



STUDY ON STORAGE CAPACITIES AND LOGISTICAL INFRASTRUCTURE FOR EU AGRICULTURAL COMMODITIES TRADE

(with a special focus on Cereals, the Oilseed Complex
and Protein Crops (COP))

Executive Summary

Written by Areté s.r.l.
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1 Objectives of the study

This study provides an **overview and mapping of the storage capacity and logistical infrastructure for cereals, the oilseed complex and protein crops** (COP henceforth) in the EU. It also analyses their evolution since 2005. **Bottlenecks in storage capacity and logistical infrastructure for COP crops** are identified. The evolution of bottlenecks and their possible **impact on intra and extra-EU trade in COP crops** are considered. Finally, the study elaborates **policy recommendations to overcome the identified bottlenecks**, and **explores opportunities for future investments** in storage capacity and logistical infrastructure for COP crops in the EU.

2 Scope of the study and applied methodology

The **mapping of storage capacity** at NUTS 2 or 3 level was carried out through a combination of desk research, interviews with business associations and independent experts, and direct enquiries to individual operators. Reported data on the storage capacity of individual facilities in 2005 and 2015 was supplemented by estimates (especially for on-farm storage). The **mapping of logistical infrastructure** (roads, railways, inland waterways and logistical hubs, including seaports) was mainly carried out through extraction from relevant databases at EU and national level, supplemented by additional material from desk research and interviews to qualified informants. Some data gaps were filled through interpolation. **Four case studies** (focusing on Germany, Hungary, Romania and China) provided additional elements for the assessment, which analysed the **evolution of both storage capacity and logistical infrastructure** between 2005 and the current situation, investigated the **underlying factors**, identified the **critical bottlenecks** and assessed their **influence on EU internal and external trade in COP crops**.

3 Conclusions of the study

3.1 Storage capacity for COP crops in the EU

The **current total storage capacity for COP in the EU28** was quantified at around **359 million tonnes**, up 20% from around 300 million tonnes in 2005. Over the same period, EU production of COP crops increased by 11%, from around 312 million tonnes to around 346 million tonnes¹. The increase in storage capacity was therefore greater than the increase in production, as some Member States fully or partially addressed the storage capacity shortages that they were facing in 2005 (see § 3.3). France currently has the largest storage capacity in the EU (around 91 million tonnes), followed by Germany (48 million tonnes) and Spain (30 million tonnes). Among the Eastern EU Member States, Poland (24 million tonnes), Romania (23 million tonnes) and Hungary (20 million tonnes) also stand out.

Facilities at individual farm level currently account for the largest share of storage capacity (143 million tonnes / 40% of EU total). Storage capacity at **farming cooperatives** is more limited (38 million tonnes / 11% of EU total). However, some vertically integrated agribusiness cooperatives operate mainly as processors and/or traders in a number of Member States (especially in France). Agribusiness cooperatives manage significant storage capacity, including a number of storage facilities located at transportation hubs, such as ports. The share of storage capacity at individual farm level is substantial in Finland (78% of total capacity), Greece (70%), Poland (67%) and the United Kingdom (62%); the share of storage capacity managed by farming cooperatives is important in Austria (37% of total capacity), Lithuania (34%), Germany (29%) and Portugal (29%).

The **trading and wholesale sector** was found to have a critical importance for COP storage (115.5 million tonnes of capacity / 32% of EU total). The share of storage capacity managed by traders is especially important in France (56%), Bulgaria (49%) and Romania (42%).

¹ Comparison between three-year averages: 2004-2006 vs. 2013-2015.

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The **processing industry** can handle substantial quantities of COP crops with a relatively limited capacity (31.5 million tonnes / 9% of EU total) thanks to rapid turnover of stocks; the same applies for **storage capacity at transportation hubs** (31 million tonnes / 9% of EU total), which is of great strategic importance for COP trade. Storage capacity managed by the processing industry is significant in Slovenia (42% of total capacity), Czech Republic (31%), Belgium (29%) and Portugal (29%); the share of storage capacity at transportation hubs is especially important in Slovenia (52%), Estonia (31%), Belgium (30%) and Portugal (30%). Storage facilities located at transportation hubs usually provide “**transit storage**”: their availability to handle exceptional production volumes is therefore limited.

Most of the pressure on the storage system from exceptional harvest volumes is felt during the harvest season and in the following months. In these periods, the heaviest pressure falls on storage facilities managed by individual farms and by farming cooperatives, as these are usually the first to handle the bulk of harvested production. Storage capacity managed by agribusiness cooperatives mainly operating as processors and/or traders can ease some of this pressure.

