

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))*

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Objectives of the study

1. Providing an **overview and mapping** of the storage capacities and of the logistical infrastructure for cereals, the oilseed complex and protein crops (COP) in the EU and analysing the **evolution** of storage capacities and logistical infrastructure since 2005.
2. Identifying **bottlenecks** related to storage capacities and logistical infrastructure and exploring the possible **impact on intra and extra EU commodity trade**, also analysing the **evolution** of bottlenecks since 2005.

Study findings (including from country-specific case studies)



Formulation of **options for policy recommendations** and identification of **investment opportunities**

Methodology: observed and estimated storage capacity

Observed component

Objective: to rely as much as possible on structured data/databases and to compile the most possible complete list of sites/facilities to be filled with direct enquiries and the «reconstruction approach»

Desk research / literature review

- Analysis of existing databases, previous studies and researches/surveys
- Public institutions, business organisations and consultants contacted

Direct enquiries

- Review of company websites / annual reports / news
- Phone and email contacts with individual operators

“Reconstructed” component

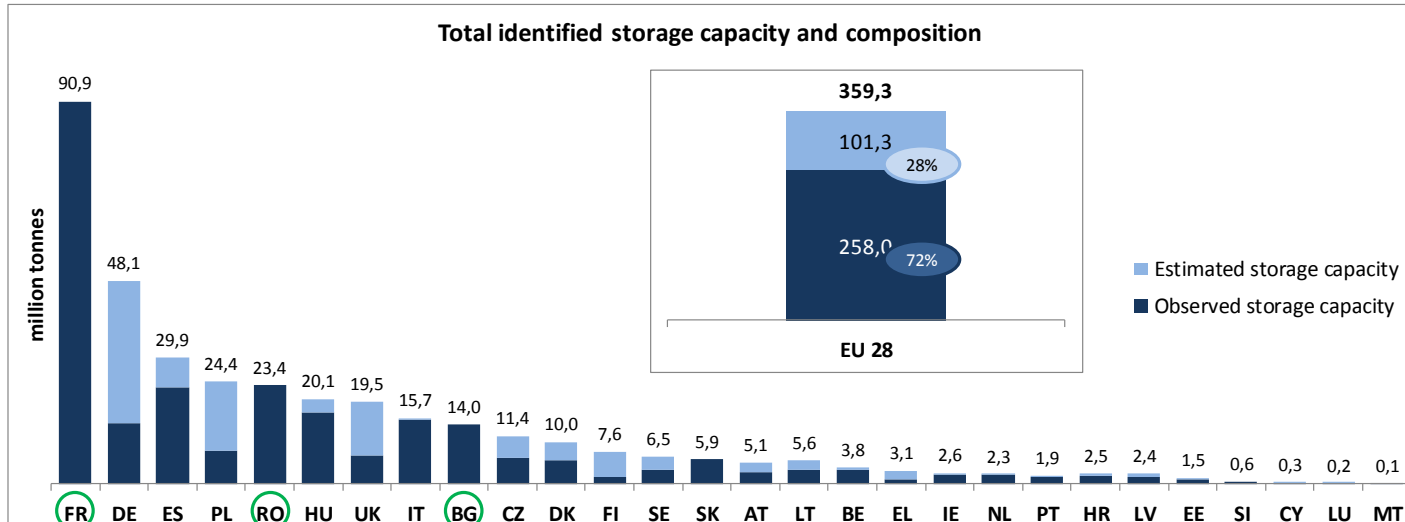
- Visual inspection of pictures of individual facilities
- Expert appraisal of their storage capacity (based on dimensions, processing capacity, stock turnover, etc.)

