,000 in 2020 to 285,000 persons in 2021.

In the last two columns of Table 4.1, qualitative information from UNIDO consultations is also reported concerning the assessment of war-related da-

mage and industrial recovery potential. The ongoing war has substantially affected some of the strategic sectors on which the Ukrainian export basket is based. The qualitative assessments reported should be interpreted with some skepticism for two main reasons. First, information on the extent of damages to industrial capacity is still limited, partly for national security reasons.[11] UNIDO consultations and existing assessments (KSE 2023) suggest extensive damages and a rather extensive relocation of some industrial plants toward regions less affected by the war. For example, about 70 percent of Kharkiv's industrial enterprises have been partially or entirely relocated. Still, expert opinions suggest that industrial capabilities have not been completely lost and that a certain degree of optimism on potential recovery prevails. Another reason for caution is related to the fact that the conflict – and its damages to Ukrainian industrial capacity both in terms of capital and human resources – is still ongoing.

The evaluation reported in **Table 4.1** is based on publicly available information – for instance, operational stops or severe damages to major plants – and interviews with public officials or private companies. We use a quantitative scale for both variables. More precisely, we classify sectors into four groups based on their Revealed Comparative Advantage (RCA) war damage: (1) none: no war-related damages specific to the sector are registered from expert consultations or other secondary sources. For sectors included in this category, damages are mostly limited to war-related economy-wide effects such as damages to transport infrastructures and logistic chains; (2) low: the conflict has generated some specific damages to the sector – for instance, limited reduction of productive agricultural land or episodic destruction of some productive facilities; (3) intermediate: the conflict has generated sizable loss of productive capacities in the sector – for instance, important productive plants have been partly destroyed, damaged and/or production has been partially halted; (4) high: the conflict has generated significant disruption in production and severe damages to productive capacities – for instance, significant destruction of essential productive plants.

Concerning the Industrial Recovery Potential indicator, we classify products by using one of three values: (1) high: potential for a full recovery of production capacity is very high as damages are limited and the disruption of production capacities is generally temporary and reversible; (2) intermediate: potential for restoring the damaged productive capacities is high but essential financial and human resources are necessary as the sector has experienced a sizable amount of disruption due to the conflict; (3) low: full recovery of the lost productive capacities is possible only with significant investments as the damages due to the conflict are sizable. Damages inflicted by the war on the competitiveness and specialization in minerals and metal sectors have been generally high as most of these industries are located in areas primarily affected by the war or areas that are or have been under the temporary military control of the Russian Federation. For example, in 2021, the Mariupol Metallurgical Plant im. Ilicha and «Azovstal» provided 40 percent of steel production in Ukraine and, because of the war, these enterprises were primarily destroyed and ceased to produce. The industrial recovery potential in most metal products will require a sizeable financial effort and a coherent mid-term strategy. The war is having a profound impact on both supply (through direct damages; temporary military control of the Russian Federation; need to relocate in Western Ukraine; capital and human losses, including migration and draft into Armed Forces; and diversion of productive resources to the war effort) and demand (through loss of market ties with Russia, Belarus and Iran; damages to logistic and transport infrastructures; and higher trade costs).

The internal demand for metals – as well as for most building materials – is undoubtedly going to be very high due to the need to rebuild the damaged buildings and infrastructure. External demand might suffer in the short term from the disruption of past market linkages and in the medium-term – from EU countries – from stricter environmental regulations. In three years (January 2026), the European Union will put into force the Carbon Border Adjustment Mechanism (CBAM) and require importers of certain

carbon-intensive goods to pay for their products' embodied carbon emissions. The CBAM covers iron, steel, aluminum, cement, fertilizer and electricity. According to the CBAM Exposure Index, developed by the World Bank, this policy measure could significantly impact the competitiveness of Ukrainian exports to the EU. Ukraine presents the highest CBAM Exposure Index among countries exporting to the EU.[12] In the likely prospect of deeper integration of the Ukrainian economy into the EU, the reconstruction effort in these CO_2-intensive sectors should consider stricter environmental regulations.

Although all sectors have been affected by the conflict, damages to specific vital industries and productions reported in Table 4.1 are less severe. Damages to agricultural production are extensive due to the war, the intensive shelling, and the disruption of logistic and transport infrastructures. However, the interviewees assessed the potential for a full recovery as high. The agriculture supply-side potential for 20 out of 25 regions of Ukraine did not change significantly; for the regions that have been or still are most affected by the conflict, the main challenge will be that of unexploded ordinances and minefields.

4.1.1 PRE-WAR STRUCTURAL TRANSFORMATION: EXPORT SURGES IN THE PERIOD 1995-2021

In recent decades, the Ukrainian economy has experienced a profound structural transformation, heavily conditioned by several episodes of political and socioeconomic instability. Part of the current export basket is rooted in specializations that pre-dated the collapse of the USSR. Still, in recent decades, new specializations emerged due to the progressive integration of the country into the world economy. This section focuses on new entries (NE), representing episodes of export surges or new specializations that progressively entered the Ukrainian export basket from 1995-2021.[13] The ability of a country to diversify its economy by adding new and more complex products to its export portfolio is a fundamental ingredient of structural change, socioeconomic progress and, ultimately, well-being. A focus on the number, importance and features of export surges reveals a great deal of information on the dynamics of structural transformation and the ability of countries to defy their static comparative advantages.

The Ukrainian economy has experienced export surges in 110 products. Still, those that entered in a stable and relevant way into the export basket – i.e. new specialization products – are the 54 products listed in **Table 4.2**. These new entries accounted for approximately US$ 6 billion, equivalent to 8.7 percent of total exports in 2021. On average, 3.4 new export specializations were developed each year, a number that is slightly below the LMI country mean.

Most new entries (42 of 54) were registered in the agricultural sector and accounted for US$ 4.13 billion in 2021, equivalent to more than two-thirds of the export value of new entries. Only one significant export surge was registered in the electronics sector, (HS8544) insulated electrical wire, with a rapid export expansion between 2000 and 2005 and now accounting for more than USS 1.6 billion in exports. Entries in other sectors were relatively marginal: textile (5 new products), chemical sector (2 new products), metals (2 new products), and minerals and machinery (1 new product each). Overall, the pattern of diversification involved products in a few sectors and was driven mainly by the abundance of land in the country. Even the consolidated comparative advantage in metallurgical products did not lead to significant export surges in related and more complex goods in metal, machinery and vehicle categories.

Besides the evidence gathered through the UNIDO DIVE Tool, further information on export surges has been provided by UNIDO consultations. The growth in exports of (HS0409) natural honey, for instance, was possible mainly due to the introduction of cluster initiatives, which ensured cooperation in the export activities of many individual producers. As a result, Ukraine exported 61.2 thousand tons of honey worth $144.9 million in 2021. Regarding product sales abroad, the country ranked fifth globally, after China, India, Argentina and Viet Nam. Poland, Germany, Belgium, France and Lithuania buy most Ukrainian honey.

Similarly, the cluster initiative has led to a success story in the export of (HS0802) other nuts (mostly walnuts). The cooperation of producers led to the inclusion of Ukraine among the top 10 walnut-exporting countries (US$ 130 million in 2021), with 584 companies operating in Ukraine and supplying nuts to 82 foreign markets (65.8 percent to the EU). Another interesting diversification story is the rise in the export of fresh blueberries – (HS0810) other fruits, fresh and (HS0811) fruits and nuts, frozen. In 2022, the total export of fresh blueberries from Ukraine exceeded 2.5 thousand tons, an increase of 1.5 times the amount exported in 2021. According to the top management of manufacturing Ukrainian companies interviewed during UNIDO consultations, ties with the Ukrainian diaspora in importing countries represented the critical factor for such an export boost, and this evidence bears paramount significance in a post-conflict scenario in which the Ukrainian diaspora is expected to be prominent. During this period, the wood processing industry also exhibited an export boom (including some products listed in **Table 4.2**, such as HS4408, HS4418, HS4401, HS4411 and HS4404). According to expert opinions, this success is related to several measures conceived to prevent market corruption and the adoption of a new regulatory environment.

TABLE 4.2: NEW ENTRIES (NE) INTO THE UKRAINIAN EXPORT BASKET, 1995-2021

Source: UNIDO elaboration, based on BACI, Centre d'Études Prospectives et d'Informations Internationales, and World Bank, *World Development Indicators database* (accessed September 2023).

HS CODE	HS DESCRIPTION	PRODUCT SECTOR	EXPORTS IN 2021 (MILLION US$)	RCA - BALASSA INDEX (2021)	PRODY (2017-2019; THOUSAND USD)	GROWTH IN GLOBAL TRADE (%, 2019-21)	COUNTRIES WITH PRODUCT IN EB (2019-21)	NR. NEW ENTRIES (PERIOD 1995-2021)	% OF PATH-DEPENDENT NEW ENTRIES	INDEX OF STRUCTURAL VULNERABILITY	PROD. RELATEDNESS-WITH UKRAINIAN PRE-EXISTING EB
8544	Insulated electrical wire	Electronics	1 642	3.3	9.1	14.8	36	14	100%	0.76	0.61
0207	Poultry	Agriculture	704	7.0	16.0	8.6	23	13	92%	0.69	0.52
1201	Soya beans	Agriculture	668	2.6	9.1	41.6	15	7	43%	0.56	0.28
1507	Soybean oil	Agriculture	289	5.1	9.2	90.3	24	17	6%	0.81	0.40
4408	Sheets for veneering for plywood	Agriculture	281	17.9	8.5	31.2	37	7	100%	0.66	0.58
2304	Solid soybean residues	Agriculture	264	2.7	9.6	18.5	18	8	25%	0.65	0.48
4418	Wood carpentry for construction	Agriculture	251	4.1	18.1	28.7	36	9	100%	0.70	0.60
0811	Fruits and nuts, frozen	Agriculture	187	7.8	11.9	41.3	37	7	100%	0.66	0.64
2202	Waters, flavored or sweetened	Agriculture	130	1.5	12.7	23.2	60	20	100%	0.81	0.50
4401	Fuel wood	Agriculture	125	3.5	12.9	0.7	36	13	92%	0.76	0.41
4818	Toilet paper	Agriculture	122	1.3	14.5	0.4	42	10	100%	0.74	0.56
0802	Other nuts	Agriculture	118	1.8	5.7	0.7	36	10	70%	0.74	0.38
2403	Other manufactured tobacco	Agriculture	116	3.2	11.3	23.9	36	24	71%	0.81	0.43
1517	Margarine	Agriculture	83	3.1	15.4	44.9	36	19	79%	0.79	0.47
4421	Other articles of wood	Agriculture	80	2.7	13.5	31.8	23	7	100%	0.57	0.48
9404	Mattresses and bedding	Textiles	79	1.0	13.7	21.7	34	12	100%	0.74	0.53
7407	Copper bars, rods and profiles	Metals	76	3.2	17.9	36.3	27	10	70%	0.70	0.53
4402	Wood charcoal	Agriculture	74	14.8	5.2	10.1	27	10	50%	0.72	0.40
4411	Fiberboard of wood	Agriculture	73	1.7	21.2	27.7	32	13	100%	0.74	0.64
6304	Other furnishing articles	Textiles	62	3.9	4.8	15.9	27	16	94%	0.73	0.51
2303	Starch residues	Agriculture	60	2.9	16.7	20.1	20	7	57%	0.59	0.47
2002	Tomatoes, prepared or preserved	Agriculture	55	3.1	13.7	16.9	23	7	43%	0.62	0.52
0407	Eggs, in shell	Agriculture	50	3.2	14.0	12.3	38	12	92%	0.76	0.45
0405	Butter	Agriculture	45	1.2	32.2	14.2	21	11	91%	0.65	0.66
1101	Wheat or meslin flour	Agriculture	37	2.2	7.7	-5.0	58	24	96%	0.82	0.49

1803	Cocoa paste	Agriculture	36	2.6	3.7	20.6	18	9	33%	0.67	0.36
0102	Bovine	Agriculture	32	1.0	8.0	1.4	45	18	89%	0.81	0.51
4301	Other raw furskins	Agriculture	29	5.8	38.8	-26.1	15	2	0%	0.44	0.44
2102	Yeasts	Agriculture	26	2.8	13.1	13.4	35	6	100%	0.63	0.50
0404	Whey	Agriculture	23	1.2	29.7	29.7	23	9	100%	0.63	0.62
1107	Malt	Agriculture	23	1.7	19.9	7.1	21	8	75%	0.60	0.53
2923	Quaternary ammonium salts and hydroxides	Chemicals	20	2.2	24.7	19.6	15	4	75%	0.37	0.65
2529	Feldspar	Minerals	20	3.6	6.4	-0.9	24	5	71%	0.56	0.49
1515	Other vegetable fats and oils	Agriculture	18	0.9	7.7	26.4	40	17	25%	0.65	0.36
0408	Egg yolks	Agriculture	16	4.0	25.6	5.4	20	7	71%	0.57	0.43
1204	Linseed	Agriculture	15	3.4	15.1	52.6	9	12	100%	0.71	0.49
2839	Silicates	Chemicals	14	5.2	13.8	19.9	20	7	100%	0.19	0.52
4205	Other articles of leather	Agriculture	14	1.5	14.3	-2.6	25	13	0%	0.50	0.40
8401	Nuclear reactors and related equipment	Machinery	14	1.0	33.4	27.4	9	2	100%	0.44	0.60
4201	Saddlery and harnesses	Agriculture	14	1.4	15.8	66.0	18	2	33%	0.53	0.27
1501	Pig and poultry fat, rendered	Agriculture	14	3.7	31.3	106.9	18	5	0%	0.47	0.35
1007	Grain sorghum	Agriculture	14	1.2	5.1	260.7	9	6	38%	0.69	0.47
0505	Feathers and down	Agriculture	12	2.1	22.3	-12.7	15	2	100%	0.74	0.57
4808	Corrugated paper and paperboard	Agriculture	10	1.2	14.9	19.3	31	14	0%	0.63	0.29
0909	Anise, fennel, etc.	Agriculture	7	1.5	1.3	25.5	20	3	100%	0.56	0.56
5606	Gimp yarn	Textiles	6	2.6	17.2	15.8	18	8	50%	0.37	0.42
8210	Hand-operated appliances, food preparation, <10kg	Metals	5	2.1	20.9	49.2	11	4	83%	0.58	0.50
4404	Strips and other pieces of wood	Agriculture	5	5.0	5.8	-1.4	26	6	60%	0.74	0.43
5904	Linoleum	Textiles	5	4.3	24.9	2.3	8	4	75%	0.29	0.53
4822	Bobbins, spools, cops of paper	Agriculture	4	2.4	25.5	20.4	29	6	100%	0.59	0.60
6216	Gloves	Textiles	4	1.1	8.9	0.5	16	5	80%	0.45	0.28
2308	Vegetable materials for animal feeding	Agriculture	4	1.0	9.4	3.9	26	12	25%	0.76	0.40
1521	Vegetable waxes and beeswax	Agriculture	4	2.9	3.8	7.3	13	4	0%	0.53	0.32
1401	Vegetable materials used for plaiting	Agriculture	1	1.3	3.8	55.7	20	2	50%	0.43	0.52
AVERAGE VALUES			**113**	**3**	**14.6**	**25.63**	**25.9**	**9.4**	**69%**	**0.63**	**0.480**

Note: Ranked by value of export in 2021; products for which RCA>1 in 2021 and > US$ 1 million.

It is interesting to notice that the level of product sophistication of the NE reported in **Table 4.2** is overall lower than the weighted average of the export basket (weighted average PRODY in 2021 was, respectively, US$ 11,922 for the new entries and US$ 12,847 for the export basket). Although Ukraine has included several products with a significant degree of complexity, their weight in terms of export value is still limited. The bulk of exports are relatively unsophisticated goods, such as (HS8544) insulated electrical wire or (HS1201) soybean products.

Global demand for Ukrainian new specializations was particularly dynamic in the last few years, with, on average, +26 percent between 2019-2021, as noted at the bottom of **Table 4.2**. This is encouraging with respect to the possibility of further strengthening Ukraine's international position in the global market.

Table 4.2 includes additional information that allows us to assess Ukraine's competitive positioning in the new sectors of comparative advantage. The first two indicators are the number of countries with the same products in their current export basket and the number of countries that, like Ukraine, experienced an export surge in the considered time interval (1995-2021). For a proper benchmarking analysis, we also report the same indicators for countries with the same income group as Ukraine, the LMI group, as defined by the World Bank's commonly used categories. On average, 26 countries have a revealed comparative advantage (RCA>1) in the products added to the Ukrainian export basket, of which six belong to the same income group of Ukraine. The corresponding average values for all the products of the HS trade classification (in total, 1241) are 19.2 countries, of which 3.7 are from LMI countries. With respect to the new entries, on average, 9.4 countries entered the recent specializations developed by Ukraine and 3.4 from LMI countries. A useful benchmark is the average number of countries that acquire a new specialization in an average product (adopting the HS 4-digit classification) in the same period: 6.3 countries developed a new specialization; among these, 1.7 belong to the LMI group. These figures suggest that Ukraine entered new specializations with a relatively high number of competing countries. This result, which aligns with a relatively low level of sophisticatedness associated with these new entries, implies that entry barriers are not exceptionally high, and global markets for many of these products are highly contestable.

Table 4.2 also reports the share of new entries experienced in the world economy for each path-dependent specialization product. An NE is defined in the DIVE methodology as path-dependent when countries adding the product to their export basket already specialize in related products; in other words, production capabilities matter and are not easy for competing countries to acquire. In general, products with high path dependence are also characterized – mainly when the frequency of new entries' occurrence is high – by a relatively high score on the Index of Structural Vulnerability (also reported in Table 4.2).

The **Index of Structural Vulnerability** (ISV) average score associated with the products in which Ukraine gained a comparative advantage (0.63) is **slightly higher than the average** computed using all products (n. 1241 of the HS 4 digits classification), which is equal to 0.61 **but in line with other LMI countries** (also 0.63).