The **detection of storage capacity shortage** is influenced by the methodology followed for the estimation of storage needs. If the estimate is based on production and export peaks recorded in the 2005-2015 period (base scenario), corresponding to the upper limit of storage needs, available storage capacity would fall short of needs in nearly 20 Member States, including large producers and traders, particularly Germany, Lithuania (as well as other Baltic states), Poland and the United Kingdom. However, operators tend to avoid creating storage capacity which would not be utilised most of the time, therefore investments in storage capacity are more likely to be adapted to average production levels (plus a security buffer) rather than peak levels. An estimate of storage needs based on average production and export levels over the 2005-2015 period (first alternative scenario) allows a better appraisal of potential **structural**² shortages of storage capacity (rather than contingent ones). Under this scenario, available storage capacity would fall significantly below the minimum need³ only in two cases (the United Kingdom and Luxembourg), while around 10 Member States (including Poland, Germany and Latvia) would have storage capacities close to their minimum structural need. A second alternative scenario focusing on structural storage needs was derived from the base scenario by taking into account the differences between net importing and net exporting Member States⁴. Under this scenario, available storage capacity would fall below the minimum need in Latvia only. Finally, an analysis of the **timing of peaks in COP exports and peaks in storage needs** was also made. This allowed the detection of situations where lack of storage capacity in critical periods of the year may have put pressure on operators to “free up” storage space through increased/anticipated export sales. For most of the leading EU exporters of COP, exports do not seem to peak immediately at the time of harvest, with the exception of Lithuania and Poland, countries where the lack of storage capacity might have been the reason behind prompt exports. Also considering the use of temporary storage solutions and the variable frequency of yearly stock turnover at storage facilities⁵, it can be concluded that **in general there is no structural shortage of COP storage capacity**

² *Structural shortages* occur where storage capacity falls systematically short of storage needs in ordinary conditions, defined by *average* COP production levels. *Contingent shortages* occur where storage capacity falls short of storage needs in exceptional circumstances, defined by *peaks* in COP production.

³ A minimum and a maximum storage need was estimated in each scenario. The minimum need was estimated on the basis of production only, whereas the maximum need was estimated by considering production, trade flows, beginning/ending stocks and consumption.

⁴ This scenario considered the different stock management models which can be applied in the two situations. Whereas the export of COP requires the availability of storage capacity in the period between harvest and actual export (whatever the length of such period), import flows usually can be managed in a more flexible way and be more tailored to the timing of consumption needs: with an accurate management of the timing of imports, a country can significantly reduce its storage needs in most years.

⁵ The higher the frequency of stock turnover, the larger the volumes which can be handled by a storage facility over the year.

in the EU and that only a limited number of Member States, principally the Baltic states and Poland, may be affected.

Available storage capacity for COP has increased in all 28 Member States since 2005, although to a different degree. Substantial increases were mostly observed in Eastern EU Member States, such as Bulgaria, Poland and Romania, but also in some Western EU ones, such as Spain. The most significant investments in storage capacity, especially in terms of construction of new storage facilities, were mainly concentrated in a number of Eastern EU Member States (Czech Republic, Slovakia, Hungary, Poland, Romania and Bulgaria) which experienced an increase in COP production and/or exports over the 2005-2015 period. Investments in Western EU Member States have been more focused on the rationalisation, expansion and/or technological upgrading⁶ of existing storage facilities. In many cases, the most substantial investments in additional capacity were made in on-farm facilities.

A **combination of multiple, and often interlinked factors, has influenced the evolution of COP storage capacity** in the EU over the observed period. This evolution has been influenced firstly by factors related to the evolution of the COP sector and to the dynamics of the related market. The **growth in COP yields and production** and the **increase in COP exports** have resulted in an increase in storage needs. **Increased volatility of COP prices** has further encouraged the use of strategic stock management, which requires the availability of surplus storage capacity. Other influencing factors are related to trends in the downstream stages of the COP supply chains. The **switch to just-in-time (JIT) inventory management models** by an increasing number of millers, oilseed crushers and producers of compound feed has resulted in increased concentration of storage capacity in the upstream stages of the supply chain: the combined share of total capacity of individual on-farm facilities and farming cooperatives has increased from 48% to 51% between 2005 and 2015, whereas the share of processing facilities has remained stable at 9%. Also the need to ensure segregation of products with different quality features or origins has promoted investments in additional storage capacity. Policy-related factors such as the implementation of **plans aimed at expanding/upgrading storage capacities for COP** have also had an influence.