Estimated component

Objective: to fill in any gaps in the observed component

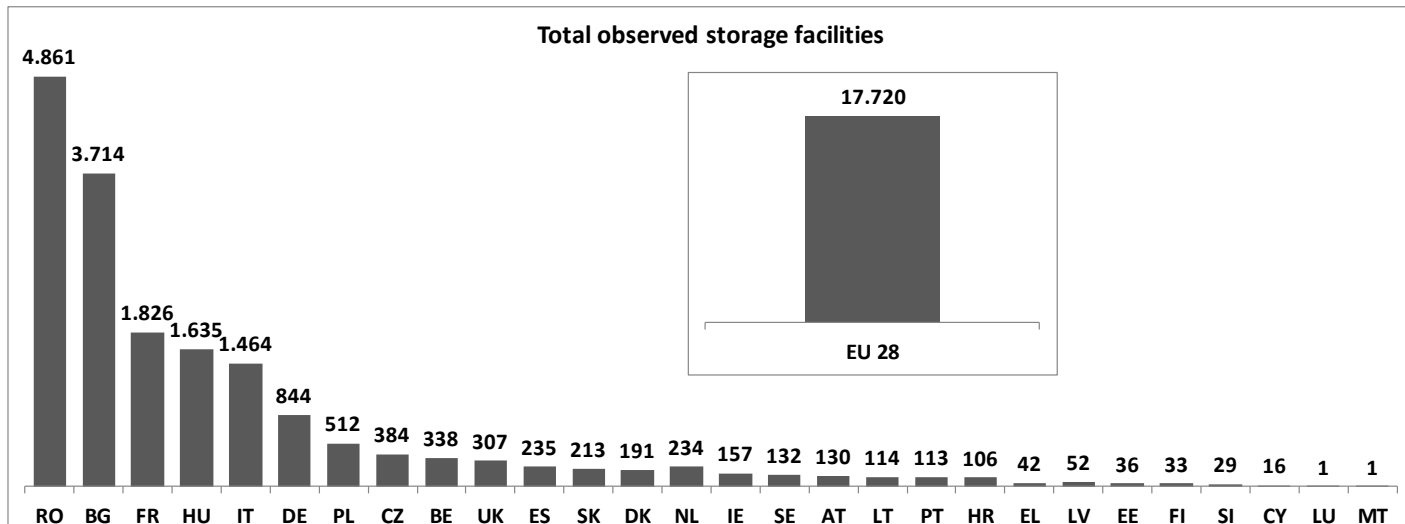
- Mainly used for **on-farm storage capacity** in most Member States
- Used as “last resort option” for the other stages of the supply chain in a very limited number of cases
- In-depth interviews at national/regional level with experts and representatives of business organisations/companies
- Estimates on the basis of regional (NUTS 2 or 3 level) data on COP production, areas and yields by Eurostat and national statistical offices
- Review and validation of results through interviews with knowledgeable experts

Methodology: estimated and observed storage capacity



- **France, Romania and Bulgaria:** availability of complete and structured databases

- **Germany:** challenges from:
 - lack of structured databases / lists of sites;
 - reluctance of contacted players to provide operational information.



Mapping of storage facilities

Member States	2005 mapped storage capacities (tonnes)	Current mapped storage capacities / total current s.c. (tonnes)	2005-2015 % change
Austria	4.420.949	5.065.549	15%
Belgium	3.636.202	3.820.630	5%
Bulgaria	7.291.367	14.032.575	92%
Croatia	2.276.926	2.504.676	10%
Cyprus	95.019	311.292	228%
Czech Republic	10.436.297	11.427.481	9%
Denmark	8.938.900	9.954.900	11%
Estonia	1.054.613	1.470.806	39%
Finland	6.540.400	7.559.500	16%
France	82.685.986	90.870.486	10%
Germany	46.520.775	48.104.734	3%
Greece	2.165.980	3.144.337	45%
Hungary	14.714.427	20.144.534	37%
Ireland	1.993.367	2.593.903	30%

