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Industrial Hemp Production and Processing: Current State, Trends, and Challenges

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EXECUTIVE SUMMARY

Strategic potential and the role of the state in developing the industrial hemp sector

Industrial hemp has significant strategic potential as a critical sector for Ukraine, owing to established comparative advantages in global and European markets, environmental sustainability of both its products and production processes, and a wide array of applications (textiles, construction, medicine, energy security, military industry, etc.).

Development of processing infrastructure

A shortage of processing capacities remains a limiting factor in the development of the hemp industry. Restricted domestic demand for retted hemp straw hampers the growth of industrial hemp cultivation, occasionally forcing agricultural producers to abandon its cultivation despite high profitability and rising demand in external markets. To address this issue, it is recommended to develop incentive mechanisms for establishing new processing plants. Mechanisms to stimulate processing development include tax incentives for investments in processing equipment and preferential crediting. The development of vertical integration, covering all participants in the value chain, enhancing their cooperation, and mutual support, is another critical aspect.

Strengthening breeding programs and seed production

Limited production of planting material may constrain the expansion of industrial hemp acreage in Ukraine. Establishing cooperation among breeders, agricultural producers, and seed stations, alongside restoring the efficiency of the primary center for breeding industrial hemp varieties—the Institute of Bast Crops of the NAAS—is crucial. This cooperation will meet the increasing domestic demand from agricultural producers for seeds, creating closed-loop systems of cultivation, processing, and sales. In the long term, such actions will enable Ukraine to enter international markets for industrial hemp planting material.

Harmonisation of legislation and quality standards

A critical challenge remains the harmonisation of national legislation with EU regulations, particularly concerning product and process quality standards and the transparency of business operations. The traceability of product origins should underpin the standardisation processes, adherence to environmental standards, and licensing. This approach will facilitate simplified access to European markets and compliance with sustainable production requirements.

Clarification of key deregulation provisions

It is essential to conduct explanatory work among law enforcement representatives regarding the provisions of the Law of Ukraine "On amendments to certain laws of Ukraine concerning state regulation of the circulation of cannabis plants (Cannabis) for educational, scientific, and technical activities, production of narcotic drugs, psychotropic substances, and medicines to expand patient access to necessary treatment." This will minimize incidents of unjustified classification of industrial hemp as prohibited crops.

INTRODUCTION

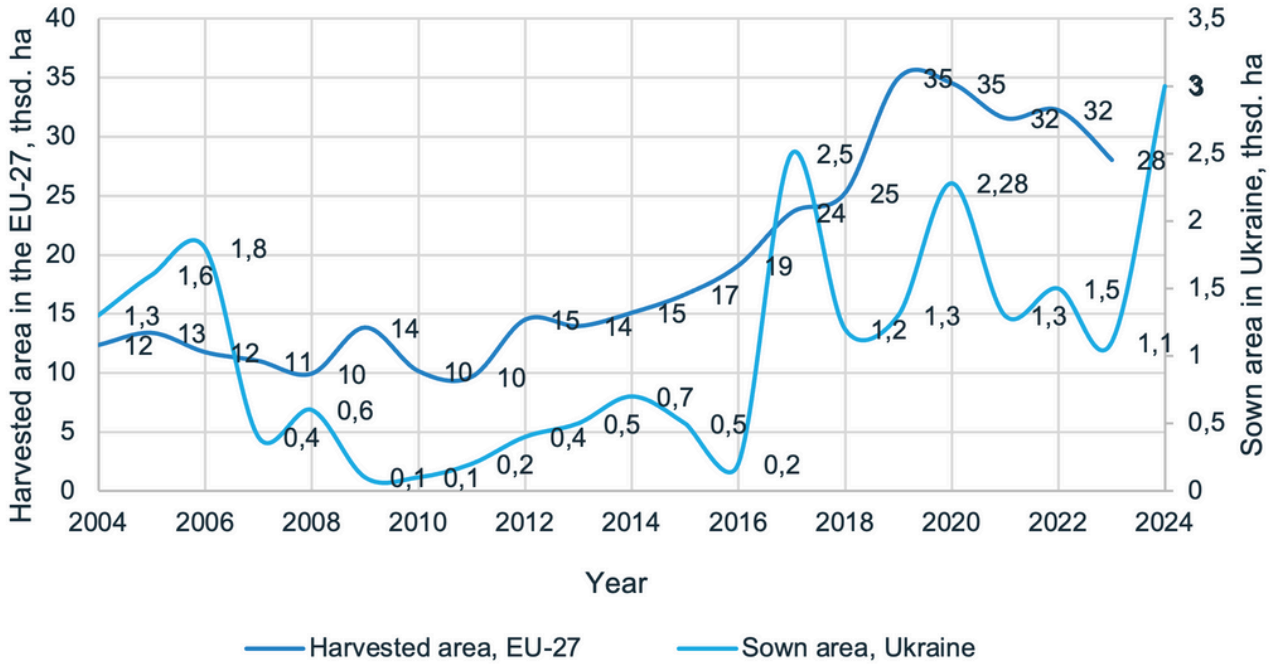
Hemp is a traditional crop for Ukraine, actively cultivated alongside wheat, rye, and peas since Scythian times (VII–III century BC) (Горбаненко, 2019). At the beginning of the 20th century, Ukraine was one of the global leaders in industrial hemp production, with a cultivated area of 105 thousand hectares (Мохер, 2020), whereas by 2004, the cultivation area had reduced significantly to just 1.2 thousand hectares. Historically, the significant factors contributing to hemp development in Ukraine were favorable climatic conditions, accessible land resources, established traditions and technologies, and the intensive breeding of industrial hemp varieties (Marchenko, 2020).

Several factors have led to a decline in industrial hemp production, both in Ukraine and worldwide, notably the rising popularity of cheaper synthetic materials and the classification of hemp as a narcotic plant (Single Convention on Narcotic Drugsб United Nations, 1961). Currently, however, a resurgence of interest in industrial hemp production is driven by fundamentally opposite factors, including: (1) increased demand for environmentally friendly and natural materials (Dhondt, 2020; Yashas, 2019); (2) gradual legalisation of industrial hemp cultivation in many countries and the removal of cannabis and its derivatives from the Single Convention on narcotic plants list; (3) high profitability of hemp cultivation and processing due to its waste-free production and growing market demand (Грузинська, 2020); (4) the healthy eating trend and growing popularity of hemp seeds as a biologically active supplement with high cannabidiol (CBD) content (Cannabidiol, 2020).

In the EU, there has been a clear trend toward the expansion of industrial hemp areas (almost tripling in 2023 compared to 2010) (Figure 1). According to Grand View Research, the global industrial hemp market was valued at USD 5.49 billion in 2023 and is expected to grow at a compound annual growth rate (CAGR) of 17.5% from 2024 to 2030 (Growing, 2019).

In Ukraine, the industrial hemp sector began gradually recovering in 2012 after the cancellation of special permits for its cultivation, aligning with growing external market demand (Михайлова, 2019). In 2017, the cultivated area of industrial hemp rapidly increased from 0.2 to 2.5 thousand hectares. In 2018, however, the area decreased by 52% to 1.2 thousand hectares due to stricter requirements for facilities intended for handling narcotic drugs, psychotropic substances, precursors, and their storage (Order No. 52 of the Ministry of Internal Affairs of Ukraine dated January 29, 2018). Following Russia’s full-scale invasion of Ukraine, the cultivation area remained practically unchanged, and in 2024 a record area was planted with industrial hemp. According to experts, the cultivation area reached between 2.6 and 3 thousand hectares in 2024.

Figure 1. Dynamics of industrial hemp cultivation areas in the EU and Ukraine



Note: The cultivated area of industrial hemp in 2024 is based on expert estimates.
Source: Eurostat, State Statistics Service of Ukraine, Ministry of Agrarian Policy and Food of Ukraine (Про затвердження порядку, 2024).

The objective of this research is to investigate the current state (regulatory framework compared to the EU, market conjuncture, economic efficiency, investment attractiveness), trends (particularly the development of external markets and Ukraine's competitive positions), prospects for the Ukrainian hemp industry and its primary challenges. The anticipated outcomes aim to provide a comprehensive overview of the current state, challenges, and potential of industrial hemp in Ukraine, considering European experience. Based on these findings, a set of measures will be proposed to ensure the revival and further development of industrial hemp cultivation and processing in the context of Ukraine's integration into the EU, creating conditions for the production of products with maximum added value and profitability.

The information base of this research includes legislative and regulatory acts of Ukraine and the EU, data from the European Commission (Eurostat), International Trade Centre (Trade map), the Ministry of Agrarian Policy and Food of Ukraine, State Statistics Service of Ukraine, official reports of international institutions involved in the sector, scientific and popular science publications, interview results (own and internet-published), Cultivation Technology Plan for industrial hemp cultivation, and data from hemp producers and processors.

RESEARCH METHODOLOGY

The structure of the research encompasses four primary sections: the study and comparative analysis of Ukrainian and European legislative and regulatory frameworks governing the production and processing of industrial hemp; analysis of the current state and development trends of the global markets for industrial hemp seeds, fibre, and yarn; evaluation of the costs and economic efficiency of industrial hemp cultivation; analysis of agricultural production of industrial hemp; and the assessment of investment attractiveness in hemp cultivation and processing sectors. The study employed the following methods: desk research, assessment of comparative advantages based on RCA indices, interviewing, and economic-statistical analysis.

DESK RESEARCH

Desk research was conducted within all mentioned sections. The informational base for desk research included legislative and regulatory acts of Ukraine and the EU, data from the European Commission (Eurostat), International Trade Centre (Trade map), Ministry of Agrarian Policy and Food of Ukraine, State Statistics Service of Ukraine, official reports from international institutions involved in the sector, and scholarly and popular science publications by domestic and foreign researchers. Desk research results identified: (1) main types of hemp products; (2) key differences between Ukrainian and European legislative and regulatory frameworks related to hemp production and processing; (3) the current state and development trends of the global and European markets for industrial hemp seeds, fibre, and yarn; (4) domestic trends in agricultural hemp production; and (5) industry development prospects and current challenges. Based on the interviewing outcomes, a SWOT analysis of the domestic hemp industry was conducted. In this study, two terms are used to refer to hemp fiber. Specifically, the term “true hemp” is initially employed in alignment with the official classification of products under the Harmonized System (HS) codes, notably HS 530210 ("Raw or retted true hemp") and HS 530290 ("Processed but not spun true hemp"), when analyzing respective markets and trade flows. Subsequently, the more general term “hemp fiber” is utilized when discussing hemp fiber products across various processing stages.

ASSESSMENT OF RCA

Assessment of comparative advantages across specific products was conducted using Revealed Comparative Advantage (RCA) indices, a method commonly used for identifying promising markets for further development (OECD, 2011). A country holds a comparative advantage in a market if its RCA index is equal to or greater than 1 (Balassa, 1965):

$$RCA = \frac{X_{ij} / X_{it}}{X_{wj} / X_{wt}}, \quad (1)$$

where X_{ij} is the export value of the j-th commodity from the i-th country; X_{it} is the total export value of the i-th country; X_{wj} is the total global/European export value of the j-th commodity; X_{wt} is the total global export value (all commodities and services); X_{ij} / X_{it} is the share of export value of the j-th commodity in the total value of all commodities exported by the i-th country; X_{wj} / X_{wt} is the share of the j-th commodity in the total value of global exports of all commodities.

The index demonstrates whether a country exports a particular product in a higher proportion than is typical for the global market, indicating specialisation. Considering methodological limitations of the classic RCA index, this study employs its modified (symmetric) version (Laursen, 2015):

$$RSCA = \frac{RCA - 1}{RCA + 1}. \quad (2)$$

A country possesses comparative advantages if the RSCA index holds a positive value.

INTERVIEWING

Nine industry experts participated in interviews, including representatives from leading entities involved in seed production for industrial hemp (Institute of Bast Crops of NAAS), industrial hemp cultivation and processing companies, and the Ukrainian Hemp Association. Key interview topics included: (1) current state assessment of industrial hemp production and/or processing; (2) market conditions where enterprises operate; (3) major obstacles for industry development at both enterprise and national levels; (4) potential mechanisms and tools to stimulate hemp industry growth.

ECONOMIC AND STATISTICAL METHOD

The economic and statistical method was applied to quantitatively assess and analyze the competitiveness of domestic hemp producers. Considering the nature of competitiveness, one of the primary attributes of its indicators is relativity, requiring comparisons with market competitors (Николюк, 2017). In this research, competitiveness was evaluated using a ranking method. Ukraine's competitiveness on hemp product markets was assessed using competitiveness indicators.