Product relatedness to the pre-existing Ukrainian export basket measures to which extent the new entries were short jumps over the potential production space (i.e. high values of relatedness) or longer jumps (i.e. lower relatedness). The average "proximity", or relatedness, was equal to 0.48, a value higher than an average new entry in the world economy (0.46) as well as an average new entry experienced by LMI countries (0.45); **the ability to defy the initial comparative advantage was relatively lower for the Ukrainian economy**.

To sum up, the analysis of the **pre-war diversification pattern of Ukraine** reveals the following stylized facts:

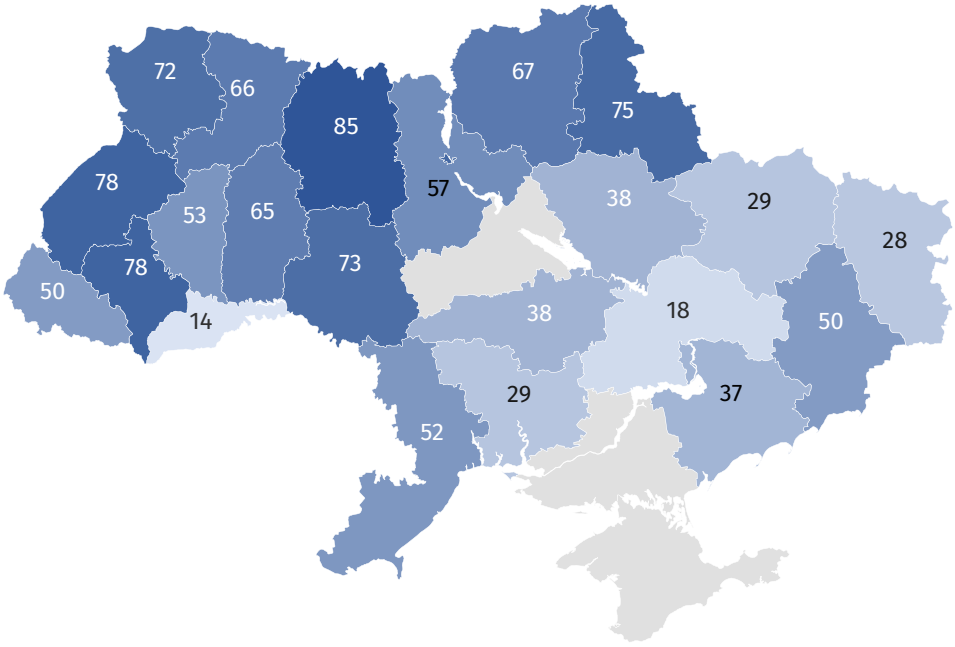
- Most of the new entries were related to agricultural products;
- The level of sophistication, or complexity, of the new entries in the export basket has been, on average, low (even lower than the overall export basket). Several high-complexity products are exported, but Ukraine shows limited specialization in these goods and/or the export values are still limited. The current capabilities are relatively concentrated and conducive to specializations generally in low-income countries' export baskets;
- Ukraine developed new specializations in products that, on average, compete with products from other countries, as captured by the number of countries that include such specializations in their export baskets. This evidence is likely associated with relatively low entry barriers, high structural vulnerability and thus more contestable global markets;
- Qualitative analysis reveals interesting cases of successful diversification – e.g. (HS0207) poultry, (HS0811) fruits and nuts, or wood products such as (HS4408) and (HS4418). Still, expert opinions converge on the limited ability of the Ukrainian economy to deploy old and new capabilities toward emerging sectors. The most relevant bottlenecks mentioned by experts are inefficient credit markets, red tape and corruption, ineffective taxing systems and political instability;
- Several cases of new entries of unrelated and path-departing products have been recorded along the time interval. Still, on average, Ukraine's ability to jump over the production space has been relatively more limited compared to an average country from the same income group.

4.1.2 REGIONAL DIMENSION OF INDUSTRIAL CAPABILITIES

In this section, we shift the focus to regional specializations to highlight some features of the geographical dimension of the export basket and newly added products of comparative advantage. **Figure 4.2** presents the geographical distribution of Ukraine's export basket by region. The figure reports the number of Ukrainian specialization products in which the regions have a location quotient – regional export share over national export share – larger than 1. We use the HS 2-digit trade classification, which allows regional data to be matched with national data. Darker colours are indicative of a more diversified regional export basket. A detailed analysis by region and sector (HS2-digits) is reported in **Table 4.3**.[14]

FIGURE 4.2: GEOGRAPHICAL DISTRIBUTION OF UKRAINIAN EXPORT SPECIALIZATIONS, 2017-2021 AVERAGE

Source: UNIDO elaboration, based on State Statistics Service of Ukraine and Centre d'Études Prospectives et d'Informations Internationales (accessed September 2023).



Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

TABLE 4.3: UKRAINIAN EXPORT SPECIALIZATIONS, BY REGION AND SECTOR, 2017-2021

Source: UNIDO elaboration, based on State Statistics Service of Ukraine and Centre d'Études Prospectives et d'Informations Internationales (accessed September 2023).

HS2-DIGITS SECTOR	HS4-DIGITS TRADE SPECIALIZATION CONTAINED IN HS2-DIGITS	NUMBER OF REGIONS WITH A RELATIVE SPECIALISATION (LQ>1)	REGIONS WITH A RELATIVE SPECIALISATION (LQ>1)
01 live animals	2	8	Chernihiv; Kirovograd; Kyiv city; Kyiv; Odesa; Rivne; Sumy; Ternopil.
02 meat and edible offal	1	5	Kyiv; Rivne; Ternopil; Vinnytsia; Volyn.
04 milk and dairy products, poultry eggs; natural honey	5	12	Chernihiv; Ivano-Frankivsk; Khmelnytsky; Kirovograd; Kyiv; Poltava; Rivne; Sumy; Ternopil; Vinnytsia; Volyn; Zhytomyr.
05 other products of animal origin	1	7	Lviv; Poltava; Rivne; Sumy; Ternopil; Vinnytsia; Volyn.
07 vegetables	2	7	Chernihiv; Khmelnytsky; Kyiv city; Odesa; Poltava; Rivne; Zaporizhzhya.
08 edible fruits and nuts	2	10	Chernivtsi; Khmelnytsky; Lviv; Odesa; Rivne; Ternopil; Transcarpathian; Vinnytsia; Volyn; Zhytomyr.
09 coffee, tea	1	6	Chernihiv; Kharkiv; Kyiv; Odesa; Rivne; Sumy.
10 cereals and grains	7	8	Chernihiv; Khmelnytsky; Kirovograd; Kyiv city; Mykolaiv; Odesa; Sumy; Vinnytsia.
11 products of the flour and cereal industry	5	4	Khmelnytsky; Kyiv city; Kyiv; Vinnytsia.
12 seeds and fruits of oil plants	8	11	Chernihiv; Khmelnytsky; Kyiv city; Kyiv; Mykolaiv; Odesa; Rivne; Sumy; Ternopil; Volyn; Zhytomyr.
14 plant materials for manufacturing	2	3	Kyiv city; Odesa; Vinnytsia.
15 Fats and oils of animal or vegetable origin	8	1	Transcarpathian.
17 sugar and sugar confectionery	2	8	Khmelnytsky; Kirovograd; Kyiv city; Kyiv; Lviv; Poltava; Sumy; Vinnytsia.
18 cocoa and cocoa products	2	3	Kyiv city; Kyiv; Sumy.
19 ready-made cereal products	2	7	Chernihiv; Khmelnytsky; Kyiv; Lviv; Poltava; Sumy; Vinnytsia.
20 processed vegetable products	2	7	Chernivtsi; Lviv; Mykolaiv; Odesa; Sumy; Ternopil; Vinnytsia.
21 miscellaneous food products	3	10	Khmelnytsky; Kirovograd; Kyiv city; Kyiv; Lviv; Rivne; Sumy; Vinnytsia; Volyn; Zhytomyr.
22 alcoholic and non-alcoholic beverages and vinegar	2	7	Kyiv city; Kyiv; Lviv; Mykolaiv; Odesa; Transcarpathian; Vinnytsia.
23 residues and waste from the food industry	5	6	Kirovograd; Kyiv city; Luhansk; Lviv; Odesa; Vinnytsia.
24 tobacco and industrial tobacco substitutes	2	4	Kyiv city; Kyiv; Lviv; Transcarpathian.
25 salt; sulphur; earth and stones	8	6	Donetsk; Ivano-Frankivsk; Khmelnytsky; Rivne; Vinnytsia; Zhytomyr.
26 ores, slag and ash	4	2	Dnipropetrovska oblast; Poltava.

HS2-DIGITS SECTOR	HS4-DIGITS TRADE SPECIALIZATION CONTAINED IN HS2-DIGITS	NUMBER OF REGIONS WITH A RELATIVE SPECIALISATION (LQ>1)	REGIONS WITH A RELATIVE SPECIALISATION (LQ>1)
27 mineral fuels; petroleum and its distillation products	3	6	Dnipropetrovska oblast; Donetsk; Ivano-Frankivsk; Kyiv city; Lviv; Poltava.
28 inorganic chemicals	8	2	Ivano-Frankivsk; Mykolaiv.
29 organic chemical compounds	3	7	Ivano-Frankivsk; Kirovograd; Luhansk; Odesa; Poltava; Transcarpathian; Vinnytsia.
31 fertilisers	1	4	Dnipropetrovska oblast; Kyiv city; Odesa; Poltava.
32 tanning extracts	1	2	Kyiv city; Sumy;
35 protein substances	1	8	Ivano-Frankivsk; Khmelnytsky; Luhansk; Mykolaiv; Ternopil; Vinnytsia; Volyn; Zaporizhzhya;
38 miscellaneous chemical products	2	5	Kyiv city; Kyiv; Luhansk; Vinnytsia; Zaporizhzhya.
39 plastics, polymeric materials	3	9	Chernihiv; Ivano-Frankivsk; Kharkiv; Khmelnytsky; Kyiv; Luhansk; Sumy; Ternopil; Volyn.
41 hides	1	5	Ivano-Frankivsk; Kyiv city; Lviv; Mykolaiv; Ternopil.
42 leather goods	2	5	Chernihiv; Kyiv; Lviv; Transcarpathian; Zhytomyr.
43 natural and artificial fur	1	3	Ivano-Frankivsk; Kyiv; Ternopil.
44 wood and wood products	15	11	Chernihiv; Ivano-Frankivsk; Kyiv; Lviv; Rivne; Sumy; Ternopil; Transcarpathian; Vinnytsia; Volyn; Zhytomyr.
48 paper and cardboard	6	7	Chernihiv; Ivano-Frankivsk; Kyiv; Luhansk; Lviv; Volyn; Zhytomyr.
49 printed matter	1	4	Kyiv city; Kyiv; Lviv; Sumy.
56 cotton wool	2	3	Chernihiv; Kharkiv; Poltava;
57 carpets	1	2	Khmelnytsky; Odesa.
58 special fabrics	1	6	Chernihiv; Ivano-Frankivsk; Lviv; Rivne; Transcarpathian; Vinnytsia.
59 textile materials	1	7	Kyiv city; Lviv; Poltava; Rivne; Ternopil; Transcarpathian; Volyn.
62 clothing and clothing accessories, textile	2	14	Chernihiv; Chernivtsi; Ivano-Frankivsk; Khmelnytsky; Kirovograd; Luhansk; Lviv; Poltava; Rivne; Ternopil; Transcarpathian; Vinnytsia; Volyn; Zhytomyr.
63 other finished textile products	2	5	Ivano-Frankivsk; Lviv; Rivne; Transcarpathian; Zhytomyr.
64 footwear	1	8	Chernihiv; Ivano-Frankivsk; Kyiv city; Lviv; Odesa; Sumy; Transcarpathian; Zhytomyr.
68 Articles of stone, plaster, cement	4	6	Ivano-Frankivsk; Kyiv; Luhansk; Lviv; Poltava; Zhytomyr.
69 ceramic products	3	5	Donetsk; Kharkiv; Khmelnytsky; Kyiv city; Zhytomyr.
70 glass and glassware	1	5	Kharkiv; Kyiv; Luhansk; Rivne; Zhytomyr.
72 ferrous metals	19	2	Donetsk; Zaporizhzhya.
73 products of ferrous metals	6	9	Chernihiv; Dnipropetrovska oblast; Donetsk; Kharkiv; Lviv; Odesa; Rivne; Sumy; Zhytomyr.

HS2-DIGITS SECTOR	HS4-DIGITS TRADE SPECIALIZATION CONTAINED IN HS2-DIGITS	NUMBER OF REGIONS WITH A RELATIVE SPECIALISATION (LQ>1)	REGIONS WITH A RELATIVE SPECIALISATION (LQ>1)
74 copper and copper products	1	3	Donetsk; Volyn; Zaporizhzhya.
78 lead and products of lead	1	1	Donetsk.
81 other non-precious metals	3	1	Zaporizhzhya.
82 tools, knife products	2	7	Chernihiv; Khmelnytsky; Kyiv; Lviv; Poltava; Rivne; Sumy.
83 other articles of non-precious metals	2	5	Lviv; Odesa; Sumy; Vinnytsia; Volyn.
84 nuclear reactors, boilers, machinery	9	8	Donetsk; Ivano-Frankivsk; Kharkiv; Kirovograd; Sumy; Volyn; Zaporizhzhya; Zhytomyr.
85 electrical machines	5	8	Chernivtsi; Ivano-Frankivsk; Khmelnytsky; Lviv; Ternopil; Transcarpathian; Volyn; Zhytomyr.
86 railway locomotives	4	4	Dnipropetrovska oblast; Odesa; Poltava; Volyn.
90 optical and photographic instruments and apparatus	1	7	Kharkiv; Khmelnytsky; Kyiv city; Kyiv; Luhansk; Odesa; Transcarpathian.
94 furniture	3	10	Chernivtsi; Kharkiv; Khmelnytsky; Kyiv; Lviv; Rivne; Ternopil; Transcarpathian; Volyn; Zhytomyr.
Total of HS4 sectors in the Export Basket	**198**		

The Harmonized System 2-digits trade classification, for which regional data is available, has a total of 58 products (listed in rows). For each region, we report the presence of a relative specialization in the HS2 products measured as the location quotient (LQ>1). In the second column, we report the number of HS4-digits products in which Ukraine specializes within the more aggregated HS2-digits category. These values indicate the relative importance of each sector and the degree of within-sector diversification for the country. Within the agricultural sector, the entries (HS10) cereals and grains, (HS12) seeds and fruits of oil plant, and (HS15) fats and oils of animal and vegetable origin present the highest number of HS4-digits products in the export basket (respectively 7, 8 and 8). (HS44) wood and wood products also contains a relatively large set of country specializations (15) as does (HS72) ferrous metals (19).

Information by column reveals the geographical distribution of each HS2-digits specialization. For instance, (HS72) ferrous metals – one of the most relevant sectors in the Ukrainian export basket, which has suffered the most from the damages of the war, as discussed throughout this block – is found primarily in Donetsk and Zaporizhzhya. It is a highly geographically concentrated sector, as it is possible to see from the last column, which reports the number of specialized regions by HS2-digit sectors.

While some (primarily agricultural) products are present in the export baskets of several regions – for example, (HS04) milk and dairy products, poultry eggs, natural honey; (HS08) edible fruits and nuts; (HS12) seeds and fruits of oil plants; or (HS44) wood and wood products; and (HS94) furniture – the industrial capabilities on which many Ukrainian specialization products are based are highly concentrated geographically.

For instance, (HS85) electrical machines – which includes (HS8544) insulated electrical wires, an essential product in the Ukrainian export basket – is present in eight regions (Chernivtsi, Ivano-Frankivsk, Khmelnytsky, Lviv, Ternopil, Volyn, Zhytomyr and Transcarpathian), mainly in the western part of the country.

Another important sector, as discussed below, is (HS70) glass and glassware. In this sector, there is a limited specialization by Ukraine (only 1 HS4-digits product), and production capacities are primarily present in five regions (Kharkiv, Kyiv, Luhansk, Rivne and Zhytomyr), some of them highly impacted by the conflict.

As for 2021, the pre-war diversification pattern of Ukraine, Kyiv, Lviv and western regions present a relatively higher level of cross-sectoral diversification. On the contrary, some regions are characterized by a more concentrated export basket, such as Chernivtsi and Dnipropetrovska Oblast (5 HS2-digits sectors), Mikolaiv and Zaporizhzhya (7 HS2-digits sectors). These initial considerations are instrumental for the analysis that is reported in the rest of this block, in particular for assessing how the war is impacting regional capabilities and specializations (Section 3) or how the diversification targets identified using the DIVE Tool (Section 5) might leverage existing localized capabilities.

4.2 EFFECTS OF THE WAR ON THE INDUSTRIAL BASE AND CAPABILITIES

The ongoing conflict has already significantly affected Ukraine's industrial potential and capabilities. Ukraine had a revealed comparative advantage in approximately 210 products before the conflict broke out (*UN COMTRADE Database*). In 2022, while losing a comparative advantage in 47 products, Ukraine gained an advantage in 35 products, with 25 showing increased exports. Among the 163 products where Ukraine maintained a comparative advantage, 42 saw increased exports, indicating that the country has a reservoir of skills and capabilities, as discussed in **Block 2**. The economy's supply side has been affected by direct capital and human losses and indirect effects, such as higher trade and operational costs, which limit competitiveness. The Kyiv School of Economics (KSE) regularly provides an extensive analysis of the damages to production facilities and infrastructure.[15] The demand side is affected by severed economic relations with Russia, Belarus and third countries, which has caused trade costs to explode and businesses to divert their imports and exports toward other destinations.