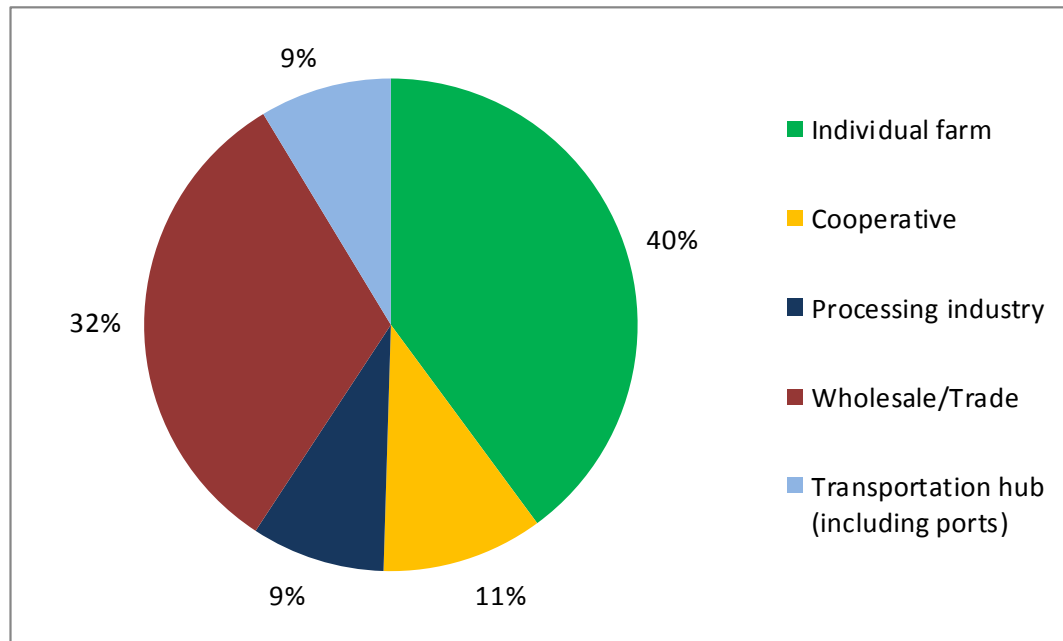
Member States	2005 mapped storage capacities (tonnes)	Current mapped storage capacities / total current s.c. (tonnes)	2005-2015 % change
Italy	14.649.689	15.683.826	7%
Latvia	1.569.028	2.377.920	52%
Lithuania	4.815.009	5.615.498	17%
Luxembourg	56.210	170.655	204%
Malta	0	88.000	n.a.
Netherlands	2.164.970	2.275.630	5%
Poland	15.494.236	24.368.366	57%
Portugal	1.755.100	1.913.580	9%
Romania	16.138.355	23.377.236	45%
Slovakia	5.698.412	5.875.219	3%
Slovenia	573.385	609.635	6%
Spain	22.464.548	29.905.814	33%
Sweden	4.384.580	6.498.430	48%
United Kingdom	17.098.723	19.517.051	14%
EU 28	299.633.454	359.282.264	20%

- France is the MS with the largest storage capacity, followed by Germany and Spain
- Among the Eastern EU MS, Poland, Romania and Hungary stand out
- Largest increases recorded in Bulgaria, Poland and Latvia (+ Cyprus and Luxembourg)

Mapping of storage facilities



2015 EU storage capacity and composition across stages of the supply chain



- Facilities at **individual farm** level account for the largest share of storage capacity in the EU (**143 million tonnes** / 40% of EU total)
- Storage capacity at **farming cooperatives** is more limited (**38 million tonnes** / 11% of EU total)
- The **processing industry** manages around **31.5 million tonnes** of storage capacity, equal to 9% of EU total
- The **trading and wholesale sector** has a critical importance for COP storage (around **115.5 million tonnes** of storage capacity / 32% of total)
- **Transportation hubs** manage around **31 million tonnes** of storage capacity (9% of total), with great strategic importance for COP trade

Logistical infrastructure / COP transportation – facts & figures

- Share of **road** transportation on **long-haul** traffic of COP in 2015: **< 10 %**
- The shorter the distance, the higher is the share of trucks in agricultural transportation, with an economically viable distance of 100-300 km

- Share of **rail** transportation on **long-haul** traffic of COP in 2015: **30-40%**
- Increased efficiency from **maximal train length, block/unit** (shuttle) trains, **“interoperability”** (*smooth operation between different rail networks*)
- Affected by **congestion along critical sections**

- Share of **IWW** transportation on **long-haul** traffic of COP in 2015: **60-70%**
- Highest **capacity** and **energy efficiency**; affected by **fairway conditions**

Main traffic axes

- Rhine (18.6 Mio t_{agri})
- Moselle
- North-South axis (FR, BE, NL)
- East-West axis (Mittelland canal)
- Danube

Main COP crops seaports

- Rotterdam (10 Mio t_{agri})
- Hamburg (5.7 Mio t_{agri})
- Antwerp (1.2 Mio t_{agri})
- Constanta