Numerical indicators of competitiveness should quantitatively reflect the factors forming competitiveness (Николюк, 2017). Key factors in competitiveness are competitive advantages. For analyzing competitiveness in specific agri-industrial product markets, advantages in production and sales play a crucial role (Table 1).

One primary sources of competitive advantages are production costs, potentially lower than competitors' costs with similar product quality. Sources of lower production costs can include reduced resource prices (especially labor costs), Higher technological level and production process innovations (Николюк, 2017). Profitability level is an essential indicator for sales advantages, reflecting capital returns as a ratio of net profit to production cost.

Table 1. Competitiveness Indicators of Hemp Product Producers

Area of Competitive Advantage Formation	Competitiveness Factors	
	Quantitative	**вартісні**
Resource provision	Cultivated/harvested area	–
Agricultural production and processing	Production volume	Production costs /total costs (Latruffe, 2010; Портер, 1998; Dovgal, 2017; Wang, 2011)
Sales	Export volume (Beck, 2024), market share (Борисова, 2000; Заруцький, 2013; Малік, 2007)	Export value (Beck, 2024), price (Трегобчук, 2007), profitability (Яців, 2013)

Source: Compiled by authors (Николюк, 2017) based on Latruffe (2010), Портер (1998), Dovgal (2017), Wang (2011), Борисова (2000), Заруцький (2013), Малік (2007), Beck (2024), Трегобчук (2007), Яців (2013).

Considering the above, Ukraine's competitive positions in European markets were evaluated based on prices, market share analysis, and previously mentioned comparative advantage indices compared with other countries.

MONOGRAPHIC METHOD

The monographic method was applied to analyze and evaluate production costs, economic efficiency of industrial hemp cultivation, and investment attractiveness in hemp supply chain. The study was based on cultivation technology plans for industrial hemp using dual-purpose technology developed by the Institute of Bast Crops NAAS. Cultivation technology plans contain detailed information on resource expenditures per technological operation for three different cultivation technologies (seeding rates of 15, 45, and 75 kg/ha). The first two technologies involve growing hemp for seeds and retted straw, while the third is exclusively for retted hemp straw production.

Production Costs. Total costs by major cost items were calculated as the sum of costs across all technological operations. Total production costs of industrial hemp () were calculated using the formula:

$$TC = DC + OvC = (W + F + Fet + S + PP + E + L) + OvC, \quad (3)$$

where DC are direct costs; OvC are overhead costs ; W a total wage fund, calculated based on workers' categories, number of shifts, and the required number of workers (including payroll taxes); F are fertilizer costs; Fet are fuel expenditures; S are seed costs; P are plant protection costs; E are electricity costs; L and lease expenditures.

Economic efficiency of industrial hemp cultivation. Economic efficiency of industrial hemp cultivation was assessed using profitability indicators based on the following procedure:

1. Calculation of production cost per ton of hemp seeds and fibre:

$$V_i = \frac{TC}{Y_i}, \tag{4}$$

where V_i are a production cost per ton of the i-th product type; Y_i is a yield per hectare for the i-th product.

2. Determining profitability level of hemp production:

$$I_i = \frac{P_i - V_i}{V_i}, \tag{5}$$

where I_i is profitability level of the i-th product; P_i is price of the i-th product.

Investment attractiveness of industrial hemp cultivation and processing. The monographic method was also applied to analyze the investment attractiveness of establishing primary processing of industrial hemp into coarse fibre. The required capital investment and operating costs were determined based on expert interviews and data from cultivation technology plans for industrial hemp cultivation. The following indicators were used for evaluating investment attractiveness:

- Income from the production of planting material (seeds) and biomass :

$$I_i = L_i \cdot Y_i \cdot P_i + S_i \cdot L_i, \qquad i \in [1;2], \tag{6}$$

where I_i is an income from producing the i-th product type; L_i is an area under cultivation for the i-th product (planting material or biomass); Y_i is a yield per hectare for the i-th product ; P_i is a price of the i-th product; S_i an amount of state support per hectare for the i-th product;

- Income from production of hemp shives and coarse fibre :

$$I_3 = L_2 \cdot Y_2 \cdot \left(P_{trhp} \cdot w_{trhp} + P_{cst} \cdot w_{cst} \cdot 0{,}5\right), \tag{7}$$

where I_3 is an income from production of hemp shives and coarse fibre; L_2 – is an area cultivated for biomass production; Y_2 is a yield of industrial hemp biomass per hectare ; P_{cst}, P_{trhp} are prices per ton of shives and coarse fibre, respectively; w_{cst}, w_{trhp} are proportions of shives (approximately 0.65) and fibre (approximately 0.26) in total dry biomass;

2) Production costs:

- Production costs of planting material and biomass cultivation :

$$C_i = L_i \cdot CpH_i + C_i^p, \qquad i \in [1;2], \tag{8}$$

where C_i are production costs of the i-th product (planting material or biomass); CpH_i are costs per hectare for the i-th product; C_i^p are fixed costs for producing the i-th product;

- Production costs of hemp shives and fibre :

$$C_4 = L_4 \cdot Y_4 \cdot CpP + C_4^p, \tag{9}$$

where C_4 are costs for processing retted hemp straw; L_2 is an area cultivated for biomass production; CpP is a yield per hectare of hemp biomass ; C_4^p are fixed costs for processing hemp straw.

3) Profit from business activities :

$$p_i = I_i - C_i, \qquad i \in [1;3], \tag{10}$$

where p_i is a profit from producing the i-th product; I_i is an income from producing the i-th product; C_i are costs for the production of the i-th product;

4) Payback period of capital investments :

$$PP_i = \frac{In_i}{p_i - D_i}, \qquad i \in [1;3], \tag{11}$$

where PP_i is a payback period of capital investments for the i-th product ; In_i are the total capital investments for producing the i-th product ; D_i are depreciation deductions related to the production of the i-th product .

1. LEGISLATIVE AND REGULATORY FRAMEWORK FOR INDUSTRIAL HEMP CULTIVATION IN UKRAINE AND THE EU

In general, the activities of hemp producers and processors are regulated under general principles based on standard legislative and regulatory acts. Based on the results of comparative analysis of legislative and regulatory mechanisms for industrial hemp cultivation in Ukraine and the EU, the following key differences have been identified (Appendix A):

Seed certification. All agricultural crop varieties in Ukraine undergo verification and state registration. In contrast, the EU permits the registration of certified seeds from approved suppliers in other member states without additional verification procedures.

THC content Imitations. According to the Law of Ukraine "On Narcotic Drugs, Psychotropic Substances, and Precursors," the permissible THC (tetrahydrocannabinol) level for industrial hemp is 0.3%. Similar regulations on THC content in industrial hemp apply within the EU (this indicator was raised from a previous level of 0.2% in 2023). THC content is monitored throughout all stages of production – from seeds to finished products – in accordance with methods established at the EU level.

Licensing of production. The EU clearly defines and describes regulatory requirements for all stages of hemp product value chains—from land plots and seed materials to finished products, including labeling, packaging, and more—to ensure transparency in all business processes. Obtaining corresponding licenses is a prerequisite for accessing state support. In Ukraine, legally regulated licensing procedures do not include tracing the origin of products along all stages of supply chain.

Environmental standards for pesticide application. Systems for pesticide application control pursue similar goals but differ in implementation mechanisms. In the EU, complying with regulations regarding the types and amounts of applied pesticides is a prerequisite for obtaining state support. Ukrainian national legislation focuses more broadly on general safety conditions for pesticide use, ecological standards, and environmental monitoring.

In contrast, EU directives promote an integrated plant protection approach, prioritizing biological, mechanical, and agricultural techniques for pest control and limiting chemical pesticide use.

Tax incentives and subsidies. In Ukraine, emphasis is placed on general state support for the agricultural sector. The main requirements for receiving state support include licensed registered activity, seed certification, and compliance with product quality standards.

In the EU, relevant processes are regulated based on the norms of the Common Agricultural Policy (CAP). In several EU member states (e.g., France, Germany, Italy, Poland, Spain, Czech Republic, and the Netherlands), industrial hemp cultivation is legally recognized as a strategically important sector, receiving special state support regimes. Eligibility requirements for receiving state support include adherence to environmental, product and business process quality standards, and proof of product origin.

Product quality control. The EU has a comprehensive regulatory system establishing precise quality and safety standards that all producers must comply with. Hemp product requirements are governed by general regulations and national standards of EU member states. In Ukraine, product quality is primarily regulated by state technical standards, compliance with which is not mandatory for producers.

Hemp seeds: There is a slight difference in permissible seed moisture levels—1% higher in Ukraine compared to the EU. Additionally, the EU specifies unique quality requirements such as seed purity and oil content, depending on the subsequent use of seeds.

Retted hemp straw /fibre: Ukraine permits a maximum impurity content in hemp fibre 1% higher than the EU standard. Ukraine's maximum moisture content level for hemp straw /fibre is 5% lower. Fibre strength permissible in both Ukraine and the EU depends on intended further use.

Taxation. Tax rates in Ukraine are generally equal to or higher than those in the EU but feature fewer tax incentives. The EU has a more flexible taxation system offering agricultural producers opportunities for tax preferences. Eligibility for preferential taxation regimes requires compliance with environmental standards, product quality and business process standards, and proof of product origin.

2. DEVELOPMENT OF THE GLOBAL HEMP FIBRE MARKET SHIVES SHIVES

The primary hemp products include retted hemp straw (processed into fibre for cellulose, textiles, biocomposites, and gunpowder; shives; biomass residues, including for pellet production), seeds (processed into oil, use for food and animal husbandry), and flowers and leaves (oil, pharmaceuticals) (Moxep, 2020). Currently, the most developed raw material markets for hemp products are those for seeds, hemp fibres of varying processing depths, and hemp yarn. Within the food industry, markets for whole and hulled hemp seeds and hemp oil are rapidly expanding.

In this research, particular attention is given to industrial hemp seeds and fibre, as these products are critical in domestic production. Hemp fibre, which has significant potential for further processing into yarn, is particularly notable for its capacity to ensure high profitability. Analyzing these products allows for a focus on strategically important areas that hold the greatest economic potential for Ukraine, fostering sustainable production and enhancing the competitiveness of domestic products on external markets.

2.1 True hemp, raw or retted (HS 530210)

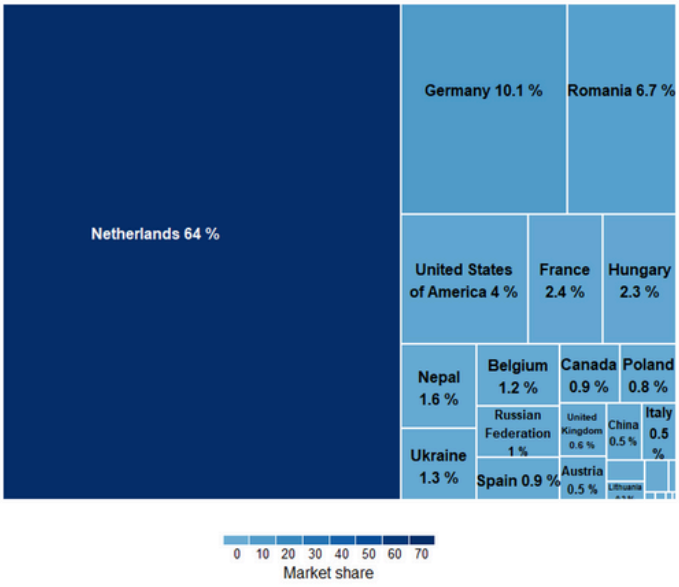
Raw or retted true hemp (HS 530210), classified under commodity code 530210 of the Harmonized Commodity Description and Coding System, is a product of primary processing (Pfau, 2024). It includes raw fibre harvested directly from the plant (regardless of the presence of leaves or seeds), as well as retted fibre (where fibres remain attached to the woody part of the plant but separate during retting) (Пояснення, 2022).

The global export volume of raw or retted hemp was relatively stable from 2020 to 2023 (Figure 2). The average export volume for this period was 11.86 thousand tonnes, peaking at 15 thousand tonnes in 2022. The Netherlands currently dominates global exports, accounting for 63% (2021) to 81% (2022) of total global exports from 2019 to 2023 (Figure 3). Romania is another consistent global leader, ranking second (2019–2022) and third (2023), with an average global export share of 11.5%. Significant global exporters also include Germany (10.1% of global exports), the USA (4%), and France (2%). Hungary (sixth place by export volume) and Nepal (seventh place) significantly increased export volumes in 2023 compared to 2022 – 16-fold and 193-fold, respectively. Key factors behind Hungary's hemp sector growth include increased demand for related products and EU subsidies (Kender, 2024). Nepal's success primarily stems from the inclusion of fibre and textiles made from hemp in an emerging list of export potential products, combined with global sustainability trends and shifts toward environmentally friendly alternatives to traditional synthetic textiles (Bajgain, 2023; Shresth, 2023).