Already, the non-recognized annexation of Crimea and the conflict in Eastern Ukraine have had significant impacts on the industrial development of Ukraine and its regions. In 2013, the sales volume of Ukrainian goods abroad amounted to US$ 63.3 billion. However, exports fell by 13.5 percent in 2014 and 29.3 percent in 2015. The decline in industrial development was not only due to the loss of some critical enterprises (for example, Donetsk Metallurgical Plant, O. F. Zasiadko Mine, Luhansk Pipe Plant and Luhansk Cartridge Plant), but also to a decrease in trade between Ukraine and the Russian Federation, which was a key importer of Ukrainian products. The declining sectors since 2014 included chemicals, machine-building, stone, textiles and transport means. Somewhat emblematic of this decline was the loss of specialization sectors such as parts of railways. The export value of (HS8606) railway cars, not self-propelled in 2012 was equal to US$ 2.9 billion and, in general, vehicles and parts accounted for approximately US$ 6 billion. In 2021, the overall export value of this macrosector was just US$ 0.8 billion.

The next section discusses the effects of the full-scale invasion of Ukraine in terms of lost specializations and new emerging ones, considering evidence that emerged during UNIDO consultations and through analysing export data for 2022.

4.2.1 LOST SPECIALIZATIONS

Some specializations highlighted above are suspended and/or lost due to the conflict. As the war is ongoing, assessing whether the status quo will be temporary or permanent is difficult. Many strategic enterprises and production plants are located in areas that are or have been under the temporary military control of the Russian Federation. UNIDO consultations highlighted how essential plants in the metal macro-sectors, such as the Ilyich Iron and Steel Works of Mariupol[16], Azovstal Iron and Steel Works, Alchevsk Iron and Steel Works, Makiivka Iron and Steel Works, Yenakiieve Iron and Steel Works, Torez hard metal surfacing plant are currently damaged and not operational. Many enterprises from other strategically important areas of activity are in similar conditions: the chemical manufacturer Concern Stirol, the Rubizhne State Chemical Plant Zoria, the pulp and paper industry enterprise Rubizhne Cardboard and Packaging Mill, the enterprise for the manufacture of agricultural machinery for harvesting grain and leguminous crops the Berdiansk Harvesters, the Melitopol Plant of Automobile and Tractor Spare Parts, as well as several other production facilities such as the State Aircraft Manufacturing Company Antonov in Kyiv[17] are currently damaged and not operational.

At the same time, even though more than 20 percent of arable land is in areas that are or have been under the temporary military control of the Russian Federation, the agriculture macrosector has maintained its position as Ukraine's leader in industrial production and export. This sector is proving highly resilient and suggests a high possibility for a full recovery.

A notable example of the disruption caused by the full-scale invasion of Ukraine – starting with the non-recognized annexation of Crimea – is the production of soda. Until 2014, there were three soda plants in Ukraine: Sloviansk, Lysychansk and Krasnoperekopsk (Crimea). Soda plants in Sloviansk and Lysychansk stopped working in 2010. At the same time, PJSC «Crimean Soda Plant» represented about 80 percent of the Ukrainian soda ash market and more than 2 percent of the respective world market. After the non-recognized annexation of Crimea in 2014, Ukraine became completely dependent on the import of soda ash and baking soda. This is a strategic issue for Ukraine's reconstruction efforts since soda is used to produce glass, several building materials and some other products. In 2014, CJSC «Lysychansk Glass Factory «Proletarii» was partially destroyed due to hostilities and then lost, thus leading to the cessation of flat glass production in Ukraine, which was never restored.

In addition, production capacity at several metallurgical enterprises in Eastern Ukraine or in other regions that are or have been under the temporary military control of the Russian Federation was lost, which, in turn, led to a sharp reduction in production and exports in the Ukrainian machine-building sector.[18]

Although damage was severe in the most affected areas of Ukraine, the core of the production and resource base still exists or is largely re-deployable with a coordinated effort and a strategic vision. Diversification policies in these territories might target products that are likely to have a high potential demand in the short-to-medium term and for which capabilities already exist (for instance, agricultural machinery, de-mining tools and vehicles, household appliances, household energy appliances, security and protection systems, building materials, etc.).

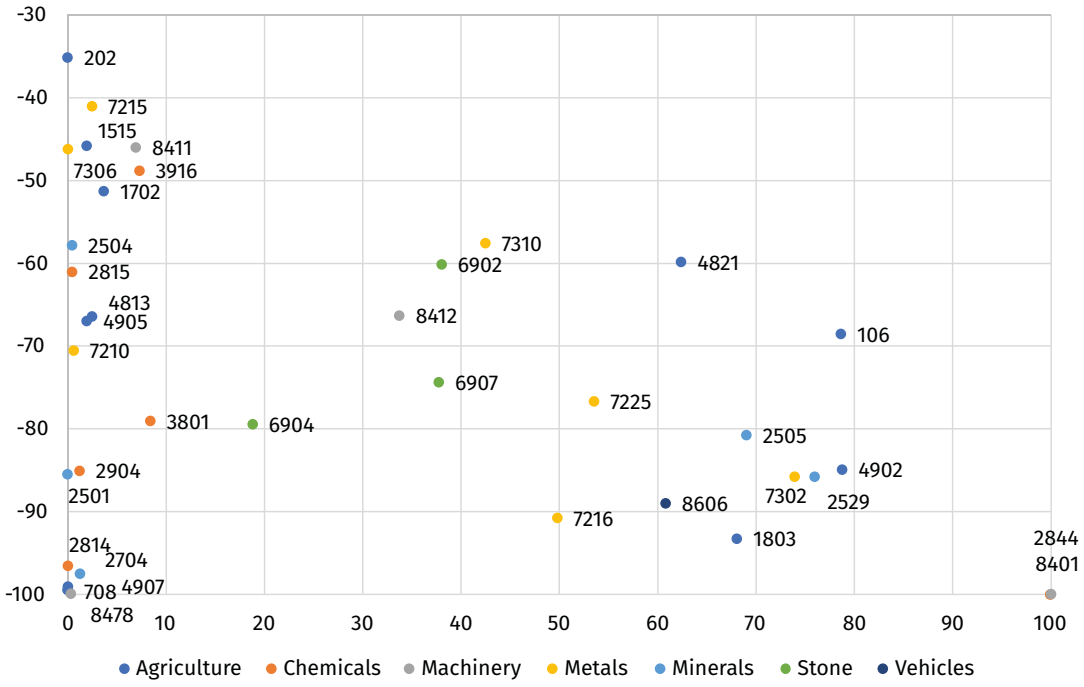
However, tackling industrial recovery and spatial inequalities in border regions will be possible only when the conflict ends. Uncertainty about the future for businesses in the most affected regions is neutralizing even the current support efforts. According to the Ministry of Economy, businesses in these regions have not been very active in applying for development grants offered under emergency support schemes. This is likely due to prevailing uncertainties on the future of these regions and is a worrying signal of the need to provide a credible and clear strategy for economic recovery.

By comparing the export specializations emerging from the application of the DIVE Tool and the export patterns in 2022 – the first full year affected by the conflict following the full-scale invasion of Ukraine – we have identified 33 lost HS4-digit specializations.[19] The most affected sectors are metals (nine lost specializations), agriculture (eight lost specializations) and chemicals (seven lost specializations). The export reduction in the affected product is remarkable and ranges from a minimum of -41 percent for (7215) other bars and rods of iron or unalloyed steel, to the zeroing of exports of (2844) uranium. In the case of uranium, the analysis of past commercial ties allows us to understand that the main reason behind the sudden contraction in exports for some former specializations is that Russia used to represent the leading partner country. Indeed, specializations such as uranium exports or those of (8401) nuclear reactors and related equipment disappeared in 2022 because the Russian Federation was the destination of 99.95 percent of exports and 100 percent of Ukrainian exports in 2021.

Figure 4.3 presents information on the 33 lost specializations with respect to the magnitude of trade reduction and the share of exports to Russia before the invasion. It allows us to visually distinguish between lost specializations probably linked to the destruction of production capabilities and those deriving from the zeroing of commercial interaction with the Russian Federation that will likely be restored after replacing Russia with new partner countries.

FIGURE 4.3: SIGNIFICANCE OF RUSSIA AS A TRADING PARTNER BEFORE THE INVASION AND EXPORT REDUCTION OF LOST SPECIALIZATION IN 2022

Source: UNCTAD, *UN COMTRADE Database* (accessed September 2023).



Note: Lost specialization products were in Ukraine's export basket in 2019-2021, for which data shows the existence of an RCA>1 in 2021 and an RCA<1 in 2022.

Chemical products such as (2815) sodium hydroxide (-61 percent); (2814) ammonia (-96.5 percent); (3801) artificial graphite (-79 percent); (2904) sulfonated, nitrated derivatives of hydrocarbons (-85 percent); (2901) acyclic hydrocarbons (-74.7 percent); and (3916) monofilament (-48.8 percent) have experienced a substantial reduction in exports, reflecting destruction in capabilities since such specializations had a relatively low share of production addressed to Russia. Finally, (0708) legumes have seen their exports decrease by 99.46 percent, despite not representing an export product for Russia before the war. On the contrary, agricultural products such as (0106) other live animals, (1803) cocoa paste, and (4821) paper labels have also exited the Ukrainian export basket (or mainly) because of the role of the Russian Federation as a trading partner in the pre-war period. Such export specialization destruction might be recovered once the country identifies new partners to divert pre-war trade patterns.

The only lost specialization in the electronics industry – (8606) railway cars, not self-propelled – has been hit by the destruction of export ties with the leading trade partner, Russia (export share 60.8 percent in 2021) since the export volume decreased by 76.7 percent between 2021 and 2022.

To get an overall picture of the destroyed specializations, it is important to note that the 33 products had an average RCA of 1.78 in 2021, which collapsed to 0.59 in 2022. In absolute terms, these lost specializations reached about US$ 2.17 billion in 2021 and fell to US$ 675 million after one year.

4.2.2 NEW EMERGING SPECIALIZATIONS

According to UNIDO consultations, the war effort has generated a significant shift of resources in new sectors. New specializations have emerged, such as the production of drones and components for them or other military equipment. These specializations are located primarily in regions of Ukraine far from the war zone. According to expert opinion, these new industries have prospects for entering foreign markets. Expert opinion acquired for the drafting of this block suggest that the prospects for entering foreign markets of innovative products of the Ukrainian military-industrial complex are very high – for this purpose, in June 2023, the state company «Ukroboronprom» was reorganized into the joint stock company «Ukrainian Defense Industry».

New enterprises started their operations to meet the needs of Ukraine's armed forces in the country's western regions. Another important finding that emerged from interviews is the creation of new enterprises in regions receiving residents moving from the eastern regions of Ukraine. Official statistics do not yet allow us to assess the features and size of the changes in production composition. Still, the sectors affected by this shift of human and financial resources are agriculture, food industry, IT, light industry (primarily textiles) and medical supplies.

By analysing export data for the year 2022 and symmetrically assessing the lost specializations, we can identify new products for which Ukraine has an RCA>1.[20] Of the 36 products, 24 recorded an increase in export values. Most of these products are characterized by low export share with Russia in 2021, except for (6310) used or new rags textile scrap, for which Ukraine has experienced a change in the target market, with the share of exports headed to Russia falling from 50 percent in 2021 to 5.6 percent in 2022.

New specializations with the highest RCA in 2022 are (3822) diagnostic or laboratory reagents (RCA equal to 73), (6501) hat forms (7.8), (1703) molasses (4.25), (2618) granulated iron or steel slag (3.87), and (3606) ferrocerium and other pyrophoric alloys (3.17). Among the new specializations, most of which are agriculture products (11), metals (7), chemicals (6) and textiles (6), those with the highest export growth between 2021 and 2022 have been (1701) sugarcane and sucrose (+596 percent), (1703) molasses (+473 percent), (7227) bars of other alloy steel (+373 percent), (9005) binoculars and telescopes (+338 percent), and (5502) artificial filament tow (+224.8 percent). The 36 new export specializations that came after the change in capabilities derived from the full-scale invasion of Ukraine have experienced an increase in export volume from US$ 630 million to US$ 813.5 million.

The comparison between the products exported with RCA in 2021 and those exported in 2022 highlights how, despite the loss of several specializations – mainly due to the loss of trading opportunities with Russia, which used to represent Ukraine's leading partner – the Ukrainian industrial structure demonstrated a discrete degree of resilience in the first year of conflict, before the start of most post-conflict recovery plans that aimed to promote integration with the EU. Relatedly, the diversification strategies reported in a later section also aim to consider the degree of complementarity between potential new specializations and import demand by European economies.

4.2.3 EXTENDING THE TIME SPAN OF THE ANALYSIS: EFFECTS OF A PROLONGED CONFLICT ON COUNTRY AND REGION INDUSTRIAL PRODUCTION

This section analyses Ukraine's industrial production and export performance in 2013-2022 by considering the recent full-scale war derived from the full-scale invasion of Ukraine. Other external shocks that have hit Ukraine include the non-recognized annexation of Crimea, the conflict in Eastern Ukraine and the global COVID-19 pandemic, which spread to Ukraine in the period 2020-2021.[21]

By following a multi-stage approach in which the analysis of the dynamics of industrial production indices and the export dynamics encompasses (1) the analysis of the structure of industrial production by type of economic activity and the clustering of economic activities by the production development dynamics, (2) the analysis of the structure and dynamics of exports by commodity groups, (3) the analysis of the impact of the non-recognized annexation of Crimea and the conflict in Eastern Ukraine and (4) the identification of Ukrainian regions' production specializations, we provide insightful details of the impact of the external shocks on the past decade.

Industrial production in Ukraine almost halved from 2013-2021 (in 2021, it amounted to 52.4 percent of 2013's level). Export dynamics over the same period decreased, and in 2021, export value reached 70.3 percent of the level in 2013.

The leading regions in terms of volume of industrial production sold in 2013 and 2022 were Dnipropetrovsk, Donetsk, Kharkiv and Zaporizhzhia regions and Kyiv City. Over the time interval under scrutiny, the share of industrial production relative to the Luhansk region – the largest in Ukraine – has decreased by 4.7 percent. In comparison, the share of the Kyiv region reduced by 2.3 percent. From 2013 to 2021, the share of the Dnipropetrovsk region increased by 2.6 percent, and industrial production in Kharkiv, Zaporizhzhia and Poltava regions reduced by 0.6 percent, 2.6 percent and 1.4 percent, respectively. The most dynamic growth in the industrial production indices in 2021 compared to 2013 was in the regions of Vinnytsia (+135.4 percent), Zhytomyr (+131.0 percent), Odesa (+125.5 percent), Ternopil (+119.6 percent) and Rivne (+119.9 percent).

According to the Index of Industrial Production (IIP), we can identify three clusters of Ukrainian regions:

Cluster I. Regions that developed most dynamically and whose industrial production indices in 2021 were as high as in 2013. They include Vinnytsia, Zhytomyr, Odesa, Ternopil, Rivne, Lviv, Volyn, Mykolaiv, Kyiv and Kherson regions.

Cluster II. Regions that experienced a decline in industrial production indices lower or equal to 50 percent of initial industrial production. They include Ivano-Frankivsk, Kirovohrad, Zaporizhzhia, Poltava, Cherkasy, Khmelnytskyi, Sumy, Kharkiv, Chernivtsi, Dnipropetrovsk, Kyiv, Chernihiv and Zakarpattia regions.

Cluster III. Regions where the industrial production indices decreased by more than 50 percent. They include Donetsk and Luhansk regions, i.e. regions where military operations have been conducted since 2014.

In light of these industrial production dynamics, Dnipropetrovsk, Donetsk, Kharkiv, Zaporizhzhia regions and Kyiv City represented the Ukrainian leaders in industrial sales in both 2013 and 2021. During the same time frame, Vinnytsia, Zhytomyr, Odesa, Ternopil, Rivne, Lviv, Volyn, Mykolaiv, Kyiv and Kherson regions were the most dynamic in terms of industrial production indices. Among them, the performances of Odesa, Mykolaiv and Kherson regions were due to the development of the agricultural sector and processing enterprises, along with port infrastructure, while those of the Vinnytsia, Zhytomyr, Ternopil, Rivne, Lviv and Volyn regions were due to the development of new industries, such as woodworking and furniture production.

Industrial production in the Donetsk and Luhansk regions suffered the greatest decline due to the impact of the conflict in Eastern Ukraine and the destruction of industrial output. These factors also hurt several regions in the Cluster II (Zaporizhzhia, Poltava, Cherkasy, Sumy, Kharkiv and Dnipropetrovsk regions).

In terms of exports of industrial goods, the leading commodity groups exported from Ukraine in 2022 were: (10) cereals, 20.6 percent share in the country's total exports; (72) ferrous metals, 10.3 percent; (26) ores, slag, and ashes, 7.0 percent; and (15) animal or plant fats and oils, 7.0 percent. Compared to 2013, the share of exports of (72) ferrous metals decreased by 12.7 percent, but the share of exports of (10) cereals increased by 10.4 percent. The most dynamic exports during this period were (12) oil seeds and fruits, which grew by 183.9 percent; (15) animal or plant fats and oils, which grew by 170.1 percent; and (10) cereals, which grew by 143.4 percent.

According to these export dynamics, the commodity groups exported by Ukraine can be classified into four different clusters:

Cluster I. The most dynamic commodity groups for which exports increased from 2013-2022. This cluster includes (01) live animals, (02) meat and meat preparations, (08) edible fruits and nuts, (10) cereals, (12) oil seeds and fruits, (15) animal or plant fats and oils, (23) remains and wastes of food industry, (44) wood and articles of wood, (70) glass and preparations thereof, and (94) furniture.

Cluster II. Commodity groups for which exports have declined by no more than 50 percent. This cluster of commodities involves (04) milk and milk products, eggs, honey; (22) alcoholic and non-alcoholic beverages, vinegar; (26) ores, slag, and ashes; (29) organic chemical combinations; (30) pharmaceutical products; (61-62) knitted clothes and knitted articles of clothes, textile clothes and textile articles of clothes; and (85) electric machines.