Main inland ports for COP crops

- **Rouen**, Paris (Le Havre)
- Metz
- Danube ports

Mapping of logistical infrastructure – core TEN-T corridors

Four TEN-T corridors have key importance for COP transportation

A - Baltic-Adriatic

- Road: 3.617.345 km
- Rail: 4.666.961
- IWW: -

B - North Sea-Baltic

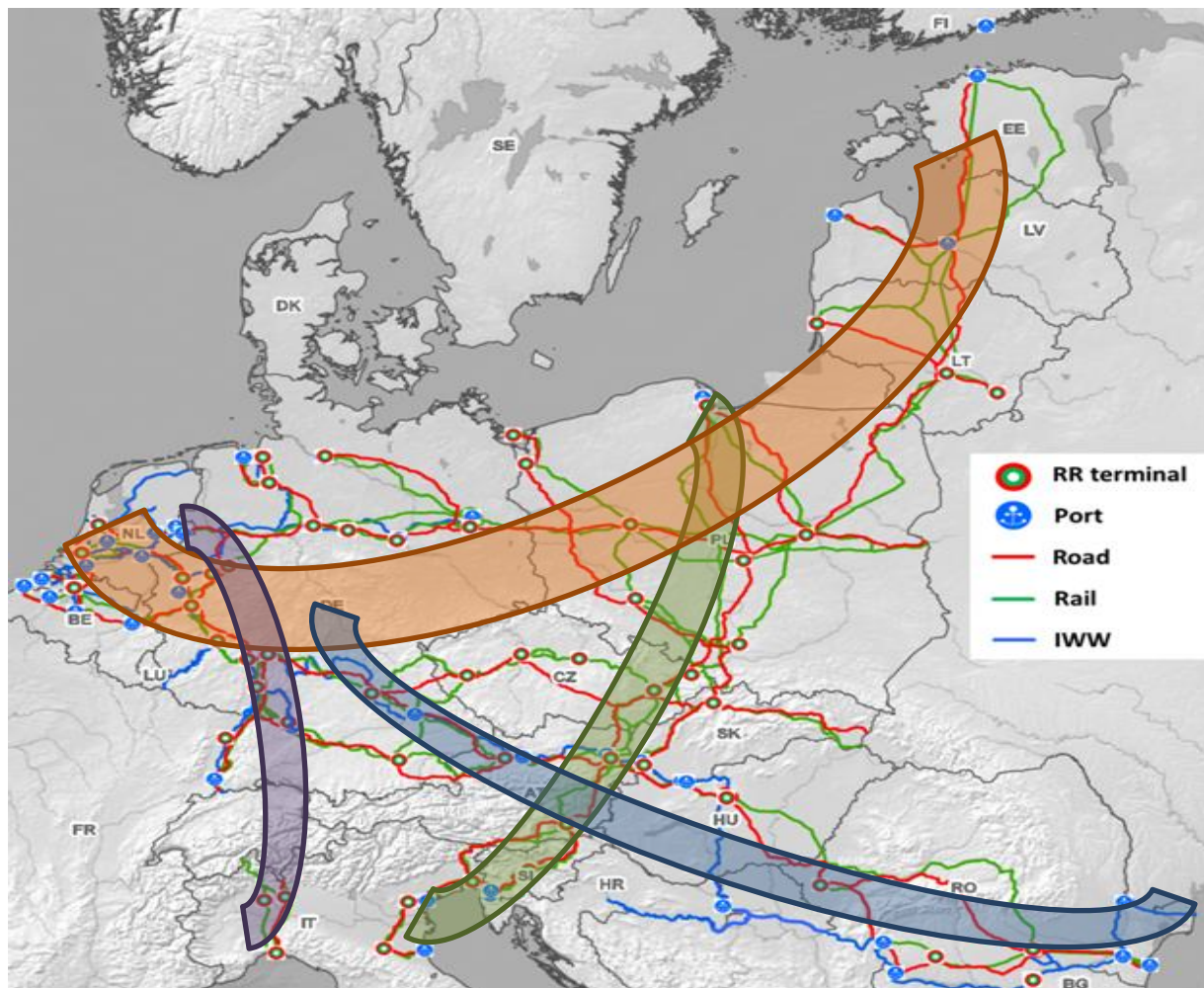
- Road: 4.058.804 km
- Rail: 6.190.236 km
- IWW: 2.088.179 km

F - Rhine-Alpine

- Road: 1.421.269 km
- Rail: 2.940.106 km
- IWW: 1.761.782 km

I - Rhine-Danube

- Road: 4.488.347 km
- Rail: 5.802.489 km
- IWW: 3.918.037 km



Current need of storage capacity

3 scenarios for the estimate of storage needs

Base scenario – highlights contingent shortages

Maximum need

- Considers peaks in production for each crop and Member State over the 2005-2015 period
- Monthly imports and exports in the year of max. production