Figure 2. Development of the global market for raw or retted hemp



Figure 3. Global market distribution of raw or retted hemp, 2023



Source: calculated based on ITC Trade Map data.

Ukraine improved its position in the global market for raw or retted hemp from 2015 to 2023. Specifically, Ukraine's global export share increased from 0.47% in 2015 to 1.3% in 2023 despite ongoing military actions (Figure 2). Following Russia's full-scale invasion of Ukraine, the country's global market share initially rose by 1 percentage point in 2022, then declined by 0.6 percentage points in 2023. One reason for Ukraine's gradual increase in global market share since 2020 has been rising export volumes, primarily driven by high profitability and steadily increasing global fibre prices (average annual growth rate of 21% during 2018–2023, according to ITC Trade Map data). These factors stimulated the expansion of retted hemp straw processing into fibre and the establishment of new processing plants both before and after Russia's invasion (e.g., the Ukrainian Hemp plant, Hempy UA industrial park, and the Ma'Rijany Hemp Company plant).

In 2023, Ukraine ranked eighth globally in exports of raw or retted hemp exporting 167 tonnes, down from 283 tonnes in 2022 (Appendix B). This decline was partly caused by a 27% reduction in cultivated area in 2023 compared to 2022. According to interviews with representatives of the Ukrainian Hemp Association, military activities have been one of the main factors constraining agricultural hemp production, especially in Sumy region, which is among Ukraine's leading hemp-producing areas.

Germany was the leading importer of Ukrainian hemp fibre (86 tonnes, 51.5% of Ukraine's total exports), followed by Lithuania (39 tonnes, 23.3%), Romania (32 tonnes, 19.2%), and Poland (11 tonnes, 6.6%).

2.2 TRUE HEMP, PROCESSED BUT NOT SPUN; TOW AND WASTE OF TRUE HEMP (INCLUDING YARN WASTE AND GARNETTED STOCK) (HS 530290)

Products classified under HS commodity code 530290 are semi-processed hemp fibres (processed but not spun) and include: (1) scutched hemp fibre (separate fibres sometimes exceeding 2 m in length, separated from the plant through scutching); (2) fibres processed through combing or other techniques appropriate for spinning; and (3) tow and waste of true hemp (Пояснення, 2022).

The global market for processed but not spun hemp has rapidly expanded since 2015. According to ITC Trade Map, the average annual growth rate of global export volumes from 2015 to 2022 was nearly 30%. In 2023, global exports surged by 5.3 times compared to 2022 (Figure 4), primarily driven by France (exporting over 42 thousand tonnes) and the Netherlands (exporting over 11 thousand tonnes), which currently lead this market (Appendix C). In 2023, the Netherlands increased its exports of processed but not spun hemp by 60% compared to 2022. Other leading exporters also significantly increased export volumes: Canada (fourfold), Belgium (double), Lithuania (26%), the USA (double), and Ukraine (nearly threefold) (Figure 5). Croatia experienced substantial market share losses in 2022–2023 compared to 2019–2020 (dropping from 7th to 29th place). Factors slowing market growth in Croatia included inadequate processing capacities (Duvnjak, 2023), systematic theft from small producers (Simmonds, 2023), and insufficient awareness among law enforcement and judicial authorities regarding legislation classifying cannabidiol (CBD) as a dietary supplement (Is CBD, 2024), resulting in unjustified penalties (Simmonds, 2023; Mullane, 2022).

Figure 4. Development of the global market for processed but not spun hemp

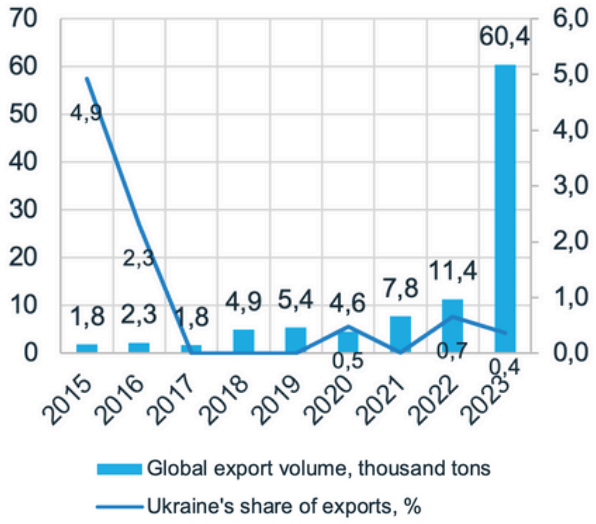
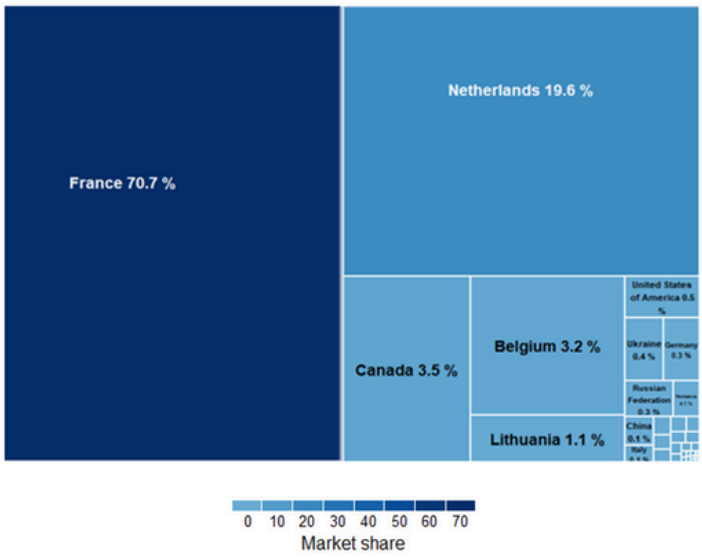


Figure 5. Global market distribution of processed but not spun hemp, 2023



Source: calculated based on ITC Trade Map data.

Due to relatively modest export volumes, which allow for the diversification of logistics sales channels to EU countries, Ukraine has sustained export growth for processed but not spun hemp, even after Russia's invasion. Annual growth in Ukrainian exports from 2015 to 2023 averaged 13.3%. In 2023, the value of Ukrainian exports to the global market more than doubled compared to 2022, increasing from EUR 72 thousand to EUR 160 thousand. Key importers of Ukrainian semi-processed hemp fibre were Germany (60 tonnes, 27.8% of total Ukrainian exports), Poland (58 tonnes, 26.9%), Romania (40 tonnes, 18.5%), Belgium (23 tonnes, 10.6%), Bulgaria, and Finland (jointly 34 tonnes, each accounting for 7.9%).

INSET 1

Success story of France

France is one of the leading players in the global industrial hemp market (20 thousand hectares in 2023 compared to 12 thousand hectares in 2015, 1,400 producers, 300 employees). The key characteristics of the French hemp sector include: (1) an effective institutional environment involving several major stakeholders, such as the National Federation of Hemp Producers (Fédération Nationale des Producteurs de Chanvre), which unites all hemp producer unions in France and represents their interests; Cooperative of Hemp Seed Producers (CCPSC); and the Union of Hemp Processors (l'Union des transformateurs du Chanvre), among others; (2) the sector's capacity to adapt production to market needs and create new hemp varieties, including zero-THC varieties, based on in-depth knowledge of the hemp genome (through CCPSC); (3) a strong network of research institutions specialized in hemp research, particularly in the field of eco-friendly construction materials, along with state financial support for relevant research; (4) contract-based cooperation between hemp producers and processors following vertically integrated principles, including clear specification of raw material quality requirements; (5) a cooperative organisational form for processors in most cases (InterChanvre, 2017; Duval, 2016; Growing CBD, 2019).

3. DEVELOPMENT OF EUROPEAN MARKETS FOR HEMP PRODUCTS AND THEIR DERIVATIVES

3.1 HEMP SEEDS (HS 12079991)

Currently, hemp seeds are among the hemp products that demonstrated relatively stable import volumes into the EU countries between 2015–2023, fluctuating within the range of 20–29 thousand tonnes (Fig. 6). However, in 2022–2023, seed imports decreased by 24% compared to 2021. Nevertheless, the growth of the seed market is projected from 2024 to 2031, with an expected cumulative average annual growth rate of 7.08%, reaching USD 101.46 billion (World, 2024). In 2023, the value of hemp seeds imported into the EU was EUR 49 billion, 14% lower compared to 2021. Prices for hemp seeds on the European market show an upward trend. Key exporters of hemp seeds to the EU include France (32% of total EU imports), the Netherlands (23%), Germany, and Estonia (7% each).

In 2023, Belgium, the Netherlands, Romania, and Germany accounted for the largest import volumes. Despite substantial seed imports, the Netherlands remains a net exporter of this products, with a positive trade balance of 687 tonnes. Nearly 80% of seeds imported into the Netherlands originated from France, Canada, Germany, and Romania. The primary importers of Dutch hemp seeds in 2023 were Germany, Romania, Belgium, and Spain (over 50% of total exports). Germany, by contrast, is a net importer with a negative trade balance of -470 tonnes. Key suppliers of hemp seeds to Germany include France and Austria (approximately 70% of total imports), while approximately 70% of Germany’s seed exports are directed to Austria (29%), Denmark, and Belgium.

Hemp seed imports from Ukraine to the EU declined significantly after 2019 (Figure 7). Potential reasons for this trend include: (1) increased domestic demand for hemp seeds due to the growth of seed processing into oil; (2) strict regulatory control within the sector. Negative factors led to a 43% reduction in industrial hemp cultivation areas in 2021 compared to 2020, a further 34% reduction in 2022, and a 52% decline in 2023. Due to decreasing hemp seed exports, Ukraine's market share in EU imports fell from 1.65% in 2015 to 0.67% in 2021, with an additional decrease to 0.25% following Russia’s full-scale invasion in 2023.

The primary EU partners importing Ukrainian hemp seeds between 2015–2023 were Poland (with all Ukrainian seed exports directed to Poland in 2023), Hungary (2015–2016, 2018–2020, and 2022), Italy, and Romania (2022).

Figure. 6. Development of the European market for hemp seeds

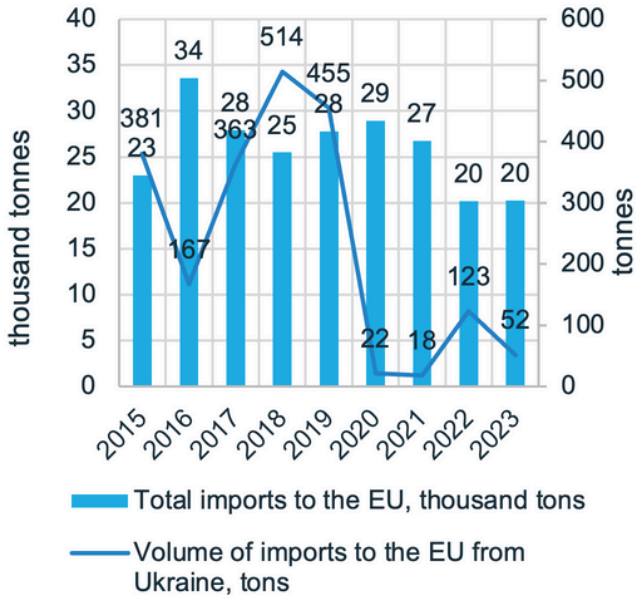
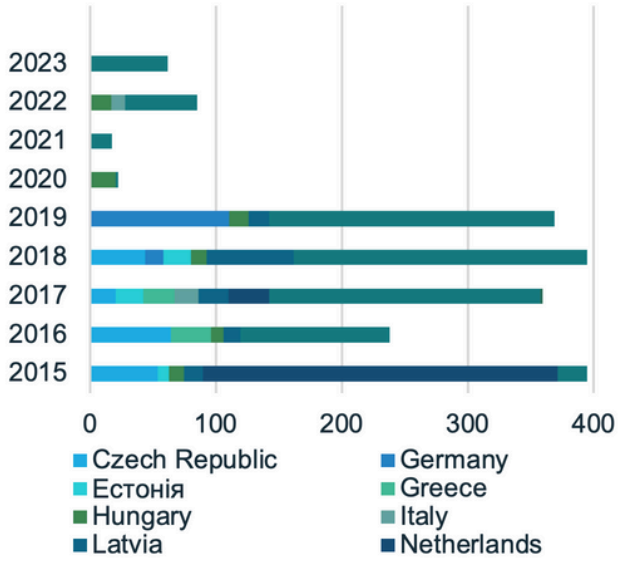


Figure 7. Export volumes of hemp seeds to the European market, tonnes



Source: calculated based on Eurostat data.