Three profiles of **prominent investors in COP storage capacity** in the EU were identified. First, agribusiness cooperatives, focusing especially on technological upgrading and rationalisation of existing facilities; second, operators in the processing stage, focusing mainly on the rationalisation of existing facilities in Western EU Member States, and more on storage capacity expansion in Eastern EU Member States; and third, export-oriented traders operating at transportation hubs. Traders completed the largest individual capacity expansion projects, which concerned especially storage facilities located at some ports⁷, in both Western and Eastern EU Member States. The most common **funding solutions for investments in COP storage capacity** in the EU include internal resources and venture capital, especially used by large-scale processors and traders; public funding – mainly through EAFRD via Rural Development Programmes – has mainly been used for on-farm storage and for some investments made by agribusiness cooperatives.

3.2 Logistical infrastructure for COP crops in the EU

Extra-EU COP exports grew at a higher pace than imports over the 2005-15 period⁸, mainly thanks to the **increasing importance of Eastern EU Member States in COP trade**. EU COP exports to third countries have more than doubled over this period. Africa (52% of the average exports over the period) and Asia (31%) are the main extra-EU destinations for COP exports. EU COP exports to Africa mainly consist of soft wheat, while

⁶ For instance, installation of handling equipment with greater loading/unloading capacity, increase in the number and/or size of receiving bins, conversion of non-ventilated facilities into ventilated ones, etc.

⁷ Notable capacity expansion projects were completed, for instance, at the ports of Burgas (Bulgaria), Constanta (Romania), Barcelona, Cadiz, La Coruña, Malaga and Valencia (Spain).

⁸ The evolution of EU COP trade and production was analysed through a comparison of three-year averages: 2004-2006 vs. 2013-2015.

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soft wheat and barley account for the majority of exports to Asia. Romania in particular increased substantially its COP exports to extra-EU destinations in Northern Africa and the Middle East. The best export performances at Member State level have not always coincided with a comparable expansion of domestic COP production over the 2005-2015 period. Among the Member States which recorded the greatest increases in COP exports, Poland and France significantly increased their COP production (+16% and +13%, respectively), Germany and Romania recorded more limited increases (+6% and +5%, respectively), while Hungary experienced a slight contraction (-2%).

Road, rail and inland waterways play different roles in the **transportation of COP crops from EU cultivation areas to their final destinations**, and are often used in combination. The road, rail and inland waterway network used for COP crop transportation is generally also used for the transportation of other goods, and often also handles passenger traffic. Inland waterways and railways handle almost all long-distance COP tonnage (60-70% for inland waterways, 30-40% for railways); trucks play a marginal role in long-distance transportation of COP, and are only used in the few areas where railway and/or inland waterway networks are not very well developed, or as an emergency solution. Road transportation by truck is much more important for short-distance moves, such as the ones from COP cultivation areas to the main storage facilities and/or to transshipment points to the other transportation modes.

Among the 9 “TEN-T corridors” of EU importance⁹, **four core corridors for long-distance transportation of COP crops** were identified: **Baltic-Adriatic, North Sea-Baltic, Rhine-Alpine and Rhine-Danube**. A number of **key logistical hubs for COP transportation** were also identified, especially along **inland waterways**¹⁰. The most important **EU ports handling COP crops** are Rouen (the leading EU port for cereal exports), Rotterdam, Hamburg and Antwerp. The seaports of Constanta and Marseille and the inland waterway ports of Paris and Metz also handle important COP traffic volumes. Where inland waterway connections are missing, **railways** play an especially important role in long-distance COP transportation. This is the case for COP crop moves from Hungary to Italy, and from the Czech Republic and Poland to the North Sea ports. Important international rail traffic of agricultural goods (including COP crops) was also identified between some German and Austrian regions and Northern Italy, and from Latvia and Lithuania towards Estonia. National rail traffic of COP is especially heavy in France, where it is mainly directed towards the North-Western ports handling COP crops; important national flows of rail traffic for COP crops were found in Germany (mainly towards the ports of Hamburg and Bremen), in Romania (towards the port of Constanta) and in Austria, where important international transit traffic combines with heavy inter-regional traffic. Heavy inter-regional **road** traffic of agricultural goods (including COP crops) was identified in Northern Italy and in North-Western France.