Cluster III. These commodity groups experienced a decrease in export volumes between 50 percent and 75 percent with respect to 2013 values. They include (18) cocoa and cocoa preparations; (24) tobacco and industrial substitutes of tobacco; (72) ferrous metals; (73) preparations from ferrous metals; (84) nuclear reactors, boilers, machines; and (87) ground transport facilities, excluding railways.

Cluster IV. The commodity groups whose exports have declined by more than 75 percent include (28) inorganic chemicals; (31) fertilizers; (48) paper, paperboard; (69) ceramic products; (86) railway locomotives; and (88) aircrafts.

According to this classification, and considering the clusters with the largest export shares, the most dynamic products result in (10) cereals, animal or plant fats and oils, (12) oil seeds and fruits, as well as (01) live animals, (02) meat and meat preparations, (08) edible fruits and nuts, (23) remains and wastes of food industry, (44) wood and articles of wood, (70) glass and preparations thereof, and (94) furniture.

In 2022, the exports of almost all product groups declined yearly, except for only (12) oil seeds and fruits; (02) meat and meat preparations; and (04) milk and milk products, eggs and honey. In 2022, the leading exporting regions of Ukraine were the Kyiv City, Dnipropetrovsk, Lviv, Zaporizhzhia and Odesa regions. In 2013, in addition to the regions mentioned above, the Donetsk region accounted for the largest share of the country's export volumes (19.6 percent), but in 2022, its share in exports decreased to 0.6 percent. In the same period, the most dynamic regions have been Vinnytsia (+235.6 percent), Lviv (+234.4 percent), Chernivtsi (+228.8 percent) and Ternopil region (+213.7 percent).

Four clusters are also identified to classify regions according to the dynamics of commodity exports in 2013-2022.

Cluster I. Regions where export growth more than doubled between 2013 and 2022. These include Vinnytsia, Lviv, Chernivtsi and Ternopil.

Cluster II. Regions with dynamic exports that grew by a rate between 100 to 200 percent. These include Volyn, Cherkasy, Khmelnytskyi, Rivne, Zakarpattia, Odesa, Ivano-Frankivsk, Chernihiv, Zhytomyr, Kyiv and Kirovohrad regions.

Cluster III. Regions with declining exports by less than 50 percent. These include the cities of Kyiv, Sumy, Zaporizhzhia, Mykolaiv, Poltava, and Dnipropetrovsk regions.

Cluster IV. Regions with over 50 percent declining exports include Kharkiv, Kherson, Donetsk and Luhansk.

Analysis of 2013-2022 has allowed us to highlight the structural changes in Ukrainian regions. Except for the Donetsk region, the most export-oriented regions in 2022 and 2013 were identical (Kyiv City, Dnipropetrovsk, Lviv, Zaporizhzhia and Odesa regions). However, among them, only the Lviv and Odesa regions have been developing dynamically all along, while the rest have had positive development dynamics until 2022, when they experienced a significant reduction in exports (from 48.6 percent to 31.7 percent). The largest decline in exports in 2022 occurred in Luhansk, Donetsk, Kherson, Mykolaiv and Kharkiv regions, i.e. the border regions that suffered great destruction due to the full-scale invasion of Ukraine.

4.3 INDUSTRIAL RECOVERY AND DIVERSIFICATION STRATEGIES FOR UKRAINE

This section aims to contribute to the analytical base on which the way forward for industrial reconstruction and development in Ukraine. With analysis presented in the following sections, we identify four types of target products that Ukraine could prioritize in its twofold effort to promote and prioritize the reconstruction of critical industrial capabilities and the diversification of its export basket.

The DIVE Tool is applied in the standard way but re-adapted to consider two fundamental elements. The full-scale invasion of Ukraine has severely damaged industrial capabilities and altered, often in an intense way, the pre-war comparative advantage of the country. This consideration means that diversification strategies must necessarily "look backward" and embed a strategic but realistic effort to reconstruct what was damaged or lost in the conflict. The second consideration is that future industrial development strategies will happen in a new geopolitical space where Ukraine will likely boost its socioeconomic integration with the EU while severing or reducing interactions on its northern and western borders.

4.3.1 FOUR CLUSTERS OF TARGET PRODUCTS

SET 1: SHORT JUMPS WITH A HIGH PATH DEPENDENCE AND MANY COMPETITORS

These products belong to Ukraine's potential diversification space and have a high degree of path dependence, i.e. products for which an economy's initial capabilities matter for the acquisition of a new specialization and which are characterized by a high degree of proximity (or relatedness) with the country's current export basket. In other words, these are targets that, in a coordinated effort of industrial recovery (post-conflict reconstruction) and diversification, have the **highest level of feasibility for the Ukrainian economy** (i.e. lower risks related to missing productive capabilities). In the selection exercise, we employ three criteria that enhance the targets' strategic value. The first is a significative **relatedness gain** (or advantage), i.e. a condition that ensures that the product is more closely related to Ukraine's export basket than other countries with a similar level of development (LMI countries). The second criterion is the presence of a **positive complexity gain**, or the inclusion of target products that have the potential to enhance the average degree of complexity or sophisticatedness of the Ukrainian economy. Based on these two criteria, we give more importance to relatively more knowledge – or capital-intensive goods at the expense of products that, although "close" to the pre-war comparative advantage of Ukraine, are now probably less strategic and desirable (for instance, products belonging to the textile or agriculture macro-categories associated with a relatively low value-added and sophisticatedness). The third criterion – relaxed for the definition of Set 2, described below – is the **presence of many countries that already specialize in the given product**. This criterion shall be interpreted simultaneously as indirect evidence of relatively low entry barriers for acquiring a trade specialization and potentially higher vulnerability to competitive pressures from other countries.

This first target list comprises 60 products from a wide range of sectors. Given their proximity with the current set of products exported by Ukraine (see third to last column in **Table 4.4**), these products are feasible targets, and Ukraine possesses a significative relatedness advantage (second to last column) with respect to competing countries in the same income group). For instance, (HS8433) harvesting or agricultural machines – a product that might

be highly interesting as an option for diversification given high internal and foreign demand and the presence of essential production capabilities – has a proximity with the current export basket (0.663) and, on average, this proximity is larger by 0.204 compared to other LMI countries. The table contains other vital features of the target products that might inform policy directions. Using the example of HS8433 again, the associated complexity gain with respect to the current Ukrainian export basket is high, +10.1 thousand US$; the recent dynamics of global trade in this product was high (+29.4 percent in the period 2019-2021) and, even more importantly, the product presents a very high potential partners' **import penetration index** – which combines the size of imports from likely importing countries with their distances from Ukraine in km – in particular toward the EU markets. The number of competitors in these sectors is generally high but not necessarily different from other LMI countries. The number of times the product enters the export baskets in the rest of the world (period 1995-2021) is a proxy for entry barriers, and countries targeting a specific product might learn – in a second stage of the targeting exercise – from past experiences of other countries that have successfully managed to develop a comparative advantage in the sectors.

We do not provide a comprehensive evaluation of the products in the table. Still, we underline that a sizable number of these potential specializations are likely to produce outputs that will be in high demand during the post-war reconstruction effort – e.g. (4009) vulcanized rubber tubes; (8405) water gas generators; (6810) articles of cement, of concrete or artificial stone; (9406) prefabricated buildings; (8501) electric motors and generators; (3006) pharmaceutical goods; and (9021) orthopedic appliances. It is worth noting how (9406) prefabricated buildings are among the new specializations according to export data provided by *UN COMTRADE Database*, despite a slight decrease in the absolute value of exports.

In the light of deeper trade links with EU countries, some products show a high export potential: (7604) aluminum bars; (7212) flat-rolled iron, width < 600mm, clad; (4005) compounded rubber; (8434) dairy machinery; (7616) other articles of aluminum; (7314) cloth of iron or steel wire; (4008) vulcanized rubber plates; (3922) baths, sinks etc.; (8716) trailers and semi-trailers; and (8433) harvesting or agricultural machinery.

The top five products in terms of the potential for increasing the sophisticatedness of Ukrainian export baskets are (5603) nonwoven textiles; (9021) orthopedic appliances; (8428) other lifting machinery; (3004) medicaments, packaged; and (8434) dairy machinery. In this respect, many other target products included in the list have significantly high complexity gains.

The qualitative analysis through expert interviews highlighted the importance of Ukraine boosting its technological capabilities for storing agricultural products and improving transportation logistics. Some of the products included in the DIVE list above – for instance, (HS8418) refrigerators, freezers or preserved agricultural products – align with these considerations. Under these conditions, the issue of creating production facilities for processing is crucial since it will facilitate both the storage and transportation of agricultural products.

TABLE 4.4: SHORT JUMPS WITH A HIGH PATH DEPENDENCE AND MANY COMPETITORS[22]

Source: UNIDO elaboration, based on BACI and Gravity, Centre d'Études Prospectives et d'Informations Internationales and World Bank, *World Development Indicators database* (accessed September 2023).

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)
7604	Aluminum bars	Metals	5228.47	36.670	1.171	1.787	39	5	0.617	0.193	9
401	Milk	Agriculture	9017.68	16.933	1.143	1.746	38	5	0.615	0.174	19
7212	Flat-rolled iron, width < 600mm, clad	Metals	11658.57	39.974	1.080	1.714	24	2	0.551	0.160	5
4005	Compounded rubber	Chemicals	15827.85	6.622	1.149	1.659	24	0	0.567	0.158	7
8434	Dairy machinery	Machinery	18054.54	-2.153	1.506	1.634	22	0	0.599	0.181	13
7616	Other articles of aluminum	Metals	8313.46	15.568	1.156	1.628	26	4	0.580	0.143	4
7314	Cloth of iron or steel wire	Metals	2739.85	44.002	1.090	1.599	31	1	0.610	0.155	6
4008	Vulcanized rubber plates	Chemicals	16074.46	10.911	1.187	1.550	22	2	0.597	0.159	6
3922	Baths, sinks etc.	Chemicals	2647.38	31.418	1.262	1.548	27	4	0.638	0.148	7
8716	Trailers and semi-trailers	Vehicles	10518.45	19.059	1.223	1.525	27	1	0.588	0.135	8
8433	Harvesting or agricultural machinery	Machinery	10119.39	29.415	1.249	1.523	25	1	0.663	0.204	8
9406	Prefabricated buildings	Textiles	8195.20	15.771	1.221	1.496	33	4	0.671	0.188	12
3209	Paints and varnishes, aqueous	Chemicals	3796.92	16.164	1.178	1.444	35	4	0.609	0.137	3
8476	Automatic goods-vending machines	Machinery	14359.12	-16.655	1.076	1.426	23	2	0.491	0.101	7
8503	Parts for use with electric generators	Electronics	6736.98	20.105	1.050	1.392	26	3	0.620	0.153	7
3003	Medicaments, not packaged	Chemicals	7818.05	-13.905	1.244	1.375	30	4	0.417	0.054	7
3214	Glaziers' putty	Chemicals	8252.94	17.066	1.192	1.330	31	4	0.634	0.171	7
3917	Plastic tubes and fittings	Chemicals	5237.17	22.565	1.115	1.319	41	5	0.559	0.112	22
7610	Aluminum structures (bridges, towers etc)	Metals	3814.88	18.067	1.072	1.304	36	2	0.676	0.173	7
7019	Glass fibers	Stone	10982.02	17.172	1.093	1.301	30	3	0.467	0.100	12
4016	Other articles of vulcanized rubber	Chemicals	7461.85	11.382	1.115	1.299	27	3	0.560	0.134	5
4009	Vulcanized rubber tubes	Chemicals	5570.76	6.753	1.123	1.293	23	1	0.634	0.230	9

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)
3921	Other plastic plates, sheets etc.	Chemicals	9218.51	21.616	1.060	1.290	35	0	0.599	0.136	12
403	Fermented milk products	Agriculture	3001.91	12.736	1.152	1.285	40	7	0.603	0.159	18
7008	Multiple-walled insulating glass	Stone	6609.31	12.281	1.045	1.276	23	1	0.638	0.205	6
8708	Parts of motor vehicles	Vehicles	8850.32	1.963	1.120	1.262	23	1	0.565	0.147	4
3503	Gelatin	Chemicals	6142.06	6.283	1.138	1.215	23	4	0.499	0.150	5
3402	Cleaning products	Chemicals	5348.50	19.048	1.084	1.204	41	7	0.664	0.203	17
9021	Orthopedic appliances	Machinery	21080.21	7.527	1.035	1.177	22	0	0.418	0.091	4
8537	Electrical boards	Electronics	7106.71	11.510	1.070	1.135	28	4	0.507	0.140	9
8538	Parts for electrical apparatus	Electronics	8007.82	14.668	0.952	1.135	25	4	0.493	0.097	11
8501	Electric motors and generators	Electronics	7430.78	13.683	1.029	1.124	24	4	0.566	0.179	8
8421	Centrifuges	Machinery	5999.86	20.473	1.087	1.119	22	1	0.495	0.103	3
3809	Finishing agents	Chemicals	14959.28	8.186	0.990	1.107	26	3	0.530	0.157	14
5603	Nonwoven textiles	Textiles	30419.14	24.953	1.003	1.106	24	1	0.522	0.153	7
4011	New pneumatic tires of rubber	Chemicals	8149.49	7.292	1.080	1.101	28	4	0.522	0.139	10
3208	Paints and varnishes, nonaqueous	Chemicals	6022.05	13.724	1.119	1.099	34	3	0.622	0.165	8
5703	Carpets, tufted	Textiles	5631.67	7.434	1.112	1.097	22	6	0.502	0.138	3
5911	Textile articles for technical use	Textiles	14450.04	10.388	1.023	1.087	23	0	0.623	0.215	7
3004	Medicaments, packaged	Chemicals	18225.68	14.334	1.095	1.085	32	2	0.483	0.093	7
6810	Articles of cement, of concrete or of artificial stone	Stone	5712.63	28.858	0.992	1.082	31	3	0.650	0.198	13
8418	Refrigerators, freezers	Machinery	7523.61	31.238	1.061	1.076	27	3	0.553	0.123	4
6807	Asphalt	Stone	7290.36	14.884	1.016	1.057	30	3	0.516	0.121	7
8428	Other lifting machinery	Machinery	20321.92	2.963	1.154	1.044	27	1	0.593	0.148	4
8530	Electric signal and traffic controls	Electronics	14260.33	6.527	1.093	1.031	23	0	0.612	0.164	12
3920	Other plates of plastics, noncellular and not reinforced	Chemicals	8471.16	22.884	0.993	1.030	37	4	0.527	0.102	9
3814	Organic composite solvents and thinners	Chemicals	5256.96	13.524	0.964	1.024	37	5	0.607	0.182	12

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)
7005	Float glass	Stone	5537.47	21.468	0.905	0.990	31	5	0.495	0.139	15
8481	Appliances for thermostatically controlled valves	Machinery	16278.07	10.534	1.087	0.986	22	1	0.539	0.150	2
8504	Electrical transformers	Electronics	6591.67	27.846	0.927	0.962	23	5	0.459	0.106	3
3405	Polishes and creams	Chemicals	4305.92	14.223	0.903	0.934	23	3	0.474	0.105	3
3902	Polymers of propylene	Chemicals	8734.07	30.665	0.979	0.900	25	2	0.444	0.110	10
3006	Pharmaceutical goods	Chemicals	9602.14	11.277	1.021	0.897	25	0	0.459	0.099	6
8419	Equipment for temperature change of materials	Machinery	14754.29	9.961	1.191	0.896	24	0	0.559	0.129	4
7902	Zinc waste and scrap	Metals	3016.42	15.366	0.755	0.782	25	3	0.503	0.115	6
3901	Polymers of ethylene	Chemicals	8788.13	25.925	0.914	0.708	25	3	0.548	0.231	13
2905	Acyclic alcohols	Chemicals	4444.21	30.324	0.900	0.676	31	3	0.484	0.144	8
2711	Petroleum gases	Minerals	7671.39	41.918	0.820	0.654	34	11	0.440	0.149	17
5402	Synthetic filament yarn	Textiles	3217.21	14.622	0.947	0.620	22	4	0.458	0.096	8
8405	Water gas generators	Machinery	5903.19	-0.593	0.901	0.538	25	3	0.576	0.223	6

Note: Products are ranked by the relevance of export potential to the EU market, as measured by the import penetration index. The list excludes agricultural products for synthesis reasons.

A few new options surface when considering the new specialization structure arising after the invasion and the associated lost products, despite most of the products in the list being persistent. For example, assuming new specializations are persistent – and not volatile, because they are measured on information gathered for a single year – several metal products show higher levels of desirability, such as (7308) structures and their parts, of iron and steel; (7326) other articles of iron and steel; (7408) copper wire; (7321) stoves and similar non-electric appliances of iron or steel; or (7616) other articles of aluminum. Other options are represented by (3814) organic composite solvents and thinner, and (8501) electric motors and generators.

SET 2: SHORT JUMPS WITH A HIGH PATH DEPENDENCE AND FEW COMPETITORS

These products have the same features as those described in Set 1 but involve a limited number of competitors or countries with a comparative advantage in the product. A low number of competitors means a potentially high desirability due to lower competition. It also means that entry barriers might be relatively high (lower feasibility).

For this target list, the choice for the most strategic products is based on the same consideration reported above regarding the potential for enhancing the complexity of the country's export basket, but also related to potential global demand for Ukraine, particularly from EU countries (import penetration indexes). It is important to note that this second set includes many products in the machinery and chemical sectors. Several target products are related to the production of building materials.

According to preliminary estimates, 87 million m^2 of housing have been destroyed in Ukraine. Restoration will require a colossal amount of building materials. According to the results of the study presented in the White Paper «Localization of Recovery in Ukraine» about 15 percent of construction enterprises were damaged or destroyed. The production of flat glass and equipment for power distribution boards was practically destroyed. The largest capacity losses were in the production of dry gypsum mixtures (the destroyed «Knauf» and «Siniat» plants in Soledar and Bakhmut of the Donetsk region) and sheet metal (the destroyed MMK im. Ilyicha and Azovstal in Mariupol). Half of the PVC profile production facilities («Mayado» and «Viknalend» plants in the Kyiv region) were also damaged. In other segments, capacity loss does not exceed 5-10 percent. According to experts, the sector generally maintains high production capacities for various construction materials; it can provide up to 90 percent of the materials needed for the country's reconstruction.