3.2 TRUE HEMP, RAW OR PROCESSED, BUT NOT SPUN (HS 5302)

The European market for raw or processed, but not spun, true hemp (HS 5302) expanded rapidly during 2015–2021, with EU import volumes growing at an average annual rate of 8%. However, in 2022–2023, import volumes dropped by nearly half compared to 2021 – from 31.4 to 20 thousand tonnes (Figure 8). This recent trend resulted from a decline in imports of both types of fibre: raw or retted, and processed but not spun. The value of true hemp imported into the EU also fell — from €24 million in 2021 to €14.8 million in 2023. This was partly due to a global decrease in true hemp prices, which declined by 34% in 2022 and by 142% in 2023 compared to 2021.

According to ITC Trade Map data, the main European importing countries of raw or processed, but not spun, true hemp in 2023 were Denmark (26% of total EU imports), the Czech Republic (22%), Germany (19%), and Belgium (15%). Denmark became the leading importer of true hemp only in 2022–2023, while in previous years its share of total European imports did not exceed 1.7%. Similarly, Belgium has significantly increased its import volumes in recent years – from 1.5% in 2015 to 15% in 2023. The highest import values were recorded in Germany and the Czech Republic (17% each of total EU true hemp imports), Italy (15%), and Belgium and Denmark (11% each).

Since 2020, EU Member States have become key partners of Ukraine in purchasing Ukrainian hemp fibre. In particular, in 2023, all exported raw or processed, but not spun, true hemp was directed to the EU (Figure 9). After a decline and suspension of exports in 2017–2019, the positive trend in true hemp sales resumed, with annual growth rates more than doubling. The largest volumes of semi-processed true hemp in 2022 and 2023 were exported to Germany (267 tonnes or 75% and 146 tonnes or 38% of Ukraine's total fibre exports, respectively) (Figure 9). The overall export growth was driven by the construction and launch of new

processing capacities in Ukraine (notably the Ukrainian Hemp plant in Cherkasy region). As of late 2024, a new processing plant was launched by Ma'Rijany Hemp Company in Zhytomyr region, continuing the trend of reviving industrial true hemp processing. In terms of value, in 2023, Ukrainian true hemp was sold at an average price of €807 per tonne, with the highest price recorded in exports to Germany (€1,082/tonne) and the lowest in exports to Bulgaria (€412/tonne).

Figure 8. Development of the European true hemp market (HS 5302)

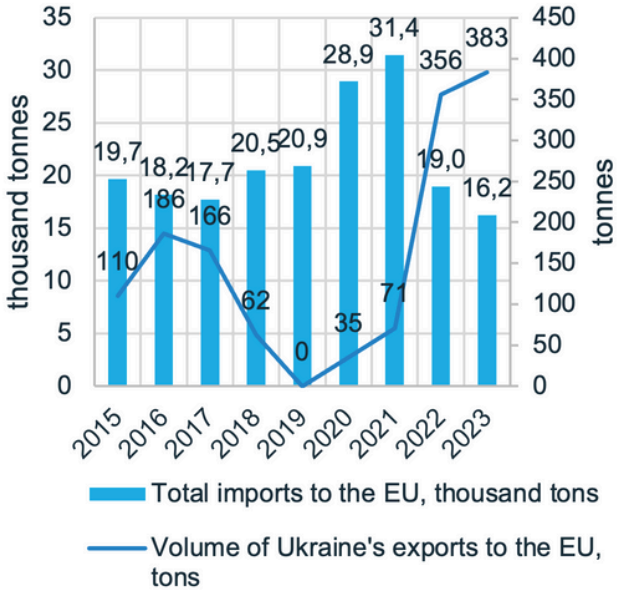
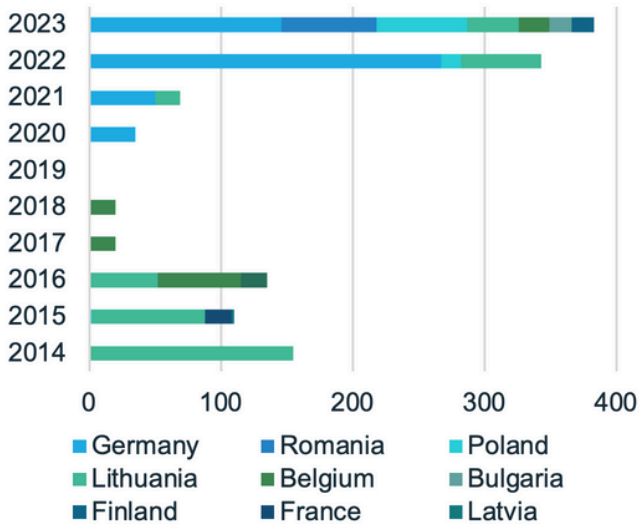


Figure 9. Volume of hemp fiber exports to the European market, tonnes (HS 5302)



Source: calculated based on ITC Trade Map data.

TRUE HEMP, RAW OR RETTED (HS 530210)

During 2015–2023, the European market for true hemp, raw or retted (HS 530210), was characterized by relatively stable import volumes. On average, the volume of raw or retted true hemp imported to EU countries during this period was 8.7 thousand tonnes, with a peak in 2017 (9.6 thousand tonnes) (Figure 10). European importing countries primarily sourced raw and retted hemp from the Czech Republic (39% of total EU imports in 2023), Germany (25%), and Belgium (13%). The main exporters of this product to EU countries were France, the Netherlands, Romania, and Belgium, reflecting strong trade ties among EU Member States.

After reaching its peak export volume of raw or retted hemp to the EU in 2022, Ukraine reduced its deliveries by 42% in 2023, while the export value declined by 34%. This decline was primarily due to reduced export volumes, while the product price increased gradually during 2020–2023 in line with the global trend of rising fibre prices. In particular, the global export price in 2023 was 25% higher than in 2021.

TRUE HEMP, PROCESSED BUT NOT SPUN; TOW AND WASTE OF TRUE HEMP (INCLUDING YARN WASTE AND GARNETTED STOCK) (HS 530290)

The European market for processed but not spun hemp grew rapidly between 2015 and 2021, with the average annual growth rate of EU import volumes reaching nearly 13% (Figure 11).

However, in 2022–2023, total import volumes decreased by a factor of 2.7 compared to 2021. The main exporters of semi-processed hemp to EU markets were predominantly EU Member States – primarily France and the Netherlands.

Over the past two years, Ukraine significantly increased its exports of processed but not spun hemp to the EU from 1 tonne in 2021 to 215 tonnes in 2023. The importers of Ukrainian products were Germany (28% of Ukraine's exports), Poland (27%), Romania (18.6%), Belgium (10.7%), Bulgaria, and Finland (each accounting for 7.9%).

Figure 10. Development of the European market for true hemp, raw or retted (HS 530210)



Figure. 11. Development of the European market for processed but not spun hemp (HS 530290)



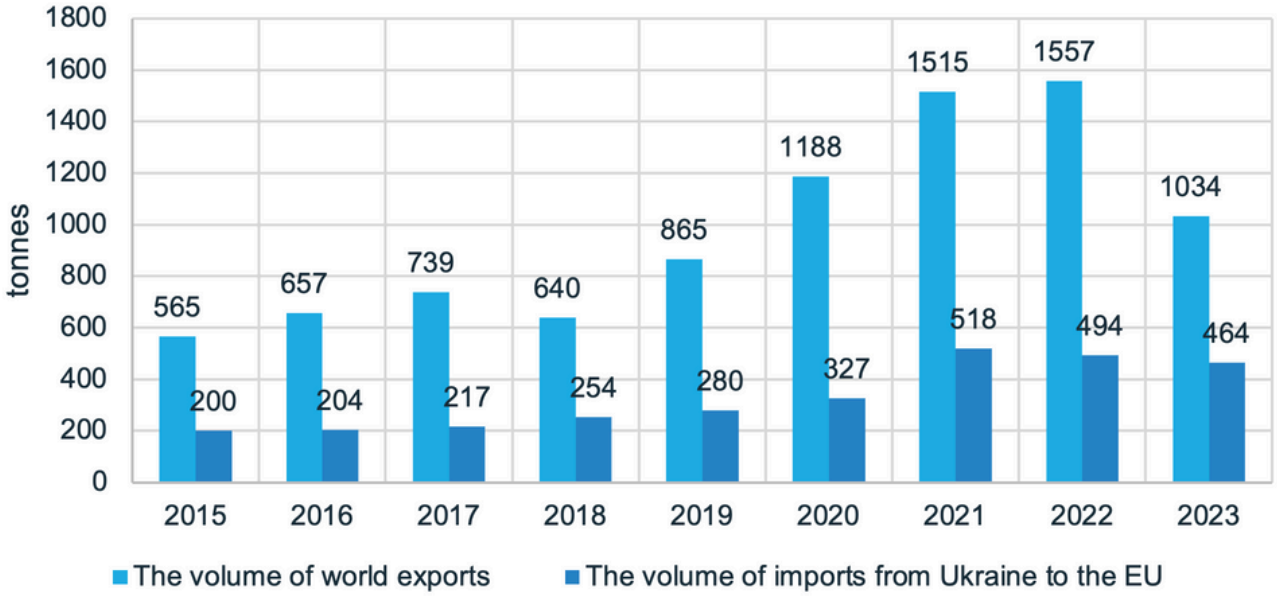
Source: calculated based on ITC Trade Map data.

3.3 HEMP YARN (HS 530820)

Overall, both the European and global markets for hemp yarn are promising and actively developing. It is projected that the global market will grow to USD 350 million by 2028, with an annual growth rate of 11.5% from 2022 to 2028 (Daily, 2024). Since 2017, import of hemp yarn to the European market has been gradually increasing. The highest import volumes were recorded in 2021 and 2022 – 518 and 494 tonnes, respectively (Figure 12). The main importers of this product in 2022–2023 were Italy and Spain, which are among the global leaders in the textile and apparel industries. In 2023, these two countries accounted for 28% of global and 62% of European imports.

In contrast to other types of hemp products and their derivatives, Ukraine does not export yarn, but imports it. Since 2020, the value of hemp yarn imports to Ukraine has increased from €31,000 to €47,000.

Figure 12. Development of the hemp yarn market



Source: calculated based on ITC Trade Map data.

INSET 2

Success story of Poland

Between 2014 and 2022, the area under industrial hemp cultivation in Poland increased from 107 ha to 6,190 ha (Scheibe, 2023). This development was driven by several factors, including the liberalisation of legislation, simplified access to EU markets, national support schemes for the sector, and funding within the framework of the CAP. In 2024, the Polish government provided support to the sector through subsidies for small farmers (up to 5 ha) in the amount of €225–1,125 per hectare, including for those cultivating hemp (Płatność, 2024). Since hemp is considered an environmentally friendly crop, the sector receives financial support under the Polish Rural Development Scheme and the CAP. The CAP Strategy for 2023–2027 allocates €0.5 million in subsidies for industrial hemp producers in Poland (Święcicki, 2022). Crowdfunding also has a positive impact on the development of the industrial hemp sector. For example, in 2023 the company "Kombinat Konopny" (Gronowo Górne, Poland) raised PLN 4.2 million in less than one day (Kombinat).

4. COMPETITIVE POSITIONS OF UKRAINE IN THE MARKETS FOR HEMP PRODUCTS AND THEIR DERIVATIVES

One of the sources of competitive advantages is the development of strong positions in niche markets. Niche markets involve trade relations that include the export of goods with a certain degree of uniqueness and a relatively exclusive target market abroad (El-Sayed, 2022; Nikmah, 2023). In other words, niche trade creates trade opportunities where limited competition naturally protects the market. This currently describes the market for hemp products and their derivatives.

Ukraine developed its comparative advantages in the global and European true hemp markets in 2022 by increasing the share of true hemp in the country's total export value. The key reasons for this include:

1. A 46% decline in the total export value of Ukraine following the full-scale invasion. According to formulas (1) and (2), a decrease in overall export value results in higher RCA and RSCA values. Therefore, the drop in total exports served as a factor enhancing Ukraine's comparative advantages in the raw or processed, but not spun hemp market. These changes are primarily explained by reduced exports across many product categories (including agricultural goods) due to military operations within the Ukraine. It is expected that these effects will be short-term and that the overall volume and value of exports will recover after the war ends. Thus, the decline in total export value is not a sustainable driver of advantage.
2. The export value oftrue hemp in 2022 and 2023 increased by 6.3 and 6.7 times, respectively, compared to the pre-war year of 2021. Export value served as a stimulating factor, the increase of which had a positive impact on Ukraine's comparative advantages in the global true hemp market.