I alternative scenario – structural shortages

Maximum need

- Considers average production for each crop and Member State over the 2005-2015 period
- Average monthly imports and exports

II alternative scenario – consideration of net trade position

Developed on the same assumptions of Base scenario

- Absolute value threshold: 500 000 tonnes of shortage
- Relative threshold: storage capacity less than 75% of average storage need
- Focus on net exporters*

Minimum need

- For each scenario, based only on production (peak or average) regardless imports and exports

Timing

- Actual timing of production for individual COP crops/MSs was considered to determine the storage peak

11 Member States with storage capacity below the minimum need (8 below maximum)

2 Member States with storage capacity below the minimum need (11 below maximum)

1 Member State as net exporter with high shortages both in absolute and relative terms

* net trade position calculated on average import and export volumes over the 2013-2015 period

Current need of storage capacity – contingent shortages

Member States	2005 mapped storage capacities (tonnes)	Current mapped storage capacities / total current s.c. (tonnes)	Minimum needed storage capacity (tonnes)	Maximum needed storage capacity (tonnes)	Shortage situations vs. the expected total capacity
Austria	4.420.949	5.065.549	3.576.000	4.981.000	✗
Belgium	3.636.202	3.820.630	2.344.000	3.951.000	✗
Bulgaria	7.291.367	14.032.575	5.295.000	6.772.000	
Croatia	2.276.926	2.504.676	1.365.000	3.689.000	✗
Cyprus	95.019	311.292	165.000	282.000	
Czech Republic	10.436.297	11.427.481	9.294.000	10.125.000	
Denmark	8.938.900	9.954.900	9.796.000	10.896.000	✗✗
Estonia	1.054.613	1.470.806	836.000	890.000	✗✗
Finland	6.540.400	7.559.500	4.379.000	4.463.000	
France	82.685.986	90.870.486	59.527.000	66.942.000	
Germany	46.520.775	48.104.734	52.092.000	57.288.000	✗✗
Greece	2.165.980	3.144.337	2.195.000	4.844.000	✗✗
Hungary	14.714.427	20.144.534	9.940.000	17.380.000	
Ireland	1.993.367	2.593.903	2.515.000	2.873.000	✗✗
Italy	14.649.689	15.683.826	11.332.000	24.886.000	✗
Latvia	1.569.028	2.377.920	1.449.000	1.507.000	✗✗
Lithuania	4.815.009	5.615.498	3.111.000	3.284.000	
Luxembourg	56.210	170.655	194.000	221.000	✗✗
Malta	0	88.000	0	61.000	
Netherlands	2.164.970	2.275.630	1.635.000	4.255.000	✗
Poland	15.494.236	24.368.366	24.728.000	27.263.000	✗✗
Portugal	1.755.100	1.913.580	464.000	2.119.000	✗
Romania	16.138.355	23.377.236	11.840.000	26.108.000	
Slovakia	5.698.412	5.875.219	3.463.000	4.306.000	
Slovenia	573.385	609.635	234.000	753.000	✗
Spain	22.464.548	29.905.814	19.881.000	25.025.000	
Sweden	4.384.580	6.498.430	5.839.000	5.992.000	✗✗
United Kingdom	17.098.723	19.517.051	24.716.000	27.153.000	✗✗
EU 28	299.633.454	359.282.264	272.205.000	348.309.000	

- The approach adopted for the estimate of storage needs is very conservative and highlights **contingent shortages** (“bumper crop years”) more than **structural** ones
- The most **serious shortages** of storage capacity in **Lithuania, Germany, Poland and the UK**
- The shortages which emerged for Denmark, Estonia, Greece, Ireland, Latvia, Luxembourg and Sweden seem less critical, as the extent of the capacity gap to cover is smaller
- In other eight MS, total storage capacity fall short of the maximum storage need only