The growth in the length of the **four core TEN-T corridors** relevant for COP transportation over the 2005-2015 period varied greatly according to the corridor and the transport mode considered (road, rail or inland waterways). A significant expansion of the **motorway network** took place in Romania, Poland, Bulgaria and Hungary. The overall expansion of the **railway and inland waterway networks** in the EU was, in contrast, rather limited. **Insufficient fairway depth** remains an issue on a number of inland waterway sections which are of critical importance for long-distance COP transportation, especially on the Danube. Moving eastwards,

⁹ The Trans-European Transport Network (TEN-T) corridors have been defined by the European Commission mainly on the basis of overall traffic volumes. The TEN-T network comprises roads, railway lines, inland waterways, inland and maritime ports, airports and rail-to-road terminals throughout the EU. Besides the four core corridors for COP transportation identified by the study, the TEN-T network also includes the Atlantic, Mediterranean, North Sea-Mediterranean, Orient – East Mediterranean, and Scandinavian-Mediterranean corridors. Corridor development can be achieved through increased length and/or increased transportation capacity and/or technological upgrade of infrastructure. Within each corridor, the road, rail and inland waterway sections can grow in length to different extents.

¹⁰ The most important ones for COP transportation are: Rhine; Moselle; North-South axis connecting the Netherlands, Belgium and northern France; Mittelland Canal connecting the Rhine-Ruhr region with Lower Saxony and Saxony-Anhalt; Danube.

locations with critical fairway conditions along the Danube are located in Germany (1 location), Austria (2 locations), Slovakia (3 locations), Hungary (5 locations), Bulgaria (3 locations) and Romania (4 locations).

The critical **factors influencing the evolution of logistical infrastructure** are: strategical governmental actions; planning and approval procedures for infrastructural projects; “Public Private Partnerships” (PPP); user financing (mainly through toll charges); and research and technological development.

The study highlighted the **critical role of the European Union as the leading investor in logistical infrastructure**, including the one used for COP transportation. A **wide range of public funding solutions is available to finance investments in the EU logistical network**, including traditional funding schemes¹¹, as well as innovative funding instruments¹². Concession Finance and Public-Private Partnerships (PPP) have also played a significant role.

3.3 Bottlenecks in storage capacity and logistical infrastructure for COP crops in the EU

Bottlenecks in COP storage capacity are defined by the **presence of a shortage of storage capacity with respect to storage needs**¹³. The evolution of bottlenecks in storage capacity over the 2005-2015 period emerged as being **balanced between Member States which improved their situation (13) and Member States where the situation worsened (15). The area where the most significant improvements were recorded was Eastern EU**. Romania switched from a shortage of storage capacity to a surplus of 5.3 million tonnes, and Poland managed to reduce its shortage by 3.9 million tonnes. In addition, Bulgaria and Hungary increased by 3.9 million tonnes and 4.8 million tonnes, respectively, the surpluses of storage capacity they already had. In Western EU, only Spain managed to achieve a substantial surplus of storage capacity (3 million tonnes), starting from a situation of balance between capacity and needs. Among the Member States where the situation worsened, Lithuania and Latvia moved from a surplus of storage capacity to a shortage of 1.3 million tonnes and 1 million tonnes, respectively. Six Member States experienced further aggravation of existing shortages of storage capacity, with Denmark, the United Kingdom and Germany being the most affected.

The main factors influencing the evolution of bottlenecks in storage capacity are the **increase of storage capacity** – recorded in all the 28 Member States – and the **evolution of storage needs**, which grew in nearly all the Member States (with the exception of Romania and Cyprus). In general, Member States which successfully reduced their shortages of storage capacity or further improved their surpluses were the ones whose increased storage needs were more than compensated by the increase of their storage capacity. Storage capacity increased also in the two Member States where storage needs remained fairly stable over the 2005-2015 period, i.e. Romania and Italy.

A number of **critical bottlenecks for logistical infrastructure** were identified in **all four core corridors for COP transportation**. The high number of critical fairway locations along the Danube (18, with 9 concentrated between Hungary and Romania) emerged as the most serious bottleneck for COP transportation along the **Rhine-Danube corridor**. Congestion at the interconnections between the Belgian, Dutch and German networks, and on the access routes to the Swiss Alpine tunnels in Germany and Italy, constitutes the main bottleneck on the **Rhine-Alpine corridor**, together with a missing link between Emmerich and Oberhausen (Germany). On the **Baltic-Adriatic corridor**, the main bottlenecks emerged at cross-border sections between Poland, the Czech Republic, Austria, Slovakia and Slovenia. Different gauges and electrification systems in the national rail networks, limiting cross-border interoperability of freight trains, emerged as the most serious

¹¹ TEN-T funds and ERDF/Cohesion Fund; European long-term investment funds (ELTIFs); Connecting Europe Facility (CEF).

¹² Structured Finance Facility (SFF); Loan Guarantee Instrument for TEN-T Network (LGTT); EU Project Bonds; Marguerite Fund.