Overall, further consolidation of Ukraine's comparative advantages in global and European markets is only possible through increasing, firstly, the export volume and, secondly, the export prices of domestic true hemp. The latter requires: (1) scaling up the production of agricultural raw materials (both through expansion of sown areas and higher industrial hemp yields per hectare); and (2) strengthening deep processing capacities for turning hemp straw into high value-added fibre. Since the development of the hemp sector significantly intensified after the full-scale invasion, it is expected that this process will accelerate even further after of Ukraine's accession to the EU, improvements in the investment climate, and reduction of internal war-related risks.

Figure 13. RSCA index of comparative advantage of Ukraine in the global market

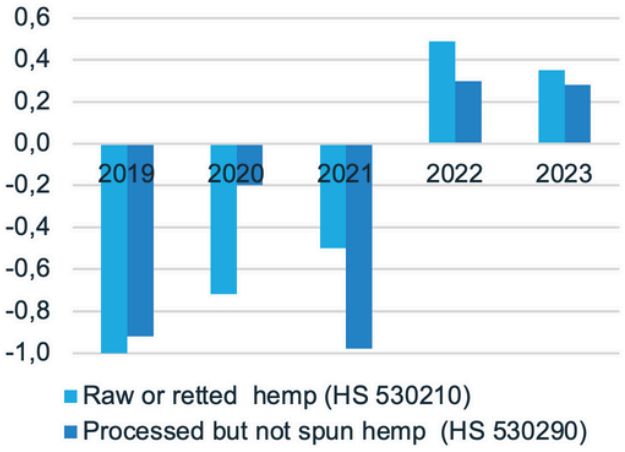
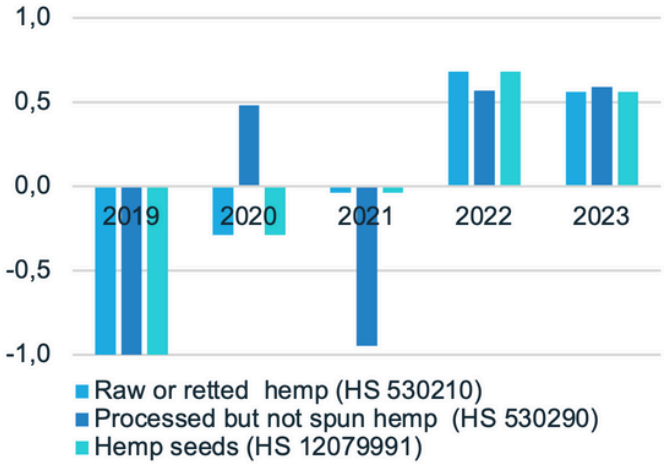


Figure 14. RSCA index of comparative advantage of Ukraine in the European market



Source: calculated based on ITC Trade Map, Eurostat.

An indicator of competitive advantage within the framework of price-based competition is the product price (Table 1). Prices for domestically produced true hemp are significantly lower than the average across European markets (Table 2). On one hand, this reflects the price advantage of Ukrainian true hemp exporters. According to interviews with domestic industry experts, European processors at times opt not to purchase raw or processed, but not spun hemp from national producers in favour of importing raw material from Ukraine due to the lower prices of Ukrainian products.

At the same time, interviewed experts noted that true hemp produced in Ukraine typically undergoes minimal processing. Therefore, the low prices of domestic true hemp are primarily due to the minimal and shallow depth of raw material processing. Additionally, the low price of Ukrainian true hemp on both the global and European markets is also determined by its type. Currently, domestic producers export short hemp fibre, which is used for further processing into textiles, nonwoven materials, paper products, composites, and environmentally friendly construction materials (Виробляємо, 2024). In contrast, another fibre type – long hemp fibre – used in the production of textiles, premium-quality apparel fabrics, and other industrial applications, is significantly more expensive. According to an interview with A. Mykytiv (Ma'Rijany Hemp Company), only a limited number of domestic hemp processors have the capacity to produce long fibre (notably, Ma'Rijany launched its own processing facilities only at the end of 2024). Overall, according to experts, Ukraine's hemp fibre exports can be described as "exporting raw material for further raw processing".

Despite the steady upward trend in prices for raw or retted and processed but not spun hemp of Ukrainian origin on European markets, the real prices for all types of exported products show a downward tendency (Table 3). In 2023, Ukraine ranked 9th in terms of pricing for this type of product. A negative trend is the decline in the price of processed but not spun hemp in 2023 compared to 2022 and 2021.

Table 2. Market share and prices across key competitors in the European market of hemp products, 2023

Exporter	Raw or retted hemp		Processed but not spun hemp		Hemp seeds	
	EU market share, %	price, €/tonne	EU market share, %	price, €/tonne	EU market share, %	price, €/tonne
Austria	0,30	2514	0,02	5394	2,02	2062
Lithuania	0,21	1689	1,38	1102	3,97	2820
United Kingdom	0,62	1239	0,06	1209	0,25	3920
Netherlands	71,46	1150	25,56	1121	22,87	3970
France	0,76	1084	68,31	472	32,66	1150
Poland	0,91	1001	0,04	1460	1,27	2344
Slovakia	0,21	886	–	–	0,04	7830
Belgium	1,11	878	0,28	2272	3,67	1690
Ukraine	1,56	749	0,47	744	0,25	1187
Romania	0,76	557	–	–	1,46	570
Germany	11,69	519	0,33	2143	7,25	4166
Hungary	1,68	41	0,03	1321	0,23	4261

Source: calculated based on ITC Trade Map, Eurostat.

Table 3. Dynamics of export prices for Ukraine's hemp products, €/tonne

Year	Hemp seeds		Raw or retted hemp		Processed but not spun hemp	
	nominal	real	nominal	real	nominal	real
2015	1094.87	1094.87	541.00	541.00	230.00	230.00
2016	1584.40	1409.61	829.00	829.00	191.00	191.00
2017	1056.14	826.41	485.00	379.50	–	–
2018	767.15	546.70	546.00	389.10	–	–
2019	810.22	554.66	–	–	–	–
2020	1027.13	669.66	1213.00	790.85	1314.00	856.69
2021	943.39	559.15	638.00	378.15	845.00	500.84
2022	1071.22	501.51	719.00	336.61	1099.00	514.52
2023	1187.32	528.90	720.00	320.73	744.00	331.42
Deviation in 2023 relative to 2015, %	8.44		33.09		223.48	
Deviation in 2023 relative to 2021, %	25.86		12.85		-11.95	

Note: real prices calculated by adjusting nominal prices to 2015 price levels.
Source: calculated based on data from ITC Trade Map, Eurostat, and inflation rate data (Index, 2025).

Similar to its position in the hemp fibre market, Ukraine has held comparative advantages in the European hemp seed market since 2022 (Appendix D, Table D.3). These advantages were formed due to a reduction in Ukraine's total export value, rather than through an increase in the value of hemp seeds exported to the EU. As for seed prices, they have shown a steady upward trend since 2018 (Table 3), but remain among the lowest in the EU (Table 2). Between 2021 and 2023, prices for Ukrainian hemp seeds on the European market increased by 26%, which does not compensate for the cumulative inflation index over this period.

5. EFFICIENCY AND PROSPECTS OF INDUSTRIAL HEMP CULTIVATION

5.1 PRODUCTION COST OF HEMP PRODUCTS

The value of initial investments in fixed assets required to begin cultivating industrial hemp primarily depend on the machinery already available at the enterprise. According to cultivation technology plans for industrial hemp, the majority of technological operations involved in hemp cultivation do not differ from those used in other crop production sectors. Therefore, most machinery used in hemp farming is standard for the majority of crop production activities (in particular: harrows, ploughs, loaders, mineral fertilizer spreaders, seed treaters, seeders, sprayers, tractors, etc.). According to interviews with enterprise managers and production unit heads, additional investments are mainly needed for purchasing specialized equipment for harvesting and turning the hemp straw. Moreover, unlike most agricultural crops (with the exception of sugar beet), hemp cultivation requires exceptionally careful pre-sowing land preparation (subgrading).

In this study, production costs for industrial hemp were calculated based on a cultivation area of 100 hectares, across three cultivation technologies (with seeding rates of 15, 45, and 75 kg/ha), using Formula (3) (Table 4). The first two technologies involve growing industrial hemp for both seeds and hemp straw, while the third is intended exclusively for retted hemp straw production. Overall, per-hectare production costs in 2024 increased by 41–52%, depending on the chosen technology.

Table 4. Production costs of industrial hemp cultivation, UAH per hectare *

Cost	2021			2024		
	seeding rate, kg/ha			seeding rate, kg/ha		
	15	45	75	15	45	75
Wages	943.24	952.93	927.87	1160,91	1172,84	1141,99
Diesel fuel	3432.11	3432.11	3507.43	5728,78	5728,78	5854,51
Mineral fertilizers	5032.44	7069.38	9046.41	8400,00	11800,00	15100,00
Seeds	1078.38	4275.00	4875.00	1980,00	4680,00	5400,00
Plant protection products	795.62	808.32	601.50	1328,03	1349,22	1004,01
Electricity	259.36	259.36	259.36	638,02	638,02	638,02
Land lease	2400.00	2400.00	2400.00	2400,00	2400,00	2400,00
Direct costs, total	**13941.16**	**19197.11**	**21617.57**	**21635,74**	**27768,87**	**31538,53**
incl. VAT	1951.76	2687.60	4323.51	3029,00	3887,64	4415,39
Overhead costs, 10%	1394.12	1919.71	2161.76	2163,57	2776,89	3133,34
Total cost per hectare	**17287.04**	**23804.41**	**28102.85**	**23799,32**	**30545,76**	**34692,38**

*Note: * – excluding depreciation; costs for fertilizers, plant protection products, fuel, and electricity in 2021 were determined by adjusting prices in 2024 to 2021 levels based on the cumulative inflation index for 2022–2024; the minimum wage in January 2021 was UAH 6,500.*
Source: calculated based on cultivation technology pans for industrial hemp using dual-purpose technology, developed by the Institute of Bast Crops of NAAS of Ukraine.

5.2 EFFICIENCY OF INDUSTRIAL HEMP CULTIVATION

DOMESTIC DEMAND

Industry experts emphasize that the potential profitability of industrial hemp cultivation can reach up to 180% (Грузинська, 2020). However, under current conditions, it is very difficult – and in some cases impossible – for domestic producers to achieve this level of efficiency. A key issue hindering the development of industrial hemp cultivation in Ukraine and limiting its efficiency is insufficient demand for the respective products on domestic markets. According to interview findings, despite the fact that industrial hemp cultivation is a zero-waste process, the primary output of the sector at present is hemp seeds, as both external and internal markets have already been established for this product. Nevertheless, some hemp producers noted that the domestic market for seeds remains limited, and a significant expansion of sown areas would lead to an oversupply of this product type.

In addition, market experts highlight the existence of a “closed loop” problem in the hemp fibre production sector. On one hand, agricultural producers are reluctant to grow hemp due to insufficient processing capacities for fibre and, consequently, limited market demand. On the other hand, according to industry experts, potential investors are unwilling to build processing plants due to the lack of raw material supply (Гордійчук, 2024). As of now, three plants processing hemp into fibre are operating in Ukraine. As of October 2024, the total annual capacity of the functioning facilities exceeds 900 tonnes of fibre per year, including:

- Linen of Desna – annual capacity of 500 tonnes of fibre (Про компанію, 2024);
- Ukrainian Hemp – annual capacity of approximately 400 tonnes (based on a processing capacity of 1 tonne of hemp straw per hour (Гордійчук, 2024), a fibre yield of 20%, 262 working days per year, and 8 working hours per day) ;
- Calipso Hemp LLC.

In addition, two officially registered industrial parks in Ukraine purchased modern equipment for industrial hemp processing in 2024:

- Ma’Rijany Hemp Company – annual capacity of 3–5 thousand tonnes;
- Hempy UA – annual capacity of 2–4 thousand tonnes (based on a processing capacity of 1 tonne of hemp straw per hour (Гордійчук, 2024), a fibre yield of 20%, 262 working days per year, and 8 working hours per day).