The production of (HS6903) ceramic goods was already relatively crucial in the pre-war period thanks to some leading companies' introduction of new technologies; this sector can also be reinforced within the current export basket with appropriate support.

Following the full-scale invasion of Ukraine and the shock to the country's industrial structure, two products in the list are provisionally among the new RCAs in 2022. These are (3505) dextrins and other modified starches – exports increased by 114 percent between 2021 and 2022, jumping from US$ 9.6 million to US$ 20.6 million (RCA 2.4) – and (8462) machine tools for molding and forging metals, for which exports have increased by 37 percent, reaching US$ 18.5 million in 2022 and an RCA equal to 1.04.

Regarding the diversification options built upon the RCA in 2022, these include many products different from those reported in **Table 4.5** that are characterized by HS codes very close to those reported. This suggests that the new specializations – together with the lost ones – have influenced the diversification option distances with respect to the export basket, preserving the type of potential specialization targets, mainly concentrated in the metals, machinery and chemicals sectors – e.g. (2925) carboxyimide-function compounds is replaced by (2910) epoxides; (8207) interchangeable tools for hand tools is replaced by (8203) pliers, pincers and other metal hand-tools; and (8480) molding boxes for metal foundry is replaced by (8463) other machine tools for working metal, without removal.

TABLE 4.5: SHORT JUMPS WITH A HIGH PATH DEPENDENCE AND FEW COMPETITORS[23]

Source: UNIDO elaboration, based on BACI and Gravity, Centre d'Études Prospectives et d'Informations Internationales and World Bank, *World Development Indicators database* (accessed September 2023).

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)
7007	Safety glass	Stone	24536.28	10.941	1.059	1.488	21	1	0.657	0.237	3
7415	Screws and similar articles of copper	Metals	12449.45	26.009	1.079	1.483	14	1	0.632	0.322	1
9029	Meters	Machinery	7094.98	-2.077	1.117	1.426	14	1	0.486	0.200	8
3001	Heparin for therapeutic use	Chemicals	19858.60	36.442	1.049	1.409	12	0	0.457	0.164	2
8465	Machine tools for working wood	Machinery	24279.79	14.603	1.243	1.277	13	0	0.524	0.186	4
8603	Self-propelled railway coaches	Vehicles	14189.44	-3.856	1.157	1.271	8	0	0.515	0.255	7
4810	Paper and paperboard, coated with kaolin	Agriculture	24147.13	-0.445	1.130	1.265	13	0	0.478	0.195	4
8701	Tractors	Vehicles	10187.79	11.463	1.154	1.264	20	1	0.594	0.181	7
8507	Batteries	Electronics	9823.37	61.362	0.998	1.260	18	2	0.491	0.181	12
3002	Serums and vaccines	Chemicals	31914.25	70.483	1.072	1.235	18	0	0.554	0.213	4
8466	Parts and accessories for metal working machines	Machinery	15753.41	4.564	1.081	1.224	17	0	0.546	0.164	0
7223	Wire of stainless steel	Metals	11457.28	32.961	1.039	1.215	14	1	0.490	0.183	6
8208	Knives and blades for machines	Metals	25867.34	13.712	1.135	1.214	18	0	0.562	0.195	1
3821	Prepared culture media for micro-organisms	Chemicals	18721.67	60.976	1.092	1.200	13	0	0.591	0.230	4
8207	Interchangeable tools for hand tools	Metals	13274.90	6.022	1.093	1.198	16	0	0.660	0.286	4
8422	Dish washing machines	Machinery	24716.29	12.361	1.181	1.198	20	1	0.560	0.170	6
3507	Enzymes	Chemicals	25741.24	33.614	1.098	1.186	12	0	0.522	0.207	3
5910	Transmission belts or belting, of textile material	Textiles	14677.49	19.413	1.090	1.174	12	2	0.469	0.188	3
8209	Articles for utensils, of cermet	Metals	31959.85	9.422	1.056	1.164	11	1	0.522	0.249	1
3909	Amino-resins	Chemicals	13441.17	38.924	1.097	1.134	16	0	0.533	0.187	6

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)
8707	Vehicle Bodies	Vehicles	14604.73	-11.830	1.531	1.130	19	0	0.599	0.217	8
3505	Dextrins and other modified starches	Chemicals	7826.33	16.217	1.119	1.102	17	3	0.572	0.229	7
8467	Tools for hand working, pneumatic, hydraulic motors	Machinery	13953.18	29.529	1.087	1.100	14	0	0.511	0.208	6
7605	Aluminum wire	Metals	13817.85	26.526	1.040	1.097	19	2	0.439	0.134	14
8408	Compression-ignition internal combustion piston engines	Machinery	15015.35	-3.207	1.083	1.066	17	1	0.572	0.209	5
8443	Printers and copiers	Machinery	16500.59	0.744	0.931	1.063	12	1	0.514	0.219	9
7607	Aluminum foil < 0.2 mm	Metals	11215.19	24.607	0.987	1.050	21	1	0.513	0.188	5
4010	Conveyor belts of vulcanized rubber	Chemicals	8857.64	7.874	1.118	1.050	21	1	0.531	0.145	2
3504	Peptones	Chemicals	24986.77	38.288	1.049	1.048	14	0	0.543	0.220	8
3403	Lubricants	Chemicals	18357.39	10.121	1.116	1.046	14	0	0.519	0.169	2
9209	Parts of musical instruments	Machinery	51636.99	15.024	0.948	1.036	18	1	0.485	0.141	4
5902	Tire cord fabric	Textiles	41476.84	19.006	1.041	1.034	13	1	0.522	0.200	5
8506	Primary cells and primary batteries	Electronics	7021.87	9.877	0.939	1.026	16	0	0.500	0.192	6
3913	Natural polymers	Chemicals	14124.71	22.153	1.050	1.020	16	0	0.542	0.201	2
3506	Glues and adhesives	Chemicals	10145.39	18.619	1.010	1.017	18	1	0.581	0.223	3
8480	Molding boxes for metal foundry	Machinery	15714.93	-1.856	0.995	1.016	15	0	0.613	0.262	0
203	Pork	Agriculture	22147.76	11.465	0.890	1.014	15	0	0.572	0.220	2
8425	Pulleys and winches	Machinery	11636.40	9.858	1.138	1.012	15	0	0.494	0.170	2
8438	Machinery for the industrial preparation of food or drink	Machinery	14045.31	5.096	1.235	1.008	21	1	0.548	0.162	7
8515	Electric soldering machines	Electronics	13180.81	7.070	1.091	1.008	13	0	0.630	0.269	6
3911	Petroleum resins	Chemicals	14924.81	16.581	0.919	1.006	11	0	0.500	0.185	2
3906	Acrylic polymers	Chemicals	14931.65	21.734	1.063	0.992	16	0	0.540	0.182	3
8414	Pumps, compressors, fans, etc.	Machinery	7731.29	13.874	1.047	0.985	16	1	0.520	0.186	5
8451	Machinery for processing fabrics	Machinery	9484.43	16.864	1.029	0.985	12	0	0.511	0.190	7
8441	Other machinery for making paper	Machinery	15535.11	13.690	1.082	0.984	14	0	0.520	0.198	3

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)
8459	Machine tools for drilling by removing metal	Machinery	10638.66	-9.559	1.174	0.983	14	1	0.520	0.180	10
8705	Special purpose motor vehicles	Vehicles	12156.25	-7.256	1.071	0.977	21	3	0.576	0.217	13
2918	Carboxylic acids with additional oxygen function	Chemicals	8494.85	27.119	1.044	0.972	17	2	0.500	0.187	7

Note: Products are ranked by the relevance of export potential to the European Union market, as measured by the import penetration index. The list excludes agricultural products for synthesis reasons.

SET 3: LONG JUMPS WITH LOW PATH DEPENDENCE, HIGH FREQUENCY OF NEW ENTRIES AND FEW COMPETITORS

These products, reported in **Table 4.6**, are potential diversification targets for Ukraine; they have low path dependence and a relatively high observed frequency of entry into the global economy. The combination of these two features suggests that the low initial relatedness with Ukraine's current export basket is not necessarily a severe constraint for developing a specialization in the product. We observe that many countries—even those with an unrelated initial specialization—have acquired a comparative advantage in the product. Moreover, these products might be particularly appealing as a policy target, provided they possess other characteristics (e.g. complexity, positive spillovers to the rest of the economy, strategic sectors), making them desirable for Ukraine.

Four products included in the list above are part of the chemical sectors (HS3215, HS2932, HS3204, HS2829). The complexity gain associated with these chemical products is relatively high, and the import penetration and vulnerability indexes are appreciable features of this set of products. It is important to note that relatively new capabilities would be necessary. In the pre-war export basket, only a few regions (e.g. Kyiv, Ivano-Frankivsk, Sumy and Mykolaiv) boosted a specialization in chemical products.

The set also includes four products belonging to the macrosector of electronics. (HS8525) transmission apparatus possesses attractive features and aligns with capabilities that have been boosted during the war effort. In addition, (HS8505) electromagnets could be an option for diversification for different considerations, such as a high import penetration index toward the EU and a high relatedness advantage. However, only three countries have acquired a competitive advantage in this product during the last two decades, which is a signal of relatively high entry barriers. Among the machinery products, (9018) medical instruments, and (8402) steam boilers are worth mentioning. When considering the RCA computed on export data from 2022, no remarkable differences are registered for this set of diversification options.

TABLE 4.6: LONG JUMPS WITH LOW PATH DEPENDENCE, HIGH FREQUENCY OF ENTRY AND FEW COMPETITORS[24]

Source: UNIDO elaboration, based on BACI and Gravity, Centre d'Études Prospectives et d'Informations Internationales and World Bank, *World Development Indicators database* (accessed September 2023).

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)	PRODUCT INDEX OF VULNERABILITY
3215	Ink	Chemicals	18891	2.8	1.16	1.56	21	4	0.37	0.05	11	0.67
8520	Magnetic tape recorders	Electronics	9111	28.8	1.10	1.27	11	2	0.38	0.10	5	0.38
8505	Electromagnets	Electronics	8913	27.9	0.94	1.17	9	2	0.38	0.13	3	0.22
9018	Medical instruments	Machinery	6772	12.6	1.01	1.00	19	2	0.36	0.07	5	0.49
2932	Heterocyclic compounds with oxygen hetero-atom(s) only	Chemicals	17646	24.4	0.97	0.98	15	2	0.37	0.09	10	0.59
7903	Zinc powders	Metals	8928	7.4	0.91	0.78	18	3	0.38	0.11	6	0.59
7503	Nickel waste and scrap	Metals	14150	-14.8	1.01	0.78	20	4	0.36	0.06	9	0.64
8521	Video recording apparatus	Electronics	5242	24.4	0.91	0.77	13	2	0.41	0.12	10	0.54
8525	Transmission apparatus for radio, telephone and TV	Electronics	13089	17.1	0.90	0.77	14	2	0.37	0.11	15	0.68
3204	Synthetic organic coloring matter	Chemicals	8564	8.8	0.90	0.76	18	4	0.41	0.09	3	0.41
5309	Woven fabrics of flax	Textiles	14368	-8.4	0.79	0.73	14	2	0.40	0.08	4	0.35
2829	Sodium chlorate	Chemicals	8044	-5.4	1.06	0.64	11	2	0.32	0.10	6	0.48
8402	Steam boilers	Machinery	6575	-29.5	0.88	0.47	18	4	0.41	0.10	5	0.48
5504	Artificial staple fibers, not processed for spinning	Textiles	12474	15.7	1.20	0.41	9	2	0.34	0.06	5	0.43

Note: Products are ranked by the relevance of export potential to the EU market, as measured by the import penetration index. The list excludes agricultural products for synthesis reasons.

SET 4: LONG JUMPS WITH A HIGH PATH DEPENDENCE, LOW RELATEDNESS AND RELATEDNESS ADVANTAGE

These products have a high degree of path-dependence, i.e. products for which an economy's initial capabilities matter substantially for the acquisition of a comparative advantage in those products, and which are characterized by a low degree of relatedness with the country's export basket. In other words, these products are relatively far from Ukrainian's current export basket and for which the feasibility of acquiring a specialization is hence relatively low. Considering Ukraine's current specialization basket, then, these targets are more ambitious. To diversify away from the current comparative advantage, these products are particularly interesting but are typically excluded from the standard policy approach (for example, the Product Space approach). Although these targets are more ambitious, we include products in this set for which the Ukrainian economy still has some strategic advantage compared to other upper middle-income countries and which might be strategic in light of the post-war industrial needs or a trajectory of deeper integration into the EU economy and GVCs. We employ the existence of a positive relatedness gain as an additional criterion, which suggests that Ukraine is more closely related to the product compared to other countries at a similar level of development.

Post-war reconstruction efforts are likely to absorb essential resources for an extended period. Industrial capabilities might be coordinated to provide the required inputs for these efforts and, at the same time, generate new specializations oriented to both the domestic and foreign markets. Building materials will be in huge demand – these are interesting targets for future industrial and diversification strategies. Several products included in this target list are reported in Table 4.7 – (6914) other ceramic articles, and (7006) worked glass. Previous tables also identify these products as likely to be in high demand in the short- to medium-term as targets. Expert opinions converge in deeming these sectors as strategic. For some products – such as glass – industrial capabilities have been affected or are primarily located in conflict areas; for other products, capabilities are mostly present, but a coordinated promotional effort by public authorities will be needed. One example often mentioned by experts in qualitative interviews is that of de-mining machines. Some existing production plants might be re-converted to producing these specialized vehicles. Estimates suggest that approximately 30 percent of the territory of Ukraine has been contaminated by explosive ordnance, amounting to 174,000 square kms, with different degrees in the presence of mines and explosive devices. The need for de-mining machines will be considerable and will require innovative approaches and technological capabilities that the war effort has already generated (e.g. reconnaissance software and drones, armed vehicle production and optical equipment).

Additionally, in this case, considering the RCA computed on export data from 2022, the diversification options list does not differ from the one obtained by considering the DIVE Tool's export basket for 2019-2021. Moreover, none of the diversification strategies reported as long jumps are listed among the new export specializations that arose after the beginning of the conflict. This suggests that the most immediate adjustments that the country's economic structure shows in the short term as a response to the external shock induced by the war are driven mainly by path dependency.

TABLE 4.7: LONG JUMPS WITH A HIGH PATH DEPENDENCE, LOW RELATEDNESS AND RELATEDNESS ADVANTAGE[25]

Source: UNIDO elaboration, based on BACI and Gravity, Centre d'Études Prospectives et d'Informations Internationales and World Bank, *World Development Indicators database* (accessed September 2023).

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)	PRODUCT INDEX OF VULNERABILITY
8519	Sound reproducing apparatus	Electronics	9266.38	16.596	1.177	1.556	12	1	0.395	0.128	12	0.582
2933	Heterocyclic compounds with nitrogen hetero-atom(s) only	Chemicals	38083.31	2.439	1.112	1.507	11	1	0.211	0.020	6	0.449
9003	Frames for spectacles, goggles	Machinery	12593.03	7.524	0.918	1.122	10	1	0.368	0.105	4	0.331
2817	Zinc oxide or peroxide	Chemicals	4747.55	24.406	0.899	1.083	21	6	0.414	0.087	10	0.659
9405	Lamps	Textiles	5944.42	20.902	1.074	1.062	12	1	0.407	0.143	2	0.299
8536	Electrical apparatus for < 1k volts	Electronics	3370.97	16.250	0.933	1.043	29	4	0.409	0.078	5	0.567
8527	Reception apparatus for radio broadcasting	Electronics	3608.68	-16.285	0.979	1.012	12	1	0.385	0.079	5	0.395
2934	Nucleic acids and their salts	Chemicals	34076.05	38.475	1.034	1.009	11	1	0.347	0.083	6	0.402
9025	Thermometers, hydrometers etc.	Machinery	14092.31	36.259	1.015	1.008	19	2	0.379	0.043	8	0.568
3302	Mixtures of odoriferous subtances	Chemicals	2456.44	10.608	1.064	1.001	18	5	0.327	0.057	8	0.589
2936	Vitamins	Chemicals	25208.72	22.452	0.974	0.972	14	2	0.412	0.096	7	0.485
6914	Other ceramic articles	Stone	4957.19	26.380	0.962	0.939	14	4	0.392	0.115	4	0.417
8518	Microphones	Electronics	13419.32	23.556	0.932	0.931	14	1	0.377	0.102	3	0.309
9019	Therapy applicances	Machinery	16657.04	58.474	1.013	0.901	15	1	0.338	0.082	5	0.446
2911	Acetals and hemiacetals	Chemicals	16562.58	18.043	0.968	0.859	7	1	0.349	0.096	4	0.291
8415	Air conditioners	Machinery	5625.85	14.786	0.963	0.855	17	1	0.410	0.128	3	0.387
2938	Glycosides	Chemicals	9327.17	29.717	1.159	0.823	11	3	0.319	0.079	5	0.396
9011	Optical microscopes	Machinery	17107.52	8.015	1.040	0.812	10	1	0.412	0.192	4	0.284
8472	Other office machines	Machinery	4708.60	-5.830	1.134	0.794	12	2	0.415	0.135	10	0.581
9016	Balances of a sensitivity < 50 milligram	Machinery	33127.76	-13.637	1.022	0.783	7	1	0.337	0.101	2	0.322

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-2021	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT ENTERED EXPORT BASKETS (1995-2014)	PRODUCT INDEX OF VULNERABILITY
8529	Parts of radios, telephones, and T.V.s	Electronics	4041.76	12.048	0.840	0.768	10	3	0.293	0.040	7	0.423
2710	Petroleum oils, refined	Minerals	3219.09	5.220	0.699	0.651	60	10	0.396	0.061	20	0.840
2713	Petroleum coke	Minerals	3265.14	11.269	0.906	0.636	35	3	0.355	0.037	14	0.801
2810	Oxides of boron; boric acids	Chemicals	12986.12	22.085	0.777	0.598	9	1	0.282	0.080	2	0.188
9009	Electrostatic photo-copyers	Machinery	3831.03	-5.918	0.771	0.510	15	2	0.406	0.108	3	0.337
4702	Chemical woodpulp, dissolving grade	Agriculture	8808.94	18.116	0.841	0.474	16	1	0.335	0.037	8	0.566
7006	Worked glass	Stone	13249.72	40.197	0.649	0.381	7	1	0.371	0.103	6	0.387
2802	Sulfur, sublimed or precipitated	Chemicals	4539.19	21.534	0.837	0.300	10	1	0.324	0.104	4	0.313
4007	Vulcanized rubber thread and cord	Chemicals	2251.99	43.006	0.866	0.239	4	1	0.156	-0.017	3	0.300
8542	Electronic integrated circuits	Electronics	13318.91	35.641	0.444	0.228	13	2	0.394	0.090	3	0.266

Note: Products are ranked by the relevance of export potential to the EU market, as measured by the import penetration index. The list excludes agricultural products for synthesis reasons.