¹³ The assessment was made by comparing the current storage capacity of each Member State with the average storage need in the base scenario (set on peaks of COP production and trade), calculated as simple average between the maximum and the minimum storage need.

bottlenecks along the **North Sea-Baltic corridor**, together with non-electrified rail segments in Germany and at the Polish-Lithuanian border. **Bottlenecks at national-regional level** emerged for **all three transportation modes**. The most serious bottlenecks for inland waterways were found along the Danube, and especially in Hungary, Romania, Bulgaria and Slovakia. Bottleneck sections on rail routes used for COP transportation were especially found in Member States where transit traffic is especially heavy, i.e. in Germany, Austria, Poland, Czech Republic, Slovakia and Hungary. Important COP production areas lacking adequate transportation infrastructure and direct connections with key logistical hubs were found in Bulgaria (Dobrich region) and Romania (Timis region). Whereas significant improvements in the **Logistics Performance Index** were observed for most of the lowest-ranked Member States (i.e. most of the Eastern EU ones), a deterioration of the overall logistical performance in Austria (especially for railways) and Germany (for all transportation modes) was observed.

As for the **possible impact of bottlenecks in storage capacity and logistical infrastructure on EU internal and external trade in COP**, the case of **France** showed that the absence of such bottlenecks is an important condition for a successful export performance. A surplus of storage capacity and state-of-the-art logistical infrastructure are needed to ensure strategic management of stocks and to sustain the expansion of domestic COP production and exports. **Poland, Lithuania and Latvia** were found to have sub-optimal availability of storage capacity compared to current storage needs. These Member States are also affected by rather serious logistical bottlenecks, which are only partially being addressed. This situation may limit the possibility for these countries to implement strategic stock management and to sustain their current production and export performance in the future. **Hungary, Romania and Bulgaria** have substantially increased their COP exports also thanks to substantial investments in storage capacity, which allowed them to achieve a surplus over current storage needs. However, the reliance of these Member States on the Rhine-Danube corridor to reach destination markets in both internal and external trade may hinder their future export performance, as this corridor is affected by a number of serious bottlenecks. On an **EU-wide perspective**, the assessment highlighted the need to address some critical bottlenecks which impede traffic flows in both internal and external trade in COP crops: the aforementioned bottlenecks on the Rhine-Danube corridor, capacity issues in the German and Austrian transportation network (which especially affect long-distance transportation of COP by rail), and also the bottlenecks on corridors crossing the Alps through Austria or Switzerland to reach Italy.

3.4 Solutions to address bottlenecks

To address bottlenecks in storage capacity, the **appropriate location of additional storage capacity** (e.g. at key transportation hubs or export terminals) and access to adequate logistical infrastructure is of critical importance. Export-oriented operators should focus their investments in **additional storage capacity at locations offering access to inland waterways and railways**, as they offer efficient transport solutions capable of handling large volumes of products, and/or **close to the main inland transportation hubs in the transport corridors of interest**, and/or directly **at the preferred seaports for export shipping**. The adoption of an **“integrated approach” aimed at addressing bottlenecks in both storage capacity and logistical infrastructure** was found to be highly advisable in terms of access to a **wider range of public funding options** than those offered by EAFRD via Rural Development Plans. This approach also presents interesting **opportunities for the development of collaborative structures** (such as partnerships, joint ventures, etc.) among the supply chain actors: agribusiness cooperatives, independent grain traders/wholesalers, processors of COP crops and operators in the logistics sector (from third-party logistic providers to port authorities).

The proposed **solutions to address bottlenecks in the core TEN-T corridors for COP transportation** are: completion of the identified critical missing links; capacity increases and technological upgrade at critical sections and key hubs; enhancement of intermodal transportation; harmonisation of technological standards (gauges, signalling, electrification and train control systems for railroads; locks, bridge clearance and canal draught for inland waterways).

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The most important **opportunities for future investments in logistical infrastructure** can be found in the priority areas for addressing the critical bottlenecks identified by the study. The **improvement of fairway conditions of inland waterways**, especially along the Danube river, presents important investment opportunities. Future investments should also focus on the **improvement of interoperability of railways** (in terms of suitable infrastructure and rolling stock, and of availability of skilled personnel), in order to improve efficiency and to reduce waiting times at cross-border terminals. Future investments should also be targeted at **improvements in regional transport connectivity**, aimed at addressing traffic congestion issues on motorways and railways through capacity expansion at critical locations/sections, and through construction of bypasses to circumvent chokepoints via alternative routes.

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