According to interviews conducted with agricultural producers of industrial hemp, the limited domestic processing capacity restricts opportunities for selling retted hemp straw. In particular, in some farms, retted hemp from previous years remains unsold. There is a practice of burning it for internal heating purposes due to the inability to sell it on the domestic market. One agricultural producer, after selecting an optimal land plot, testing the technology, and successfully cultivating industrial hemp for three years, abandoned hemp cultivation. This decision was primarily driven by the difficulty in selling retted hemp straw, as well as the nearly identical economic efficiency of cultivating hemp seeds compared to grain and oilseed crops (see section below). Due to the risks associated with market access and the complexity of regulatory procedures, the farm chose to return to traditional agricultural crops. In cases where the economic efficiency of industrial hemp and traditional crops is comparable, several factors may favour the latter: (i) the high cost of specialized machinery for harvesting and turning hemp straw, which is essential for the crop cultivation and currently not produced in Ukraine (Михайлова, 2019); (ii) the regulation of industrial hemp cultivation, which requires expert testing of hemp samples for THC content during the flowering period and before harvesting, conducted by certified forensic laboratories (Про внесення, 2023), of which only two are currently operating in Ukraine.

EFFICIENCY OF HEMP CULTIVATION

Table 5 presents the economic efficiency of industrial hemp cultivation, assessed using formulas (4) and (5). The profitability level of hemp seed production may range from 58% to 142%. As for retted hemp straw, as previously noted, domestic market demand remains limited. Therefore, in the absence of in-house processing facilities or established partnerships with fibre processing plants, cultivating industrial hemp for fibre is considered high-risk.

Table 5. Efficiency of industrial hemp cultivation (domestic market)

Cost	Seeding rate, kg/ha	
	15	45
Seed yield, t/ha	0,70	0,90
Yield of retted hemp straw, t/ha	3,00	4,60
Production cost of hemp seeds, UAH/t	33999,00	33940,00
Production cost of retted hemp, UAH/t	8858,00	8858,00
Price of hemp seeds, UAH/t	60000,00	60000,00
Income from seed production, UAH/ha	42000	54000,00
Profit from seed production, UAH/t	26001,00	26060,00
Profitability level of seed production, %	76,48	159,10

Source: calculated based on cultivation technology plans for industrial hemp using dual-purpose technology, developed by the Institute of Bast Crops of NAAS of Ukraine.

Thus, the development of the domestic market for agricultural hemp products requires the launch of new processing lines for converting retted hemp straw into fibre and the expansion of processing capacities within Ukraine. The key resources required for organising retted hemp straw processing are capital (primarily for investment in processing facilities and specialised machinery that ensures minimal crop losses (Мохер, 2020) and land. According to market experts, it is necessary to meet the demand for land resources not only for hemp cultivation itself, but also to maintain proper crop rotation (at least three agricultural crops), and to plan processing facilities with consideration of the surrounding land (Кошкіна, 2024). According to representatives of Ma'Rijany Hemp Company, achieving high yield levels is only possible if specialised equipment is acquired for producing each type of product (primarily seeds and fibre), which is currently not manufactured in Ukraine. As noted by some interviewed experts, additional investments in specialised harvesting and turning machinery are not economically justified, since similar profits can be obtained from cultivating other crops without additional financial inputs. However, according to the authors' team led by І. Грузинська, a high level of profitability can be achieved if all types of agricultural products from industrial hemp (primarily seeds and retted hemp straw) are produced and sold (Грузинська, 2020).

INSET 1

Success Story Ma'Rijany Hemp Company

Ma'Rijany Hemp Company is one of the leading enterprises in Ukraine's hemp sector. In 2023, it accounted for approximately one-third of the total area sown with industrial hemp in Ukraine. In 2024, the company acquired the necessary processing equipment and began constructing the first phase of a facility for primary processing of retted hemp straw into long fibre, short fibre, and hemp shives, along with purchasing specialised machinery for harvesting and turning hemp straw. According to Andrii Mykytiv, founder of Ma'Rijany Hemp Company and co-founder of K-Tex, the company's key success factors include: (i) the organisation of operations based on vertical integration, currently covering the cultivation of industrial hemp and primary processing, with plans for further movement along the product value chain. This allows the company not only to process its own raw materials but also those of other producers, thereby generating higher value-added products; (ii) the ability to form a team of experts with substantial practical experience and deep understanding of all stages and operations within the supply chain; (iii) a thoroughly developed business plan and financial model, which enabled the company to attract the necessary investment capital for importing specialised agricultural machinery and building the processing facility.

5.3 ASSESSMENT OF INVESTMENT ATTRACTIVENESS IN INDUSTRIAL HEMP FBRE PRODUCTION

Given the relevance of developing industrial hemp production and processing, this study includes an assessment of the investment attractiveness of establishing primary processing of retted hemp straw into coarse fibre based on the principles of vertical integration. The product value chain includes the following stages: selective cultivation of planting material, cultivation of industrial hemp for dry biomass, and the production of coarse fibre and hemp shives. A key feature of business operations based on vertical integration is close cooperation between participants and the generation of added value through the production capacities of enterprises within the vertically integrated structure.

To assess the investment attractiveness, formulas (6)–(11) were applied. The evaluation of investment attractiveness for industrial hemp cultivation and processing was conducted based on a cultivation area of 10,000 hectares of industrial hemp with subsequent processing. The assessment of the potential investment attractiveness of production and primary processing of industrial hemp on the basis of vertical integration is based on data from cultivation technology plans and expert interview findings. Specifically, the investment attractiveness evaluation relies on the following assumptions:

1. production of planting material: seed yield is 0.8 t/ha; the seeding rate for cultivating industrial hemp for fibre is 0.08 t/ha; the cost of producing selective industrial hemp seed is USD 1 600/ha; the price of selective seed is USD 3,700/t. The required volume of planting

material for cultivating industrial hemp on an area of 10 000 hectares will amount to tonnes, and the area needed for producing planting material will be hectares; fixed costs amount to USD 333 000;
2. cultivation of industrial hemp for biomass: the yield of industrial hemp (dried retted hemp straw) is 6 t/ha; the cost of cultivating industrial hemp is USD 950/ha (this includes the cost per hectare according to the cultivation technology plans for industrial hemp, as well as 25% for unforeseen expenses); the price of dried retted hemp straw is USD 350/t;
3. production of coarse fibre and hemp shives: operating costs for processing retted hemp amount to USD 300/t; the share of fibre in dry retted hemp straw is 26%; the share of hemp shives in dry retted hemp straw is 65%; the price of coarse fibre is USD 3,750/t, and the price of hemp shives is USD 300/t; fixed costs for processing retted hemp straw amount to USD 3.5 million; annual depreciation charges total USD 4.8 million.

Table 6. Assessment of investment attractiveness in coarse hemp fibre production based on vertical integration

Indicator	Production of planting material	Biomass production	Production of coarse fibre and hemp shives	Overall within the value chain
Total capital investment, USD	2 500 000	50 000 000	72 000 000	124 500 000
Production costs, USD	1 933 333	9 500 000	18 000 000	29 433 333
Revenue, USD	2 960 000	21 000 000	60 450 000	84 410 000
Profit, USD	1 026 667	11 500 000	48 700 000	51 476 667
Profitability level, %	53,10	121,05	216,00	174,89
Payback period	2 years and 5 months	4 years and 4 months	2 years	3 years

Source: calculated based on expert interview results and data from cultivation technology plans for industrial hemp cultivation.

According to expert interviews in the field of hemp fibre processing, the development of the sector is hindered by a reluctance to invest significant funds in the absence of successful examples of industrial hemp cultivation and processing. High profitability levels in both the agricultural and processing sectors are not, by themselves, sufficient to stimulate large-scale capital investments. Therefore, it is crucial to create incentive conditions during the business start-up phase. This is especially relevant for processing, which is the most capital-intensive stage. As for agricultural producers, their support is justified similarly to other branches of Ukraine's agricultural sector.

Another area for launching and stimulating the development of industrial hemp cultivation is the establishment of domestic production of specialised machinery in Ukraine and the inclusion of relevant manufacturers and equipment in the official list approved by the Ministry of Economy of Ukraine.

5.4 SUPPORT FOR INDUSTRIAL HEMP PRODUCERS

Two industrial parks in Ukraine currently specialise in the production and processing of industrial hemp (Ma'Rijany Hemp Company and Hempy UA). According to current legislation, imports of new equipment (machinery) and related components carried out within the framework of industrial park activities are exempt from value-added tax (VAT) (Про внесення змін, 2022). However, a key issue lies in the lack of clearly defined mechanisms for implementing this legal provision in practice – particularly in cases where equipment and components constitute a complex production unit (i.e., an integrated processing line) but are delivered in multiple shipments. For example, while implementing an investment project within an industrial park, Ma'Rijany encountered significant delays and unpredictability in the customs clearance process for technical documentation required to import equipment under the VAT exemption. Consultations with customs authorities lasted 3.5 months. As a result, the prolonged approval process entirely neutralise the benefits of the VAT exemption and significantly delayed the commissioning of the processing line. Due to these procedural delays, the project team concluded that, from a practical standpoint, it would have been more efficient not to register an industrial park and instead import the equipment under the standard customs regime. In other words, to ensure that declared benefits of industrial park operations are realised in practice, there is a need for further formalisation and simplification of customs procedures.

An additional source of partial cost coverage for the purchase of expensive specialised agricultural machinery is financial support for agricultural producers. Recognising the hemp sector as strategically important for the country and approving relevant development programmes would create the legal basis for a special regime of state support for agricultural producers of industrial hemp. This approach to stimulating the development of hemp cultivation has already been implemented in France, Germany, Italy, Poland, Spain, the Czech Republic, the Netherlands, and others. In Poland and Romania, subsidies granted after EU accession were among the key drivers of the sector's growth. In the case of minimum direct support as declared in the EU – €200/ha (Income), the production costs per hectare would be reduced by approximately 22–33%, depending on the cultivation technology used. Under such conditions, for example, a farm with 1,000 hectares of industrial hemp would receive an additional €200 000, which could be invested in the purchase of specialised agricultural machinery.

One of the positive effects of industrial hemp cultivation is its ability to absorb carbon dioxide. Based on scientific research findings, cultivating industrial hemp on 1 hectare with a yield of 6 tonnes per hectare can ensure carbon sequestration ranging from 3 tonnes (Dhondt, 2021) to 8.22–9.6 tonnes (Jensen, 2022). Managers of one Ukrainian company operating in the hemp sector noted during interviews that, according to their preliminary estimates, if an industrial

hemp producer enters the carbon credit market, they could earn up to €300 per hectare in additional income. In the case of receiving an additional €200 per hectare in subsidies, a producer with 800 hectares under hemp cultivation would obtain €400 000. This represents 34% of the total cost of harvesting equipment (1 mower priced at approximately €800 000) and turning equipment (3 turners with a combined cost of €360 000).

Additional revenues generated through support mechanisms and the sale of carbon credits will contribute to forming price competitive advantages for Ukrainian producers not only on the European and global hemp product markets, but also more broadly across the whole textile market. Currently, one of the main factors constraining the development of the natural textile market is the high cost of such products compared to synthetic fibres (Gschwandtner, 2022).

5.5 SHORTAGE OF INDUSTRIAL HEMP PLANTING MATERIAL

One of the main factors that, according to interviewed experts, may hinder the development of the domestic hemp sector is the shortage of industrial hemp Ukrainian planting material. The primary producer of hemp seed material in Ukraine for many years has been, and remains, the Institute of Bast Crops of the National Academy of Agrarian Sciences of Ukraine. It was at this institute that the first monoecious, high-yielding industrial hemp varieties completely free of psychoactive compounds (THC) were developed. Today, new hemp seed producers are entering the market, operating under licenses from the Institute, alongside enterprises that are developing their hemp in-house breeding based on the Institute's methodologies. Out of the 21 industrial hemp varieties in the national register, 13 belong directly to the Institute, while the others were developed with the involvement of the Institute's scientific expertise.

During interviews, representatives of the Institute of Bast Crops emphasised the issue of delayed and insufficient wage payments, which has resulted in the loss of some highly qualified specialists. The lack of funding has also made it impossible to maintain the institute's material and technical base in proper condition. Under such circumstances, scientific advancement in the field of breeding and production of hemp planting material is significantly constrained.