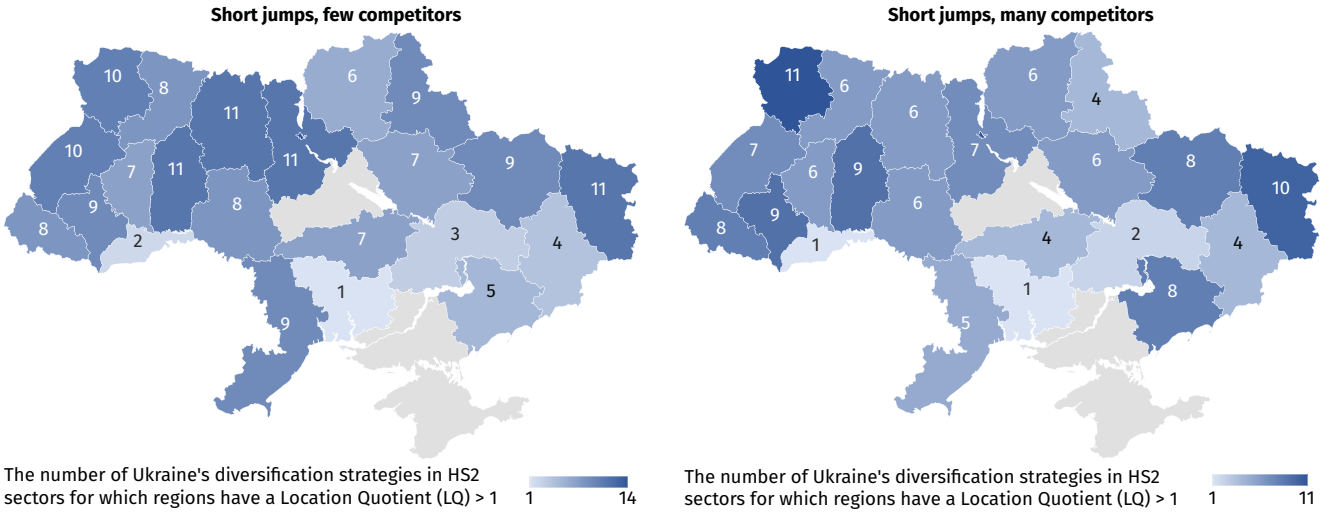
4.3.1 FOUR CLUSTERS OF TARGET PRODUCTS

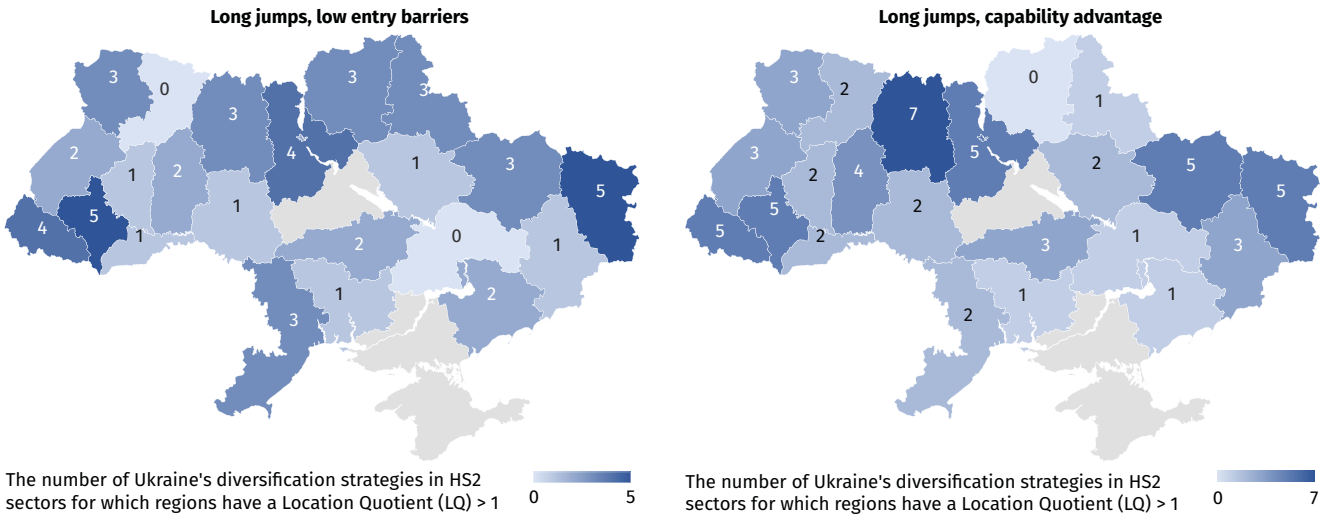
By focusing on regional export patterns – reported in **Table 4.8** and **Figure 4.4** – reflecting the existing capabilities, it is possible to assess whether some of the target sectors identified in the country-level analysis are already present in the oblasts' export baskets. **Table 4.8** reports that the most targeted sector is (84) nuclear reactors, boilers, machinery, which comprises eight HS4 products in the short jumps/many competitors diversification set, 22 products in the short jumps/few competitors set, four products in the long jumps/low path-dependency option set, and three products among those identified as long jumps/high path-dependency. Other sectors mainly targeted in our analysis of potential selected products are (39) plastics, polymeric materials and (40) rubber products (DIVE Set 1); (85) electrical machines (DIVE Sets 1, 2 and 4); (87) means of land transport, other than railway (DIVE Set 2); tanning extracts (DIVE Set 3); and (29) organic chemical compounds and (90) optical and photographic instruments and apparatus (DIVE Set 4).

The sector with the highest number of location quotients higher than unity (i.e. regional export share higher than national export share) is (04) milk and dairy products, poultry eggs, natural honey: half of the provinces are relatively specialized in exporting products in this sector. Rather ubiquitous sectors also include (21) miscellaneous food products, and (94) furniture, with LQ>1 in 10 Regions. Less ubiquitous production at the regional level are (15) fats and oils of animal or vegetable origin, and (81) other non-precious metals; each of which are present in only one province (Transcarpathian and Zaporizhzhya regions, respectively). By combining information on ubiquity and the number of HS4 products identified for each sector, the most promising directions are those relative to diversification in nuclear reactors, boilers, machinery (38 products in the four sets and sectors present in eight different provinces) and electrical machines (19 products in the four sets and sector present in eight provinces).

FIGURE 4.4: GEOGRAPHICAL DISTRIBUTION OF UKRAINIAN LOCATION QUOTIENTS IN SECTORS WITH DIVERSIFICATION OPTIONS, 2017-2021 AVERAGE

Source: UNIDO elaboration based on State Statistics Service of Ukraine and Centre d'Études Prospectives et d'Informations Internationales (accessed September 2023).





Note: Boundaries, names and designations on this map do not imply UNIDO's official endorsement or acceptance.

The province with the highest sectoral production concentration is the Kyiv region, in which 19 sectors record an LQ higher than unity, followed by the Kyiv City region (16), Volyn region (15) and Khmelnytsky, Luhansk and Lviv regions (14 specializations). By considering the information on the number of products in the HS2 sector present in the different regions (reported in the maps in **Figure 4**), the most endowed regions in terms of capabilities related to targeted products at the country level are Kyiv city, Kyiv region, Zhytomyr, Ivano-Frankivsk and Volyn for the diversification list 1, Kharviv, Zaporiska, Volyn and Ivano-Frankivsk for the list 2, the western regions of Volyn, Zakarpattia, Ivano-Frankivsk and Zhytomyr for the lists 3 and 4. It is worth noticing how the eastern regions – those mainly involved in the conflict in Eastern Ukraine - are well endowed with capabilities related to path-dependent diversification strategies. It is also evident from the figures that the Luhansk region has significant production in sectors targeted in all four diversification strategies.

TABLE 4.8: DIVERSIFICATION STRATEGIES AND REGIONAL CAPABILITIES

Source: UNIDO elaboration, based on State Statistics Service of Ukraine and Centre d'Études Prospectives et d'Informations Internationales (accessed September 2023).

PRODUCTS HS2-DIGITS CLASSIFICATION	SHORT JUMPS W/ MANY COMPETITORS	SHORT JUMPS W/ FEW COMPETITORS	LONG JUMPS W/ LOW PATH DEPENDENCY	LONG JUMPS W/ HIGH PATH DEPENDENCY	REGIONS WITH A LOCATION QUOTIENT ABOVE UNITY IN THE SECTOR EXPORTS
84 nuclear reactors, boilers, machinery	9	22	4	3	Donetsk region; Ivano-Frankivsk region; Kharkiv region; Kirovograd region; Sumy region; Volyn region; Zaporizhzhya region; Zhytomyr region.
85 electrical machines	6	7	0	6	Chernivtsi region; Ivano-Frankivsk region; Khmelnytsky region; Lviv region; Ternopil region; Transcarpathian region; Volyn region; Zhytomyr region.
90 optical and photographic instruments and apparatus	1	7	0	5	Kharkiv region; Khmelnytsky region; Kyiv city; Kyiv region; Luhansk region; Odesa region; Transcarpathian region.
29 organic chemical compounds	1	5	1	5	Ivano-Frankivsk region; Kirovograd region; Luhansk region; Odesa region; Poltava region; Transcarpathian region; Vinnytsia region.
39 plastics, polymeric materials	6	4	0	0	Ivano-Frankivsk region; Kharkiv region; Khmelnytsky region; Kyiv region; Luhansk region; Sumy region; Ternopil region; Volyn region.
87 means of land transport, other than railway	2	4	1	0	Dnipropetrovska oblast; Kharkiv region; Poltava region; Rivne region; Sumy region; Transcarpathian region; Volyn region; Zaporizhzhya region.
40 rubber, rubber products	5	3	0	1	Kirovograd region; Kyiv region; Luhansk region; Zhytomyr region.
35 protein substances	1	4	0	0	Ivano-Frankivsk region; Khmelnytsky region; Luhansk region; Mykolaiv region; Ternopil region; Vinnytsia region; Volyn region; Zaporizhzhya region.
38 miscellaneous chemical products	2	4	0	0	Kyiv city; Kyiv region; Luhansk region; Vinnytsia region; Zaporizhzhya region.
70 glass and glassware	3	2	0	1	Kharkiv region; Kyiv region; Luhansk region; Rivne region; Zhytomyr region.
82 tools, knife products	0	3	1	0	Khmelnytsky region; Kyiv region; Lviv region; Poltava region; Rivne region; Sumy region.
76 aluminium and products of aluminium	3	2	1	0	Khmelnytsky region; Kyiv region; Odesa region.
30 pharmaceutical products	3	2	0	0	Kharkiv region; Kyiv city; Kyiv region; Luhansk region.
59 textile materials	1	2	0	0	Kyiv city; Lviv region; Poltava region; Rivne region; Ternopil region; Transcarpathian region; Volyn region.

PRODUCTS HS2-DIGITS CLASSIFICATION	SHORT JUMPS W/ MANY COMPETITORS	SHORT JUMPS W/ FEW COMPETITORS	LONG JUMPS W/ LOW PATH DEPENDENCY	LONG JUMPS W/ HIGH PATH DEPENDENCY	REGIONS WITH A LOCATION QUOTIENT ABOVE UNITY IN THE SECTOR EXPORTS
27 mineral fuels; petroleum and its distillation products	1	0	0	2	Dnipropetrovska oblast; Donetsk region; Ivano-Frankivsk region; Kyiv city; Lviv region; Poltava region.
34 soaps, surfactants	2	1	0	0	Ivano-Frankivsk region; Khmelnytsky region; Kirovograd region; Kyiv city; Lviv region; Vinnytsia region.
32 tanning extracts	3	0	2	0	Kyiv city; Sumy region.
04 milk and dairy products, poultry eggs; natural honey	2	0	0	0	Ivano-Frankivsk region; Khmelnytsky region; Kirovograd region; Kyiv region; Poltava region; Rivne region; Sumy region; Ternopil region; Vinnytsia region; Volyn region; Zhytomyr region.
94 furniture	1	0	0	1	Chernivtsi region; Kharkiv region; Khmelnytsky region; Kyiv region; Lviv region; Rivne region; Ternopil region; Transcarpathian region; Volyn region; Zhytomyr region.
28 inorganic chemicals	0	0	1	3	Ivano-Frankivsk region; Mykolaiv region.
48 paper and cardboard	0	1	1	0	Ivano-Frankivsk region; Kyiv region; Luhansk region; Lviv region; Volyn region; Zhytomyr region.
68 Articles of stone, plaster, cement	2	0	0	0	Ivano-Frankivsk region; Kyiv region; Luhansk region; Lviv region; Poltava region; Zhytomyr region.
69 ceramic products	0	1	0	1	Donetsk region; Kharkiv region; Khmelnytsky region; Kyiv city; Zhytomyr region.
56 cotton wool	1	1	0	0	Kharkiv region; Poltava region.
74 copper and copper products	0	1	1	0	Donetsk region; Volyn region; Zaporizhzhya region.
73 products of ferrous metals	1	0	0	0	Dnipropetrovska oblast; Donetsk region; Kharkiv region; Lviv region; Odesa region; Rivne region; Sumy region; Zhytomyr region.
47 mass of wood	0	0	0	1	Kyiv city; Luhansk region; Vinnytsia region; Zhytomyr region.
72 ferrous metals	1	1	0	0	Donetsk region; Zaporizhzhya region.
54 synthetic or artificial threads	1	0	0	0	Khmelnytsky region; Luhansk region; Lviv region; Odesa region; Transcarpathian region; Volyn region; Zhytomyr region.
02 meat and edible offal	0	1	0	0	Kyiv region; Rivne region; Ternopil region; Vinnytsia region; Volyn region.
11 products of the flour and cereal industry	0	1	0	0	Khmelnytsky region; Kyiv city; Kyiv region; Vinnytsia region.
53 other textile fibres	0	0	1	0	Kyiv city; Luhansk region; Sumy region.
86 railway locomotives	0	1	0	0	Dnipropetrovska oblast; Odesa region; Poltava region; Volyn region.

PRODUCTS HS2-DIGITS CLASSIFICATION	SHORT JUMPS W/ MANY COMPETITORS	SHORT JUMPS W/ FEW COMPETITORS	LONG JUMPS W/ LOW PATH DEPENDENCY	LONG JUMPS W/ HIGH PATH DEPENDENCY	REGIONS WITH A LOCATION QUOTIENT ABOVE UNITY IN THE SECTOR EXPORTS
33 essential oils	0	0	0	1	Kyiv city; Kyiv region; Transcarpathian region.
92 musical instruments	0	1	0	0	Ivano-Frankivsk region; Lviv region; Transcarpathian region.
57 carpets	1	0	0	0	Khmelnytsky region; Odesa region.
75 Nickel and products from it	0	1	0	0	Luhansk region; Zaporizhzhya region.
79 zinc and products of zinc	1	0	0	0	Odesa region; Transcarpathian region.
15 Fats and oils of animal or vegetable origin	0	1	0	0	Transcarpathian region.
81 other non-precious metals	0	1	0	0	Zaporizhzhya region.
01 live animals	0	0	0	0	Kirovograd region; Kyiv city; Kyiv region; Odesa region; Rivne region; Sumy region; Ternopil region.
16 meat and fish products	0	0	0	0	Kyiv region; Odesa region; Vinnytsia region.
21 miscellaneous food products	0	0	0	0	Khmelnytsky region; Kirovograd region; Kyiv city; Kyiv region; Lviv region; Rivne region; Sumy region; Vinnytsia region; Volyn region; Zhytomyr region.
49 printed matter	0	0	0	0	Kyiv city; Kyiv region; Lviv region; Sumy region.
55 synthetic or artificial staple fibres	0	0	0	0	Kharkiv region; Kyiv city.
95 toys	0	0	0	0	Ivano-Frankivsk region; Lviv region; Odesa region; Rivne region; Ternopil region; Transcarpathian region; Volyn region.
Total of HS4 sectors in the DIVE Sets	**60**	**84**	**14**	**30**	

Note: The table reports the number of HS4 products listed in DIVE target sets (**Tables 4.4-4.7**) in each HS2 sector. The list of Ukrainian regions with a location quotient (regional export share over country export share) above unity is reported in the last column for each sector. Their diffusion among regional capabilities ranks the HS2 sectors.

4.4 CONCLUDING REMARKS

There is a clear consensus on the need for a credible and comprehensive strategy for Ukraine's industrial recovery. The need for export and production base diversification was already evident before the conflict, and the full-scale invasion of Ukraine has only amplified this need. Still, it has created new urgencies related to reconstructing the pre-existing production capabilities and the importance of addressing newly emerging territorial inequalities.