There is a possibility of partially substituting domestically produced hemp seed with imported varieties. However, one of the barriers to using foreign industrial hemp seeds is the requirement to register these varieties in the state register of plant varieties of Ukraine. To stimulate industrial hemp production, it is important to simplify this procedure as much as possible (particularly for varieties already listed in the common catalogue of varieties of agricultural plant species of the European Union) and ensure that the registration process is as short as possible. Moreover, according to experts from the Institute of Bast Crops, even when using imported seed, there is a risk that the basic characteristics of these varieties may diverge from legal norms during acclimatization – primarily regarding THC content. As noted by the Institute's specialists, the biological properties of hemp – its tendency to revert to its "original characteristics" – necessitate comprehensive breeding and seed production efforts. This complicates seed production and requires strict adherence to appropriate methodological protocols.

Given the above, in case of a significant expansion of industrial hemp cultivation areas, it is crucial to revitalise domestic breeding and increase the volume of domestic production of industrial hemp seeds. Entering external markets for planting material is also considered a promising direction. France serves as the most prominent example of a country that has established and maintained strong competitive positions on the global industrial hemp seed market. The development of domestic breeding in France – and, as a result, the ability to produce seed material tailored to the technical needs of specific markets (including those in the Southern Hemisphere) – enabled the country to build and sustain its leadership position (InterChanvre, 2017).

5.6 PROSPECTS FOR THE DEVELOPMENT OF THE INDUSTRIAL HEMP PRODUCTION AND PROCESSING SECTOR

The strengths and weaknesses, as well as the potential opportunities and risks of the Ukrainian hemp sector, are presented in Table 7. Based on the results of the SWOT analysis, the primary focus of industrial hemp producers and processors, as well as government institutions, should be directed toward addressing the following key issues:

1. shortage of processing capacities;
2. deficit of planting material;
3. challenges in the implementation of current legislation related to tax incentives for industrial parks.

All other factors constraining the development of the sector, as described above, are largely consequences of these three core issues.

Table 7. SWOT Analysis of the Industrial Hemp Sector

Strengths	Weaknesses
• Extensive areas of agricultural land suitable for industrial hemp cultivation (especially in regions with soils less fertile for traditional agricultural crops) • Potentially high profitability (provided that product sales and zero-waste agricultural production are ensured) • Long-standing history and practical experience in the breeding and production of planting material for industrial hemp cultivation	• Limited production volume of seed material • Lack of processing facilities for producing deeply processed fibre with maximum price and added value • Difficulty in selling retted hemp straw due to insufficient processing capacity • Low prices on foreign markets resulting from minimal fibre processing depth and the type of exported fibre • Ineffectiveness of mechanisms for implementing tax incentives provided for industrial parks • Requirement to register EU-licensed planting material in Ukraine
Opportunities	**Threats**
• Formation of local closed-loop supply chains from seed production to the manufacture and sale of high value-added, deeply processed industrial hemp products • Development of alternative processing sectors (e.g., pellets for heating, gunpowder, construction materials) for which stable demand is expected • Carbon credits • Development of organic hemp cultivation • Establishment of strong competitive positions on global and European markets for products with maximum added value (in the case of building processing facilities)	• Potential losses due to military actions • Risk of underutilisation of land resources resulting from limited seed production • Lack of opportunity to diversify planting material suppliers • According to industry experts, there is a risk of pressure from law enforcement agencies [Козаченко, 2023], despite the deregulation and legalisation of industrial hemp cultivation in Ukraine (as observed in other countries that underwent deregulation, such as the USA, Croatia, and Spain)

Source: authors' research, results of interviews with hemp industry experts (agricultural producers, seed material producers, researchers, processors).

Based on the results of the presented SWOT analysis and the opinions of experts interviewed within this study, the following directions for sector development have been identified:

VERTICAL INTEGRATION

Deepening cooperation among all participants of the supply chain with a focus on the production and export of products with maximum added value. According to the experts interviewed, close collaboration between producers (both agricultural and manufacturing) and seed producers on a contractual basis is particularly relevant.

DEVELOPMENT OF PROCESSING CAPACITIES

Establishing domestic markets is an essential condition for the development of the hemp production. In addition to traditional deep processing and the production of high-quality hemp fibre with high added value, it is important to stimulate the construction of facilities for processing industrial hemp into products that are in growing demand amid wartime conditions, high energy prices, and trends toward environmentally conscious living. Examples of such products include heating pellets, gunpowder, and construction materials.

According to experts, given the substantial increase in demand for ammunition and the shortage of gunpowder, cultivating hemp for further processing into gunpowder appears to be a promising direction (Павлиш У Мінагрополітики, 2024; Павлиш Рада, 2024). Currently, the potential construction of gunpowder production plants in Ukraine is already under consideration, and discussions are ongoing regarding areas and mechanisms of state support for cotton producers with the aim of processing it into gunpowder. According to the Minister of Agrarian Policy and Food of Ukraine, Vitalii Koval, state programmes to finance producers of this crop are expected to be launched in 2025 (Коваль, 2024).

Considering that hemp is a viable alternative to cotton and is well-adapted to Ukraine's agro-climatic, landscape, and other conditions, it would be logical to extend support to industrial hemp producers who direct their output toward strategically important gunpowder production.

FINANCIAL SUPPORT

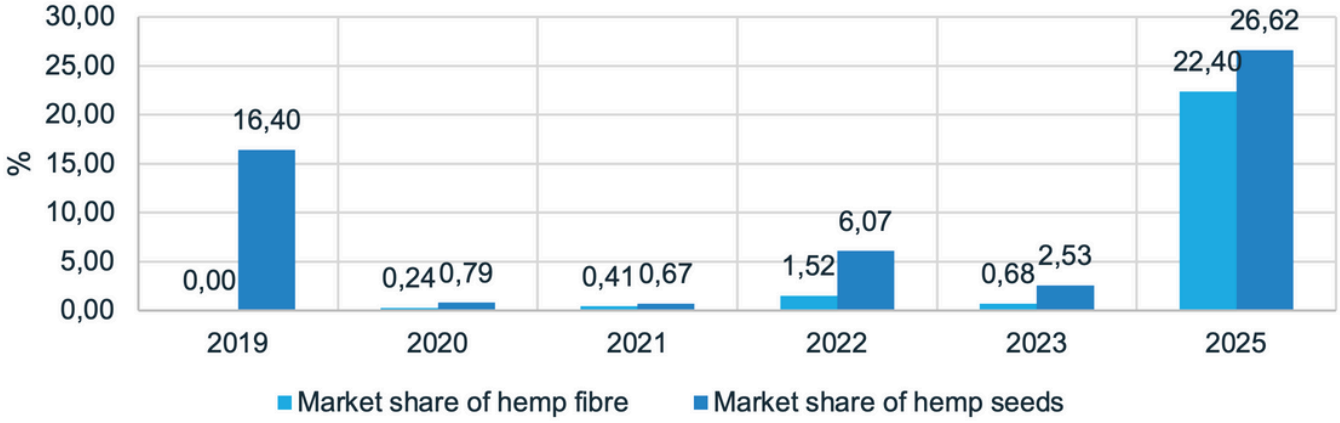
Sources of funding: (1) tax incentives for business start-up (in particular, for the import of equipment by industrial parks, provided that procedural issues related to importing processing facilities with the customs service are resolved, and tax holidays during the launch of processing facilities); (2) access to low-interest loans (stimulating commercial banks to provide loans to producers and processors of industrial hemp, and partial compensation of interest rates for agricultural producers); (3) international grants and project-based funding. An additional priority is ensuring full-scale financing for the work of breeding researchers. According to expert interviews, including with representatives of the Ukrainian Hemp Association, it is essential to establish formal breeding orders (particularly, public orders) for the development of new varieties.

REGULATORY FRAMEWORK HARMONISATION

Clarification of the legislative provisions that deregulate industrial hemp cultivation should be provided to law enforcement agencies in order to eliminate the expert-identified risk of unwarranted oversight and penalties.

According to estimates by the Ministry of Agrarian Policy and Food of Ukraine, the sown area of industrial hemp in 2025 amounts to 8 000 hectares (Бриль, 2024). Figure 14 shows the potential increase in Ukraine's share of the hemp seed and fibre markets, assuming the entire volume of additionally produced goods is exported to European markets. The projections are based on two assumptions. First, that all additionally produced hemp seed will be exported. Second, that the retted hemp straw obtained from the expanded cultivation area will be processed into fibre and subsequently exported.

Figure 14. Hypothetical potential increase in Ukraine's share of the European market for key industrial hemp products in 2025



Note: based on the assumption by the Ministry of Agrarian Policy and Food of Ukraine regarding the sown area of industrial hemp in 2025 (8 000 ha), a fibre yield of 2.275 tonnes per hectare (derived from 6.5 tonnes per hectare of retted hemp straw with a fibre yield rate of 35%), and a seed yield of 0.9 tonnes per hectare.
Source: calculated based on ITC Trade Map data.

The presented projections are optimistic and assumes a significant expansion of industrial hemp cultivation areas, which, according to industry experts involved in this study, is currently not supported by volumes of planting material. The results obtained provide grounds to anticipate a substantial increase in Ukraine's market share on European hemp seed and fibre markets, provided that the challenges outlined in the study are addressed. Moreover, in the long term, the fibre exported to the EU could be sold at significantly higher prices if a network of processing facilities is established and processing is deepened.

CONCLUSIONS

1. The global and European markets for industrial hemp products – particularly hemp seed and fibre – are characterised by a stable growth trend. At present, hemp-based products are used across a wide range of industries, including textiles, construction, medicine, chemicals, pulp and paper, and defence.
2. Despite the high level of regulatory oversight over industrial hemp cultivation, the Ukrainian hemp sector began to recover in 2017. As a result, there was a gradual expansion of sown areas and an increase in the export volumes of hemp seeds and fibre. Following the full-scale invasion of Ukraine by the Russian Federation, new facilities for processing retted hemp straw into hemp fibre were launched. This reflects the commitment of Ukrainian producers to develop industrial hemp production and processing.
3. Ukraine holds comparative advantages on the global and European markets for industrial hemp products. To strengthen these advantages, it is advisable to implement regulatory mechanisms that stimulate the development of industrial hemp production and processing.
4. The main driver of domestic industrial hemp production and processing is the sector's high profitability. However, due to limited domestic demand for retted hemp straw – caused by insufficient processing capacity – some agricultural producers have abandoned hemp cultivation. As a result, industrial hemp in Ukraine is currently grown primarily for seeds rather than for fibre production. At present, three processing plants operate in Ukraine, but their capacities are insufficient to process the potential future volumes of retted hemp straw. One of the key reasons for the shortage of processing capacity is the high cost of equipment. In addition, the efficient cultivation of industrial hemp requires substantial capital investment in specialised agricultural machinery.
5. Another factor that may potentially limit the future development of the domestic hemp sector is the shortage of planting material. Experts emphasise that the potential expansion of industrial hemp cultivation areas – even if sufficient processing capacity is established – is currently unrealistic due to the loss of seed production capacity and limited ability to develop new varieties. Importing seeds from European countries is also not a viable alternative, particularly due to the biological characteristics of the crop and the requirement to register foreign varieties.
6. According to industry experts consulted in this study, there is a risk that law enforcement authorities may inadequately implement the new legislative provisions that deregulate and legalise industrial hemp cultivation. The realism of such concerns among agricultural producers is supported by negative experiences in other countries that faced the problem of incorrect classification of industrial hemp by the police after the legalization of industrial hemp production (for example, the USA, Croatia, Spain, etc.).

RECOMMENDATIONS

1. Implement state support and regulatory mechanisms such as tax incentives, partial interest rate compensation on loans, and incentives for banks to finance equipment purchases and the construction of processing facilities. These measures will encourage agricultural producers and processors to invest in the establishment of processing capacities, thereby stimulating domestic demand for industrial hemp products. Such support is critically important during the launch phase of both industrial hemp cultivation and processing. Given the high profitability of the sector, businesses will subsequently be able to ensure expanded reproduction and scale their operations through reinvestment.
2. Strengthen cooperation among all participants in the production process – from breeders and seed stations to end-product manufacturers – particularly through vertical integration. This cooperation can be based on contractual agreements, which are essential for coordinated actions, supply chain stability, and the effective development of the sector.
3. Simplify or eliminate the procedures for registering industrial hemp varieties in the state register of plant varieties of Ukraine.
4. Introduce a system for the operation of industrial hemp breeders that ensures full-scale funding and enables their effective performance. Establish tripartite relationships between agricultural producers cultivating industrial hemp, the breeding institute, and seed stations. This will allow seed producers to access working capital and ensure maximum alignment between seed supply and demand.
5. Provide state support to agricultural producers of industrial hemp when their output can be used in the production of strategically important products for the country (e.g., gunpowder).
6. Conduct preventive awareness-raising activities among law enforcement officers to clarify the differences between industrial hemp and products subject to special control under narcotics regulations.
7. Regularize the procedures for approving technical documentation required for the import of processing equipment under the zero VAT rate. This is particularly important given the potential of registering industrial parks for the construction of processing facilities.

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APPENDICES

APPENDIX A

Comparative analysis of the regulatory frameworks of Ukraine and the EU governing hemp production

Regulatory Area	Legislation of Ukraine	Legislation of the EU	Differences
Seed certification	Law of Ukraine "On seeds and planting material"	Regulation (EU) No 1308/2013	All varieties in Ukraine undergo inspection and state registration. In the EU, certified seed from approved suppliers in other Member States may be registered without additional verification.
THC restrictions	Law of Ukraine “On narcotic drugs, psychotropic substances and precursors”, Vidomosti Verkhovnoi Rady Ukrainy (VVR), 1995, No. 10, Article 60 Cabinet of Ministers of Ukraine Resolution No. 770 of 6 May 2000 “On the approval of the list of narcotic drugs, psychotropic substances and precursors”	Regulation (EU) No 1307/2013, Regulation (EU) No 1308/2013,Regulation (EU) 2021/2115	In Ukraine, the permissible THC level for industrial hemp is 0.3% (according to the Law of Ukraine "On narcotic drugs, psychotropic substances and precursors"). However, Cabinet of Ministers Resolution No. 770 of 6 May 2000 "On the approval of the list of narcotic drugs, psychotropic substances and precursors" sets the THC limit in dried hemp straw at 0.2%. As of 16 February 2027, the maximum allowable THC concentration in dried hemp straw for industrial purposes must not exceed 0.3%.
Licensing of production	Law of Ukraine “On licensing of types of economic activities” (Edition as of 2 September 2024)	Regulation (EU) No 1307/2013,Common Agricultural Policy	In the EU, regulatory documentation clearly defines and outlines requirements for all stages of the industrial hemp product value chains – from land plot and seed requirements to finished products, including labelling, packaging, and more – with the aim of ensuring transparency across all business processes and the traceability of raw materials. Obtaining the appropriate licences is a necessary condition for receiving state support. Ukrainian legislation defines a general procedure for licensing business activities without distinguishing the specific features of licensing activities related to the production, processing, or sale of hemp products. Within the legally regulated licensing procedures, there is no provision for tracing the origin of goods.

Environmental standards (pesticide use)	Law of Ukraine “On environmental protection”Law of Ukraine “On pesticides and agrochemicals”Law of Ukraine “On seeds and planting material”Law of Ukraine “On basic principles and requirements for organic production, circulation and labelling of organic products”	Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides	The systems share similar objectives but differ in the mechanisms used to achieve them.In the EU, compliance with requirements concerning the types and quantities of pesticides used is a condition for receiving state support; certification and training of operators working with pesticides are mandatory.Ukrainian legislation does not establish requirements for the certification and training of operators who work with pesticides.
Tax benefits and subsidies	Tax Code of UkraineLaw of Ukraine “On state support of agriculture of Ukraine”	Common Agricultural PolicyRegulation (EU) 2021/2115	In Ukraine, the focus is placed on state support for the agricultural sector as a whole. In the EU, relevant processes are regulated under the provisions of the Common Agricultural Policy.In some EU Member States, hemp cultivation is legally recognised as a strategically important sector, which provides for a special regime of state support. Eligibility for such support requires compliance with environmental standards, product quality standards, business operation requirements, and proof of product origin.
Product quality control	Law of Ukraine “On seeds and planting material”State Standards	Regulation (EU) № 1307/2013,	The EU operates a comprehensive system of regulations that sets clear quality and safety standards which all producers must meet. Requirements for hemp products are governed by general EU regulations as well as national standards of the Member States. In Ukraine, product quality is primarily regulated by state technical specifications, compliance with which is not a mandatory requirement for producers.
Taxation of activities	Tax Code of UkraineLaw of Ukraine “On state support of agriculture of Ukraine”	Directive 2006/112/ECDirective 2011/16/ECRegulation (EU) 2017/1128	In Ukraine, tax rates are higher or equal, but with a limited number of exemptions. In the EU, there is a more flexible system with the possibility of discounts for agricultural producers. Access to preferential taxation is only possible if environmental standards, product quality standards, business operation requirements, and product origin verification are adhered to.

APPENDIX B

Leading countries by export volume of raw or retted true hemp on the global market

Country	Export volume, tonnes					Rank by export volume				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Netherlands	6782	10195	8930	12163	7963	1	1	1	1	1
Germany	224	331	331	81	1257	4	5	5	9	2
Romania	1292	2263	2148	964	827	2	2	2	2	3
USA	108	597	981	474	499	6	3	3	3	4
France	0	0	429	201	297	24	26	4	6	5
Hungary	2	7	4	18	288	19	20	26	19	6
Nepal	10	4	4	1	193	14	21	26	26	7
Ukraine	**0**	**13**	**69**	**283**	**167**	**24**	**14**	**12**	**4**	**8 ↓**
Belgium	429	522	229	129	154	3	4	6	7	9
Russia	0	36	192	262	127	24	11	8	5	10
Spain	217	36	76	62	110	5	11	11	11	11
Canada	81	58	209	93	108	8	10	7	8	12
Poland	34	86	62	74	99	10	8	13	10	13
United Kingdom	3	8	16	8	75	18	19	16	22	14
Austria	108	123	98	35	64	6	7	10	13	15
China	5	10	15	60	62	16	18	18	12	16
Italy	28	76	190	31	59	11	9	9	16	17
Czech Republic	0	24	27	23	25	24	13	14	17	18
Lithuania	52	12	7	35	23	9	16	21	13	19
Slovakia	0	0	0	1	23	24	26	35	26	19

Примітка: волокно необроблене або вимочене (HS 530210).

APPENDIX C

Leading countries by export volume of processed but not spun hemp on the global market

Country	Export volume, tonnes					Rank by export volume				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
France	0	0	0	0	42709	31	30	34	28	1
Netherlands	3445	939	3327	7308	11820	1	2	1	1	2
Canada	63	84	86	480	2111	8	10	10	5	3
Belgium	189	412	898	946	1904	5	3	3	2	4
Lithuania	371	1296	1292	521	646	3	1	2	4	5
USA	38	291	59	115	275	9	6	12	10	6
Ukraine	**0**	**22**	**1**	**74**	**216**	**31**	**15**	**27**	**13**	**7 ↑**
Germany	122	93	596	841	204	6	9	4	3	8
Russia	37	55	329	128	153	10	13	6	9	9
Romania	216	397	244	208	86	4	4	7	7	10
China	25	185	501	215	72	15	7	5	6	11
Italy	22	72	91	36	40	16	12	9	15	12
United Kingdom	32	18	13	25	29	12	16	17	17	13
Switzerland	1	16	4	3	22	27	17	19	22	14
Vietnam	0	0	0	0	20	31	30	34	28	15
Poland	2	24	117	84	20	23	14	8	12	15
Luxembourg	2	14	4	136	18	23	18	19	8	17
South Africa	4	2	16	38	14	21	26	15	14	18
Sweden	4	3	2	3	14	21	23	25	22	18
Turkey	0	5	8	0	11	31	20	18	28	20

APPENDIX D

Table D.1. Leading countries by comparative advantages on the global market of raw or retted hemp (HS 530210)

Country	RSCA index					Rank by RSCA index				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Nepal	0.97	0.92	0.87	0.65	0.98	2	2	4	9	1
Portugal	-1.00	-1.00	-1.00	-0.99	0.95	30	33	41	36	2
Luxembourg	0.98	0.98	0.98	0.99	0.92	1	1	2	2	3
Italy	-0.31	0.42	0.69	0.81	0.79	14	8	8	6	4
Switzerland	0.90	0.88	0.90	0.80	0.77	4	3	3	7	5
Netherlands	0.81	0.82	0.77	0.82	0.76	6	4	6	5	6
Lesotho	-1.00	-0.30	0.99	0.99	0.76	30	14	1	1	7
Spain	0.54	0.48	0.35	0.38	0.62	9	7	10	13	8
Romania	0.85	0.79	0.75	0.56	0.47	5	5	7	10	9
Ukraine	**-1.00**	**-0.72**	**-0.50**	**0.49**	**0.35**	**30**	**19**	**17**	**11**	**10 ↑**
South Africa	-0.70	-0.87	-0.99	-0.95	0.13	19	21	38	33	11
Slovenia	-0.88	-0.95	0.60	0.67	0.06	23	27	9	8	12

Note: a country has a comparative advantage in true hemp export on the global market if its share in global hemp fibre exports is higher than its share in the total global export.

Table D.2. Leading countries by comparative advantages on the global market of processed but not spun hemp (HS 530290)

Country	RSCA index					Rank by RSCA index				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Lesotho	-1.00	0.10	0.98	1.00	1.00	35	12	1	1	1
Luxembourg	-0.30	0.43	-0.57	0.97	0.91	14	8	19	3	2
Uganda	-1.00	-1.00	-1.00	0.99	0.91	35	35	39	2	3
France	-1.00	-1.00	-1.00	-1.00	0.86	38	36	40	39	4
South Africa	-0.04	-0.72	0.67	0.85	0.84	10	25	9	4	5
Netherlands	0.71	0.09	0.81	0.74	0.75	7	13	7	7	6
Slovenia	-1.00	-1.00	-1.00	-0.85	0.75	35	35	39	28	7
Lithuania	0.92	0.94	0.81	0.84	0.74	4	3	5	5	8
Nepal	0.98	-1.00	0.40	0.43	0.57	3	35	12	10	9
Italy	0.80	0.82	0.86	0.78	0.53	5	5	3	6	10
Czech Republic	-0.89	-0.65	0.41	0.69	0.50	27	23	11	8	11
Croatia	0.99	0.99	0.81	0.37	0.37	1	1	4	11	12
Belgium	-0.25	0.28	0.37	0.50	0.35	13	9	13	9	13
Jamaica	-1.00	-1.00	0.87	-1.00	0.32	35	35	2	37	14
Ukraine	**-0.92**	**-0.20**	**-0.98**	**0.30**	**0.28**	**28**	**16**	**36**	**12**	**15 ↓**
Canada	-0.54	-0.49	-0.61	0.12	0.21	18	18	21	13	16
Zimbabwe	-1.00	-1.00	-1.00	-1.00	0.15	35	35	39	37	17

Table D.3. Leading countries by comparative advantages on the global market of hemp seeds

Country	RSCA index					Rank by RSCA index				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Lebanon	-1.00	-1.00	0.98	0.98	0.99	37	38	1	1	1
Estonia	0.99	0.98	0.97	0.97	0.98	1	1	2	2	2
Lithuania	0.94	0.95	0.96	0.96	0.95	3	3	4	3	3
Canada	0.95	0.96	0.97	0.88	0.92	2	2	3	4	4
Bulgaria	-0.16	0.06	0.25	0.33	0.92	19	17	20	19	5
France	0.80	0.79	0.75	0.86	0.84	7	9	11	7	6
Netherlands	0.88	0.87	0.86	0.87	0.84	4	5	7	5	7
Australia	0.68	0.54	0.63	0.84	0.81	11	13	13	8	8
Romania	0.72	0.89	0.84	0.74	0.77	10	4	8	13	9
Latvia	0.76	0.79	0.76	0.76	0.76	9	8	10	12	10
Slovenia	0.29	0.86	0.50	0.64	0.76	14	6	16	14	11
Spain	0.81	0.70	0.81	0.77	0.74	5	11	9	10	12
Czech Republic	-0.63	-0.63	-0.17	0.51	0.64	26	31	30	16	13
Malta	-0.66	-0.16	-0.39	0.77	0.46	28	21	33	11	14
China	0.78	0.69	0.63	0.46	0.40	8	12	13	17	15
Germany	-0.10	-0.05	0.16	0.16	0.39	18	19	22	22	16
Slovakia	0.40	0.71	0.51	0.53	0.33	12	10	15	15	17
Russia	-1.00	-0.55	0.48	0.39	0.31	37	29	17	17	18
Croatia	-0.17	0.86	0.88	0.80	0.31	20	7	6	9	19
Belgium	-0.05	-0.53	0.16	-0.19	0.27	17	28	21	24	20
Denmark	-0.56	-0.23	-0.01	0.08	0.25	24	22	24	23	21
Ukraine	**0.77**	**-0.40**	**-0.60**	**0.38**	**0.12**	**8**	**27**	**34**	**18**	**22 ↓**
Poland	-0.86	0.00	0.31	0.31	0.05	29	18	19	20	23