The design of diversification and industrial policies is a complex task that relies on comprehensive methods and information. The aim of this block – which analyses data based on the application of the UNIDO DIVE Tool and expert opinions – is to highlight information that could support the prioritization of target products/sectors in diversification and reconstruction policy. The tool provides a helpful diagnosis of the main characteristics of Ukrainian's export basket, highlighting notable features such as its structural vulnerability, i.e. the potential for other countries to specialize in products that belong to the current export basket, and helps us analyse the ability of the country to acquire or recombine production capabilities, a key ingredient of structural change.

The Ukrainian economy scored significantly worse in terms of diversification than other countries at a similar level of development. Notwithstanding a growing process of integration in the global economy (the country entered into WTO in 2008 and signed a trade agreement with the EU in 2016), the country's export basket is highly concentrated in two macro-sectors, agriculture and metals, and within these sectors, mainly in low-complexity products. Analysis of recent (pre-conflict) NEs or export surges does not yield a positive assessment of the country's ability to defy its static comparative advantage.

Our analysis assesses the "direction" that diversification strategies could take. The application of the DIVE Tool led to the definition of a list of potential products that might represent new sectors/areas of diversification. This should be considered a first step in defining potential targets, with the aim of a more in-depth analysis of specific value chains and the identification of critical enabling factors (e.g. evolving technologies, likely demand, key industrial and institutional players) as well as market failures and bottlenecks that might prevent the development of the target sectors. Targets have a strategic value related to domestic firms' actual and/or potential linkages. This more in-depth analysis should also highlight those sectors connected by backward and forward linkages that are already competitive or might soon become competitive with adequate policy stimuli (Farooki and Kaplinsky, 2014).

The analysis also provides additional insights into factors that must be addressed to reconstruct the Ukrainian economy successfully. The first element is related to the governance of diversification and reconstruction efforts. The government, the primary owner of this process, must formulate the country's industrial policy vision and priorities. Many expert opinions pointed to the need to create a central government body responsible for industrial policy in the country. In the current framework, there is a lack of a coherent legal and administrative framework for industrial policy. The Ministry of Economy is responsible for developing some industries, while the Ministry of Industry and Trade is responsible for developing others. More coordination across ministries and different levels of government (central-regional-municipal) is essential.

A second clear element from the analysis is the need to intensify the adaptation of Ukrainian production standards to European ones. The changing geopolitical landscape implies that socioeconomic and political ties will be boosted in a westward direction. To allow a business to re-adjust to this new scenario, the state should create a programme of information and consulting support for entrepreneurs adapting to European requirements.

Many products/sectors reported in the DIVE target sets (**Tables 4.4-4.7**) are coherent with the recons-

truction and diversification strategies discussed between the Government of Ukraine and the EU. In particular, we refer to the Ukrainian Facility Programme, a special instrument managed by the European Commission to provide short- and medium-term financing for Ukraine's recovery and reconstruction needs over 2024-2027.[26] Facility plans are being developed for the following strategic macrosectors: agriculture, energy, transport and logistics, IT, critical infrastructure, and machine building. Areas of support in the programme are organized into three components: (1) direct financial support to the Plan of Ukraine, which the Ukrainian government began preparing in autumn 2023, (2) attraction of additional public and private investment to support the Plan of Ukraine, and (3) provision of technical assistance to strengthen institutional capacity and harmonize EU Acquis. Funds provided under the programme will also support the implementation of critical reforms for Ukraine's rapid accession to the EU and transition to a green, digital and inclusive economy. These reforms are instrumental for a successful diversification strategy, particularly in sectors where trade barriers are relatively high due to regulations and rigid standards applied by EU countries.

Public procurement is needed as an effective industrial policy tool in the post-war reconstruction effort. Considering the exceptional circumstances and the need to rebuild and expand industrial capacities and provide job opportunities in those areas most affected by the war, local content provisions in public procurement should be employed wisely to balance the need for effective recovery with that of industrial policy. On the other hand, effective public procurement must tackle corruption issues, removing as much discretionary power from public officials as possible and introducing more effective preventive measures.[27]

Given the extensive damage to the existing infrastructure, industrial parks might also be an essential tool in the policy mix that can speed up the process of industrial recovery. The Government of Ukraine is promoting several amendments to the legislation on industrial parks to stimulate their development. Damage to critical infrastructures (transport, energy, water supply and treatment) make the case for well-managed and well-endowed industrial parks compelling. Targeting public support schemes and incentives for developing strategic sectors might also be more effective. The role of municipalities and the regional state administrations in industrial recovery will also be necessary, but, to date, these administrations have had limited roles and resources.

The war has generated a critical shortage of specialists across most sectors. Some human capital has relocated abroad or to other regions, and some have been called up for service in the armed forces. Scientific and technological capabilities will also change the pre-war development trajectory based on a few unsophisticated sectors. The high quality of human capital – the development of the IT sector is a good indicator of this – and the existing universities and research centres will have a central position in a coherent strategy for industrial upgrades.[28] The loss and limited development of human resources could be a barrier to diversification and industrial recovery that should be adequately addressed in the future.

Another fundamental economic infrastructure that will represent a pre-condition for a successful diversification strategy is the banking and financial sector. Interviews with private companies' executives in war-affected regions suggest that SMEs have been particularly affected, mainly through the deterioration of financial conditions. Even before the conflict, the allocation of credit – primarily controlled by state-controlled financial institutions – was considered one of the main obstacles to diversification and, generally, to the development of the private sectors (mainly SMEs). An effective credit provision to private companies will be the engine of reconstruction.

Finally, it is essential to underline that reconstruction efforts will likely be quicker and more effective with the active involvement of the Ukrainian diaspora. It will be critical to transforming what is now a drain on human resources (hopefully temporary) into a lever to promote the development of new production capacities.

NOTES

[1] The qualitative analysis that has been employed for integrating/complementing the analysis based on the DIVE Tool is based on a total of 19 in-depth interviews in Ukraine with key experts belonging to public organizations as well as the private sector. Interviews with public-sector and intermediate bodies representatives (n. 9) included: Ukrainian League of Industrialists and Entrepreneurs; Regional Council of Entrepreneurs of Kharkiv Region; All-Ukrainian network of experts and practitioners in regional and local development REGIO-NET; State Owned Enterprise M.P. Shulgin State Road Research Institute; Confederation of Builders of Ukraine, Construction Chamber, Academy of Construction of Ukraine, Ministry of Development of Communities, Territories, and Infrastructure; Donetsk Chamber of Commerce and Industry; Ministry of Economy of Ukraine; and Kharkiv Regional State Administration (during the war, Kharkiv Regional Military Administration). Private-sector consultations were organized with CEOs and top managers of 10 representative companies (1 large, 6 medium-sized, 3 small) from the following sectors of the economy: machinery (5); production of non-metallic mineral products (2); wood processing and manufacturing of wood products (1); and chemicals and pharmaceuticals (2) located in the north-eastern (Kharkiv, Kremenchuk, Piatyhirs'ke village, Svitlovodsk) and eastern regions of Ukraine (Dnipro).

[2] UNIDO (2023) is a study that rather adopts a prioritization approach based on employment considerations and input – output analysis.

[3] Please see the Appendix A and B for some more technical explanations of the concepts and equations.

[4] Since 2016 the EU-Ukraine Deep and Comprehensive Free Trade Area applies. The agreement eliminated most tariffs – EU: 98.1 percent and Ukraine: 99.1 percent – and the remaining tariff barriers are relatively low. The barriers that limit the access of SMEs to the large EU market are mostly non-tariff and technical. This is an important area of international cooperation that will be instrumental to the diversification of the Ukrainian economy. It is important to note that the EU has granted Ukraine full but temporary trade liberalization, suspending import duties, quotas and trade defense measures for imports from Ukraine within the framework of Autonomous Trade Measures (ATM) Regulation (valid until June 2024). See, for more details: EU trade relations with Ukraine (europa.eu).

[5] Average product sophisticatedness – proxied by ProdY, i.e. the level of GDP per capita associated with each product's exports (Hausmann et al 2007) – weighted by the relative size of each product in the export basket. Ukraine's weighted average is lower than a simple average as the weight of low-complexity goods in the export basket is high.

[6] These 33 products are those in the 2019-2021 export basket (according to the DIVE methodology) that have seen their RCA in Ukraine go from values above unity in 2021 to values lower than unity in 2022, according to *UN COMTRADE* data.

[7] Average products sophisticatedness – proxied by ProdY, i.e. the level of GDP per capita associated with each product's exports (Hausmann et al 2007) – weighted by the relative size of each product in the export basket. Ukraine's weighted average is lower than a simple average as the weight of low-complexity goods in the export basket is high.

[8] Following DIVE Tool methodology (https://www.unido.org/sites/default/files/files/2023-06/DIVE_Tool_Manual.pdf), we compute the country level of vulnerability as the weighted average of the product vulnerability of exported goods. Product-specific vulnerabilities are computed on the basis of product characteristics (ubiquity, frequency of new entry and tendency to enter in a path-departing way).

[9] Index for the Revealed Comparative Advantage, elaborated by Balassa (1965), computed as the ratio between a country's export share of a product and the worldwide export share of the same products. It indicates the degree of specialization of a country in such product.

[10] Following DIVE tool methodology (https://www.unido.org/sites/default/files/files/2023-06/DIVE_Tool_Manual.pdf), we compute the relative occurrence by which each product enters in countries export basket in a path-departing way, i.e. with a degree of relatedness to existing capabilities lower than the average potential new entry (option set, OS).

[11] The Verkhovna Rada of Ukraine adopted the law «On Protection of the Interests of Entities Submitting Reports and Other Documents during Martial Law or State of War», which determined that statistical and financial statements will be submitted by enterprises only after the war ceases.

[12] More information on the World Bank analysis on the vulnerability of exports to CBAM can be found here: https://www.worldbank.org/en/data/interactive/2023/06/15/relative-cbam-exposure-index#4.

[13] We focus in this section on products for which we observe a rather rapid expansion of exports moving from an RCA<0.5 to an RCA>1, in time intervals of approximately five years, that are then part of the Ukrainian export basket in a stable way until now (last year employed: 2021). We include only those products that are economically meaningful using as a threshold a minimum value of US$ 1 million of exports in 2021.

[14] To perform the oblast-level analysis we adopt data for the pre-COVID-19 period. The maximum level of disaggregation is provided at the 2-digit HS classification. Data availability is uneven among the territories. Taking into consideration data from 2019, disaggregated data is available for 24 territories (23 oblasts and the Kyiv City), as data for Cherkasy region is only available at the HS Chapter level. Limited information is provided also for exports of Kherson region (13.5 percent of total), Kharkiv region (44.8 percent of total), Chernivtsi region (64.6 percent) and Kirovograd region (69.6 percent). Overall, in 2019, the available 2-digit export data covers 85.7 percent of aggregated figures.

[15] See: KSE Institute (2023). Report on Damages to Infrastructure Caused by Russia's War against Ukraine, March 2022. Available at: https://kse.ua/wp-content/uploads/2023/03/ENG_FINAL_Damages-Report_.pdf.

[16] The company had the capacity to annually produce 3.7 million tons of converter steel, 12 million tons of sinter, more than 4.3 million tons of cast iron and more than 5 million tons of finished rolling mill products. The plant was an important Ukrainian exporter. The company was also the largest manufacturer of galvanized cold-rolled sheets in Ukraine, which was used in construction and the automotive industry.

[17] «Antonov» plant was one of the two enterprises of the Ukrainian aircraft industry, employing more than 9,000 workers. The world's largest cargo aircraft AN-225 («Mriya») was built here. The plant had a full cycle of aircraft development: from research at the stage of project creation to construction and testing, produced both cargo (AN-132, AN-138) and passenger aircraft. Production facilities were partly damaged in March 2022.

[18] PJSC Alchevsk Iron and Steel Works, Yenakiyeve Iron and Steel Works, Donetsksteel metallurgical plant, PJSC Khartsyzsk PIPE PLANT are located in the areas that are or have been under the temporary military control of the Russian Federation. Two large mining and metallurgical plants were largely destroyed – «Azovstal iron & steel works» and PJSC «Ilyich Iron and Steel Works».

[19] These 33 products are those in the 2019-2021 export basket (according to the DIVE methodology) that have seen their RCA in Ukraine go from values above unity in 2021 to values lower than unity in 2022, according to *UN COMTRADE Database* data.

[20] To compare new export patterns with pre-war specializations, we have identified a list of products that were not part of the export basket and that have an RCA>1 in 2022, that show an average export value of at least US$ 1 million in 2021-2022.

[21] See Khaustova et al. (2024).

[22] Appendix C lists the excluded products.

[23] Ibid.

[24] Ibid.

[25] Ibid.

[26] For details see European Commission (2023) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on establishing the Ukraine Facility. Available at: https://ec.europa.eu/commission/presscorner/detail/da/qanda_23_3353.

[27] On 14 July 2022, the Law of Ukraine No. 1977-IX came into force, which amends the Law of Ukraine «On Public Procurement» in the part of requirements for the degree of localization of production. According to the document, from mid-2022, in state tenders for the purchase of urban transport, municipal equipment, railway transport, aerospace products and energy engineering products, at least 10% of components are required to be of Ukrainian origin. The threshold will increase by 5 percent annually until the national production quotient reaches 40 percent. The law allows the Cabinet of Ministers to expand the list of goods subject to this localization requirement, increase by 10 percent or decrease by 5 percent the localization requirement for a specific category of goods per year. It also allows, in cases of urgent need, for reducting the proportion of the local component to zero in a particular procurement.

[28] Investment in science and higher education will be particularly important in the border regions affected by the conflict. Kharkiv, one of the industrial engines of the country before the war, is an emblematic example. As of 1 July 2021, 1.426 million people lived in Kharkiv and about 300,000 students studied in the more than 60 higher educational institutions in the area. Although reliable statistics are not yet available, it is estimated that hundreds of thousands of people – mostly young – have left.

[29] We identify products according to the Harmonized System (HS) nomenclature, Rev. 1992.

[30] We adopt the BACI data set provided by CEPII.

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APPENDIX A: KEY METHODOLOGICAL ASPECTS AND CONCEPTS

IDENTIFICATION OF EXPORT BASKETS

Using trade data HS 4-digit Rev. 1992, we adopt the Balassa index of revealed comparative advantage to quantify the degree of export specialization for each product i, each country k and each year t. The index of export specialization is computed as follows:

$$RCA_{ikt} = \frac{x_{ikt} / \sum_i x_{ikt}}{\sum_k x_{ikt} / \sum_i \sum_k x_{ikt}}$$

where x_{ikt} is the export value of product i in country k at time t. The Balassa index is computed for all years for which data are available. A product is only included in a country's export basket if its RCA was above unity for at least two years in the interval $[t,t+2]$.

COMPUTATION OF RELATEDNESS BETWEEN PRODUCTS

Following Hidalgo et al. (2007), we compute the network of relatedness as the minimum of the pairwise conditional probability of being co-exported with an RCA above unity in three years $[t,t+2]$. The relatedness between product i and product j at time t is thus computed as follows:

$$\varphi_{ijt} = min\{P(EB_{it}|EB_{jt}), P(EB_{jt}|EB_{it})\}$$

where EB_{it} denotes the presence of product i in the export basket at time t. The degree of similarity in the capability required to produce different goods changes over time, and thus, for computing distances in terms of relatedness, we adopt year-specific networks.

NEW EXPORT SPECIALIZATIONS

A product is a new export specialization at time t if:

i. it is exported with an RCA higher than unity at time t;

ii. it has been exported with an RCA lower than 0.5 for at least two in the previous five years;

iii. it has never been exported with an RCA higher than unity in the previous five years;

iv. alternatively,

   a. it has been exported with an RCA higher than unity for at least two years in the following five years and has been exported with an RCA lower than 0.5 for no more than once in the next five years;

   b. it has been exported with an RCA higher than unity in the following three years;

v. the average export value in the next five years is higher than the average export values in the previous five years;

vi. the export value at time t is higher than $US one million.

THE OPTION SET (OS)

To be included in a country's OS and line with ex-ante criteria for the identification of new entries, a product is part of the diversification (or option) set if it:

i. is exported with an RCA lower than unity at time t;

ii. is exported with an RCA lower than 0.5 for at least two years in the previous five years;

iii. has never been exported with an RCA higher than unity in the last five years.

We retrieved information on countries' option sets for 2000–2019.

DISTANCE BETWEEN NES/PRODUCTS IN THE OS AND PRE-EXISTING EXPORT BASKET

The degree of relatedness between products outside the export basket and those already being exported with an RCA is given by the degree of proximity between such NEs/products in the OS and the closest products among those in the export basket.

$$dist_{i,EB_{kt}} = \max\{\varphi_{ij}\} with\ j \in EB_{kt}$$

where product ***i*** is the new entry (or the product in the diversification set) and EB_{kt} is the country's export basket at time ***t***. Our approach focuses on this definition, avoiding measures of average distance from the overall export basket, e.g. network density metrics. A measure of network density is reliable in the context of an ex-ante forecast of potential NEs and, as reported in many works that adopted the PS framework, is correlated with the probability of entering a country's export basket. Our analysis relies on the distance of actual new entries and potential ones to export baskets, and we virtually attach the latest entries that are close to the most related product. Averaging over the entire set of proximities would underestimate the degree of relatedness of products with high similarities in local capabilities with only a few existing specializations.

To compute the relatedness of new export specializations and products in the diversification space at time ***t***, we adopt relatedness matrices referred to as time ***t-5*** so that the proximity is computed a priori, thus avoiding endogeneity.

PRODUCT INDEX OF PATH DEPARTURE

To detect the extent to which a product usually follows "the path", we have developed three alternative metrics that capture distinct diversification aspects. The three metrics focus on the country-product dimension to capture the country-specific heterogeneity of product path dependence and aggregate the information on path departure at the product level.

The first step is to identify the average proximity of the products in the OS for each country and each initial year. This represents the threshold for distinguishing between path-dependent and path-defying new entries.

Relative distance from the threshold: the first metric computes the extent to which a single NE defies the path and is given by the ratio between the difference in relatedness between the threshold and the latest entry and the threshold value, as follows:

$$ipd_{ikt} = \frac{\mu_{kt} - dist_{i,EB_{kt}}}{\mu_{kt}}$$

where μ_{kt} is the country-time-specific threshold, and $dist_{(i,EBkt)}$ is the distance between new entry ***i*** and the pre-existing export basket of country ***k*** at time ***t-5***. The index has a positive value when the new entry has a lower proximity to the export basket than the OS, on average. The metrics obtained thereby are subsequently aggregated at the product level for the entire period of analysis, as follows:

$$IPD_i = \frac{\sum_t \sum_k ipd_{ikt}}{|NE_i|}$$

where $|NE_i|$ is the number of total new entries of product ***i*** in the period considered.

Share of path-defying new entries: by adopting the threshold value introduced above, we assign a dichotomic value to each new entry: if the relatedness is higher than the average proximity of the OS, it represents a path-dependent new entry. By contrast, if the relatedness of the new entry is lower than the average proximity of the OS, it is labeled as a path-defying new entry.

$$d\_ipd_{ikt} = \begin{cases} 1\ if\ \mu_{kt} > dist_{i,EB_{kt}} \\ 0\ otherwise \end{cases}$$

The product-level metrics, similar to the previous one, are computed as follows:

$$d\_IPD_i = \frac{\sum_t \sum_k d\_ipd_{ikt}}{|NE_i|}$$

The third metric considers the entire distribution of the OS's relatedness distribution. Each NE's inverse measure of distance from the export basket ($dist_{(i,EBkt)}$) is associated with a percentile in the distribution of the OS ranging from 0 to 100. Higher values denote path-dependent new entries; thus, we transform this value into a measure of path departure as follows:

$$percentile_{ikt} = 1 - rank_{OS,ikt}/100$$

The path departure, product-country-time-specific metrics are subsequently transformed into a product-specific measure of path departure as follows:

$$av\_perc\_dep_{it} = \frac{\sum_t \sum_k percentile_{ikt}}{|NE_i|}$$

PRODUCT AND COUNTRY INDEX OF VULNERABILITY

As reported earlier in this block, a vulnerable product is one with a high level of path departure (low path dependence suggests that the set of available local capabilities is not difficult to acquire), high ubiquity (because capabilities are present in several countries, so international competition is high), and high frequency of entry (high level of contestability in the middle-long term).

All three dimensions are computed using an index with values ranging from 0 to 1. For frequency and ubiquity, the product value is obtained as the relative position (percentile) of its frequency/ubiquity with respect to other products' frequency/ubiquity. A value of 1 is assigned to products that most entered export baskets. A value of 0.5 is assigned to products in the middle of the distribution. The value of the degree of product-level path defiance is computed by: (1) comparing new entry relatedness with the pre-existing export basket with the OS's relatedness distribution and obtaining a value for each new entry in each country; and (2) averaging the product-country relative position in the OS distribution across countries. Products with a value of 1 have the lowest relatedness level of all OS products.

The three dimensions are joint In a unique index computed as follows:

$$IPV_i = \sqrt{freq_i^{\,2} + pathdepa_i^{\,2} + ubiq_i^{\,2}} \Big/ \sqrt{3}$$

where the index of product vulnerability of product i is equal to the square root of the sum of the square of the three components divided by the square root of 3 (the denominator serves to obtain an index ranging in the [0,1] interval). Assuming the product index of frequency, the product index of path departure, and the product index of ubiquity are three dimensions represented as a 3x1 vector. The numerator corresponds to its norm.

Moving to the country dimension, we can compute the ISV for the export basket. This is obtained as the weighted average of the indices of product vulnerability, where the weights are given by the export shares of product i of country k.

$$ISV_k = \sum_i sh_{ik} IPV_i$$

COUNTRY INDEX OF PATH DEPARTURE

All product indices of path departure presented have been used to obtain valid metrics for the entire set of products exported by each country. Similarly to the measure adopted, with ipd_i denoting the product index of path departure, the country measure is obtained as follows:

$$IPD_k = \sum_i sh_{ik} ipd_i$$

where IPD_k indicates, alternatively, the country's relative distance from path dependence, the share of path-dependent new entries or the average percen-

tile position of the country's export basket.

COUNTRY INDEX OF STRUCTURAL DYNAMISM

By considering one measure that has already been introduced, i.e. the country index of path departure (as measured by the percentile method) and the amount of NEs of each country in the period analysed, we obtain a country index of structural dynamism (***ISD_k***), which gives a measure of how dynamic an economy's export basket is over a given period (in our case, 1995–2019).

We have already introduced the country index of path departure. The number of a country's new entries is normalized in the interval [0.1] by assigning a value to each country corresponding to its relative position in the distribution of countries' NE numbers. In other words, the country with the highest number of NEs over the period analysed – i.e. the country that witnessed the biggest changes in its set of specializations – has a value equal to 1. A country with no entries has a value very close to 0.

Similar to the country index of structural vulnerability, we have added the two dimensions as follows:

$$ISD_i = \sqrt{NE\_rank_i^{\,2} + pathdepa_i^{\,2}} \Big/ \sqrt{2}$$

where NE_rank_i is the relative position of country i in the distribution of world economies according to the number of NEs in 1995–2019. The denominator is a correction to obtain an index bounded in the interval [0,1].

APPENDIX B: KEY DEFINITIONS AND CONCEPTS

Revealed Comparative Advantage (RCA) is an index that can be used to compute an economy's relative advantage—or disadvantage—in producing a particular product or class of products using international trade data. In its best-known formulation, the Balassa index of RCA of an economy ***c*** in the production of a good ***i*** is given by the ratio between the relative value of good ***i*** exports over country ***c*** total exports (country export share of product ***i***) and the relative value of good ***i*** exports over global total exports (world export share of product ***i***). Values lower than 1 reflect a country's disadvantage in producing a product, while values higher than unity reflect a country's relative advantage in producing a product. Its success is due to its ability to proxy an economy's underlying structure since it identifies which (set of) class of products an economy is specialized in, or the "export basket" (the bundle of products exported with an RCA higher than 1).

Path dependence/path defiance. A path-dependent NE occurs when a newly introduced specialization is related to the existing export basket. By contrast, with path departure (or path defiance), we indicate that a new economic specialization is characterized by the presence of production capabilities non-strictly related to those already developed in a country.

Export basket. The set of products[29] that a country specializes in. The export basket is identified as measuring RCAs. This study[30] analyses, using export data, how export baskets change over time. In other words, we identify NEs in the export basket in recent decades for all countries worldwide. One of the core novelties of the DIVE Tool is the assessment of the degree of "path dependence" of these new product specializations.

The product space. The PS is a network representation of all goods traded in the world in which every good is linked to others according to its "relatedness." The PS was initially presented by Hidalgo et al. (2007). Here, the authors highlight the role of path dependence in a country's specialization over time. As an economy's export mix changes, there is a strong tendency to move towards related goods rather than less associated goods.

Relatedness. The theoretical concept of relatedness refers to the degree to which the production capabilities required for specialization in producing two products (e.g. product A and product B) overlap. The empirical measure of relatedness is the (minimum of) pairwise probability that products A and B are co-exported with a revealed comparative advantage higher than 1 (RCA>1). See Hidalgo et al. (2007) and Appendix A for details on how relatedness is computed.

Relatedness advantage. We define this measure as the difference between the relatedness of product I to the export country of the country under analysis (in our case, Ukraine) and its relatedness with other countries at a similar level of development. A higher advantage signals that the country is better positioned to diversify toward the product than potential competitors; this concept is relevant for products characterized by a high level of path dependence (low level of path defiance).

Product sophistication or complexity (PRODY). Products are complex or sophisticated when they require a complex set of productive capabilities that are generally abundant and available in high-productivity economic contexts (for instance, those that characterize rich and developed economies). In this report, we measure product complexity by employing the PRODY index developed by Hausmann et al. (2007).

Sophistication or complexity gain. We report a measure of the increase in complexity associated with a new entry (actual or potential), which is given by the difference between the product's PRODY and the country's EXPY. The higher the gain, the higher the potential of a product to increase a country's level of production complexity.

Country sophistication or complexity (EXPY). Using the values of the PRODY of products belonging to countries' export baskets, we measure the aggregated level of complexity or sophistication. Empirical results show that the complexity measures positively correlate with income level and that deviations from this relationship predict future growth.

Diversification space or option set. The diversification space, alternatively referred to as option set (OS), is the country-time-specific bundle of products representing potential specializations that have not yet been developed. For each country and each year of analysis, the OS represents the bundle of possible new entries.

APPENDIX C: LISTS OF EXCLUDED PRODUCTS OF TABLES 4.4-4.7

SHORT JUMPS WITH A HIGH PATH DEPENDENCE AND MANY COMPETITORS (EXCLUDED PRODUCTS)

Source: UNIDO elaboration, based on BACI and Gravity, Centre d'Études Prospectives et d'Informations Internationales and World Bank, *World Development Indicators database* (accessed September 2023).

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-21	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT I ENTERED EXPBASKETS BETWEEN 1995 AND 2014
1601	Sausages	Agriculture	1807.26	18.54	1.22	1.76	37	2	0.68	0.18	4
105	Fowl	Agriculture	6812.51	3.88	1.00	1.73	34	6	0.60	0.19	12
4901	Books, brochures etc.	Agriculture	5052.36	-2.77	1.08	1.40	26	3	0.49	0.10	9
2309	Animal feed	Agriculture	2744.51	31.13	1.12	1.37	42	5	0.50	0.05	12
710	Frozen vegetables	Agriculture	547.58	4.03	1.07	1.26	33	6	0.54	0.13	8
4817	Letterstock	Agriculture	9479.47	9.80	1.01	1.21	26	2	0.47	0.08	8
1602	Other prepared or preserved meat	Agriculture	5984.59	3.45	1.03	1.18	33	3	0.57	0.13	7
506	Bones, simply prepared	Agriculture	368.87	18.41	0.89	1.06	22	3	0.54	0.15	9
201	Beef	Agriculture	2690.75	19.82	0.91	1.06	27	2	0.46	0.08	11
4707	Paper waste	Agriculture	8487.75	38.00	0.83	0.88	43	4	0.65	0.18	11
2106	Food preparations n.e.c.	Agriculture	10250.58	20.92	0.92	0.86	49	6	0.58	0.10	12
206	Edible offal	Agriculture	11280.97	16.42	0.77	0.42	24	2	0.44	0.08	9

SHORT JUMPS WITH A HIGH PATH DEPENDENCE AND FEW COMPETITORS (EXCLUDED PRODUCTS)

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-21	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT I ENTERED EXPBASKETS BETWEEN 1995 AND 2014
1506	Other animal fats and oils	Agriculture	10103.50	71.08	1.27	2.79	14	0	0.51	0.18	11
103	Swine	Agriculture	27047.24	-4.39	1.25	2.47	19	1	0.50	0.15	9
208	Other meat	Agriculture	19276.12	-3.15	1.11	1.95	21	2	0.47	0.10	5
1522	Degras and wax residues	Agriculture	399.16	23.42	1.00	1.88	17	2	0.54	0.20	8
210	Preserved meat	Agriculture	4694.39	5.33	1.20	1.80	16	1	0.46	0.15	9
1518	Animal or vegetable fats and oils, processed	Agriculture	7640.12	82.71	0.94	1.78	20	2	0.51	0.19	21
4910	Calendars	Agriculture	7394.93	2.74	1.12	1.42	15	0	0.50	0.18	2
4801	Newsprint	Agriculture	25301.69	-21.81	1.06	1.35	13	0	0.48	0.18	5
4804	Uncoated kraft paper and paperboard	Agriculture	12492.14	12.18	0.89	1.04	21	1	0.42	0.05	5
4202	Trunks or cases	Agriculture	8207.66	0.45	0.91	0.88	17	7	0.43	0.10	4

LONG JUMPS WITH LOW PATH DEPENDENCE, HIGH FREQUENCY OF ENTRY AND FEW COMPETITORS (EXCLUDED PRODUCTS)

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PE-NETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PE-NETRATION INDEX FOR UKRAINE (EU MAR-KETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-21	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT I ENTERED EXPBASKETS BETWEEN 1995 AND 2014	PRODUCT INDEX OF VULNERA-BILITY
4108	Chamois leather	Agriculture	319.46	-21.75	1.08	1.65	11	3	0.33	0.06	4	0.41
705	Lettuce	Agriculture	6.27	12.60	1.09	1.65	13	5	0.35	0.08	7	0.48
4802	Paper used for graphic purposes	Agriculture	8673.26	-10.02	0.99	0.95	20	2	0.38	0.09	6	0.57
204	Lamb	Agriculture	11296.08	31.14	0.93	0.77	18	3	0.28	0.02	6	0.55

LONG JUMPS WITH A HIGH PATH DEPENDENCE, LOW RELATEDNESS AND RELATEDNESS ADVANTAGE (EXCLUDED PRODUCTS)

HARMONIZED SYSTEM 4-DIGIT PRODUCT CODE	HARMONIZED SYSTEM 4-DIGIT PRODUCT DESCRIPTION	PRODUCT SECTOR	COMPLEXITY GAIN (USD, 2021)	GLOBAL TRADE % GROWTH (2019-2021)	IMPORT PENETRATION INDEX FOR UKRAINE (WORLD)	IMPORT PENETRATION INDEX FOR UKRAINE (EU MARKETS)	NR OF COUNTRIES FOR WHICH PRODUCT IS IN THE EXPORT BASKET IN 2019-21	OF WHICH LMI COUNTRIES	PRODUCT PROXIMITY WRT UKRAINE EXPORT PRODUCTS	RELATIVE RELATEDNESS ADVANTAGE (VIS-À-VIS LMI COUNTRIES)	NR OF TIMES PRODUCT I ENTERED EXPBASKETS BETWEEN 1995 AND 2014	PRODUCT INDEX OF VULNERABILITY
302	Fish, excluding fillets	Agriculture	1220.72	11.95	1.18	1.89	47	11	0.384	-0.003	9	0.73
4501	Natural cork, raw	Agriculture	1918.31	-11.80	0.85	1.74	6	3	0.250	0.058	2	0.10
305	Preserved fish	Agriculture	10493.76	1.23	1.06	1.53	43	10	0.409	-0.003	8	0.71
901	Coffee	Agriculture	-10269.91	20.25	1.14	1.44	41	12	0.367	-0.007	3	0.60
701	Potatoes	Agriculture	154.61	-10.34	1.06	1.23	36	9	0.403	0.033	6	0.64
304	Fish fillets	Agriculture	7246.99	6.10	1.04	1.21	49	13	0.356	-0.034	11	0.76
812	Fruits and nuts, provisionally preserved	Agriculture	-9147.46	7.27	0.95	1.17	12	3	0.373	0.111	3	0.33
704	Cabbages, cauliflowers, broccoli	Agriculture	-5975.33	12.87	0.98	1.16	24	9	0.396	0.035	9	0.66
4106	Tanned skins of other animals	Agriculture	-9308.48	-44.20	0.70	0.84	19	9	0.301	0.002	6	0.51
4101	Raw hides of bovines or equines	Agriculture	-7654.20	-21.27	0.81	0.81	20	3	0.339	0.068	10	0.62
2201	Waters	Agriculture	-5106.56	2.27	0.93	0.80	26	2	0.409	0.083	10	0.68
906	Cinnamon	Agriculture	-9617.70	21.64	0.82	0.47	8	4	0.343	0.105	1	0.23
1511	Palm oil	Agriculture	-10224.37	69.54	0.92	0.38	27	11	0.257	-0.083	9	0.69
4102	Raw skins of sheep or lambs	Agriculture	-2145.49	-1.20	1.04	0.29	24	2	0.286	0.003	6	0.58

Note: Products are ranked by the relevance of export potential to the EU market, as measured by the import penetration index.

5 Conclusion

Findings from all blocks and sections in this industrial diagnostics study are distilled from quantitative and qualitative information belonging to different layers of the economic system (macro, meso, micro and product) and different dimensions of sustainability (economic, social and environmental). Consultations and the elaborated quantitative information suggest immediate food for thought and action. **Food for thought for immediate action for a green industrial recovery** includes:

- Reinstating the importance of industrial policy in the government agenda.
- Approval of an action plan for recovery and reconstruction.
- Decisions on industry prioritization and territorial rebalancing of industrial development to reduce vulnerability.
- Collapse of foreign and domestic investments during the war and the structural low access of firms to credit to business exacerbated by the war urge the definition of a substantive programme of loans, grants and investments promotion for recovery and technical assistance.
- Technical assistance to support SMEs.
- Technical assistance for disclosing the prioritized industrial sectors and product potential and strengthening the value chain's value addition.
- Technical assistance to those industrial sectors most affected by the war.
- Tax exemptions or reductions, access to new credit, grant support, preferential loans, lowering the administration burden and updating legislation are identified by firms as effective policy instruments to mitigate the devastating effects of the war crisis. Financial sources, dealing with red tape and searching new international and domestic markets are identified as critical areas for action.
- Intensification of efforts to increase the relevance of Ukrainian products in the European market and adapt Ukrainian standards to European ones.
- Simplification of regulations and improvement of the business environment.
- Review of education programmes and TVET for a better connection to the industrial system.
- Improvement of statistics reporting for monitoring.
- Strengthening of public/private partnerships.
- Promotion of synergies between environmental and resource efficiency, circular economy practices and firm competitiveness, with a focus on the sound management of energy, water and materials resources.
- Decarbonization of existing hard-to-abate sectors and diversify towards low-emissions-intensity products.
- Reinstatement of energy infrastructure and green the energy electrical system with a stronger focus on small plants close to consumer needs (distributed energy).
- Governance improvement through capacity-building, better monitoring of the policy measures, and effective decentralization.

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