Current need of storage capacity – I alternative scenario

Member States	Current mapped storage capacities / total current s.c. (tonnes)	Minimum needed storage capacity (tonnes)	Maximum needed storage capacity (tonnes)	Shortage situations vs. the expected total capacity
Austria	5.065.549	3.034.000	4.950.000	
Belgium	3.820.630	2.355.000	4.490.000	✗
Bulgaria	14.032.575	6.734.000	6.858.000	
Croatia	2.504.676	1.384.000	3.191.000	✗
Cyprus	311.292	58.000	211.000	
Czech Republic	11.427.481	8.015.000	8.402.000	
Denmark	9.954.900	9.726.000	10.615.000	✗
Estonia	1.470.806	1.054.000	1.103.000	
Finland	7.559.500	3.936.000	3.990.000	
France	90.870.486	57.787.000	64.494.000	
Germany	48.104.734	47.136.000	52.992.000	✗
Greece	3.144.337	2.311.000	4.532.000	✗
Hungary	20.144.534	8.341.000	13.783.000	
Ireland	2.593.903	2.293.000	2.730.000	✗
Italy	15.683.826	9.582.000	21.142.000	✗
Latvia	2.377.920	1.968.000	2.009.000	
Lithuania	5.615.498	4.045.000	4.121.000	
Luxembourg	170.655	180.000	193.000	✗✗
Malta	88.000	0	26.000	
Netherlands	2.275.630	1.553.000	4.699.000	✗
Poland	24.368.366	23.931.000	26.085.000	✗
Portugal	1.913.580	286.000	2.036.000	✗
Romania	23.377.236	10.275.000	16.629.000	
Slovakia	5.875.219	2.895.000	3.652.000	
Slovenia	609.635	263.000	681.000	✗
Spain	29.905.814	16.462.000	21.999.000	
Sweden	6.498.430	5.269.000	5.451.000	
United Kingdom	19.517.051	23.850.000	26.270.000	✗✗
EU 28	359.282.264	254.723.000	317.334.000	

- An **alternative methodology** for the estimate of storage need was elaborated
- Storage needs are calculated on the basis of the **average** production and imports-exports over the 2005-2015 period, **rather than on the maximum level**
- Under this assumption, only the United Kingdom and Luxembourg result to have serious shortages (storage capacity below the minimum need) although the very high diffusion of **just-in-time inventory management** in the UK suggests that there is no structural shortage of storage capacity in the country

Current need of storage capacity – II alternative scenario

Member States	Shortages above 500 000 tonnes	Storage capacity less than 75% of average storage needs	Net trade position	Serious potential concerns
Austria	No	No	Importer	-
Belgium	No	No	Importer	-
Bulgaria	No	No	Exporter	-
Croatia	No	No	Exporter	-
Cyprus	No	No	Importer	-
Czech Republic	No	No	Exporter	-
Denmark	Yes	No	Importer	-
Estonia	No	No	Exporter	-
Finland	No	No	Exporter	-
France	No	No	Exporter	-
Germany	Yes	No	Importer	-
Greece	Yes	Yes	Importer	-
Hungary	No	No	Exporter	-
Ireland	Yes	No	Importer	-
Italy	Yes	No	Importer	-
Latvia	Yes	Yes	Exporter	✗
Lithuania	Yes	No	Exporter	-
Luxembourg	No	Yes	Importer	-
Malta	No	No	Importer	-
Netherlands	Yes	Yes	Importer	-
Poland	Yes	No	Exporter	-
Portugal	No	No	Importer	-
Romania	No	No	Exporter	-
Slovakia	No	No	Exporter	-
Slovenia	No	No	Importer	-
Spain	No	No	Importer	-
Sweden	Yes	No	Exporter	-
United Kingdom	Yes	Yes	Importer	-
EU 28				-

- Under the assumption that net COP exporter MS may have less flexibility in managing their storage needs in comparison with net COP importer MS, an analysis was developed to highlight the “true” potential concerns from a trade perspective
- Out of the 28 MS, **the only net exporter recording shortages above 500 000 tonnes (i.e. the volume set as “threshold”) and with storage capacity below 75% of their average storage needs is Latvia**
- Other seven MS (Denmark, Germany, Greece, Ireland, Italy, Netherlands, and the UK) result to have (contingent) shortages above 500 000 tonnes: being net importers of COP, these MS have more flexibility in managing their storage needs
- Lithuania, Poland and Sweden are next exporters with shortages above 500 000 tonnes but with a limited relative weight on their respective storage needs (*relative “threshold”*)

Storage capacity – factors influencing evolution

Factors specific to the functioning of COP supply chains

- Growth in COP yields and production
- Increasing exports of COP
- Increased volatility of prices on the EU market
- Switch to just-in-time inventory management models
- Need of segregation of lots of products with different quality
- Plans aimed at expanding/upgrading storage capacities for COP

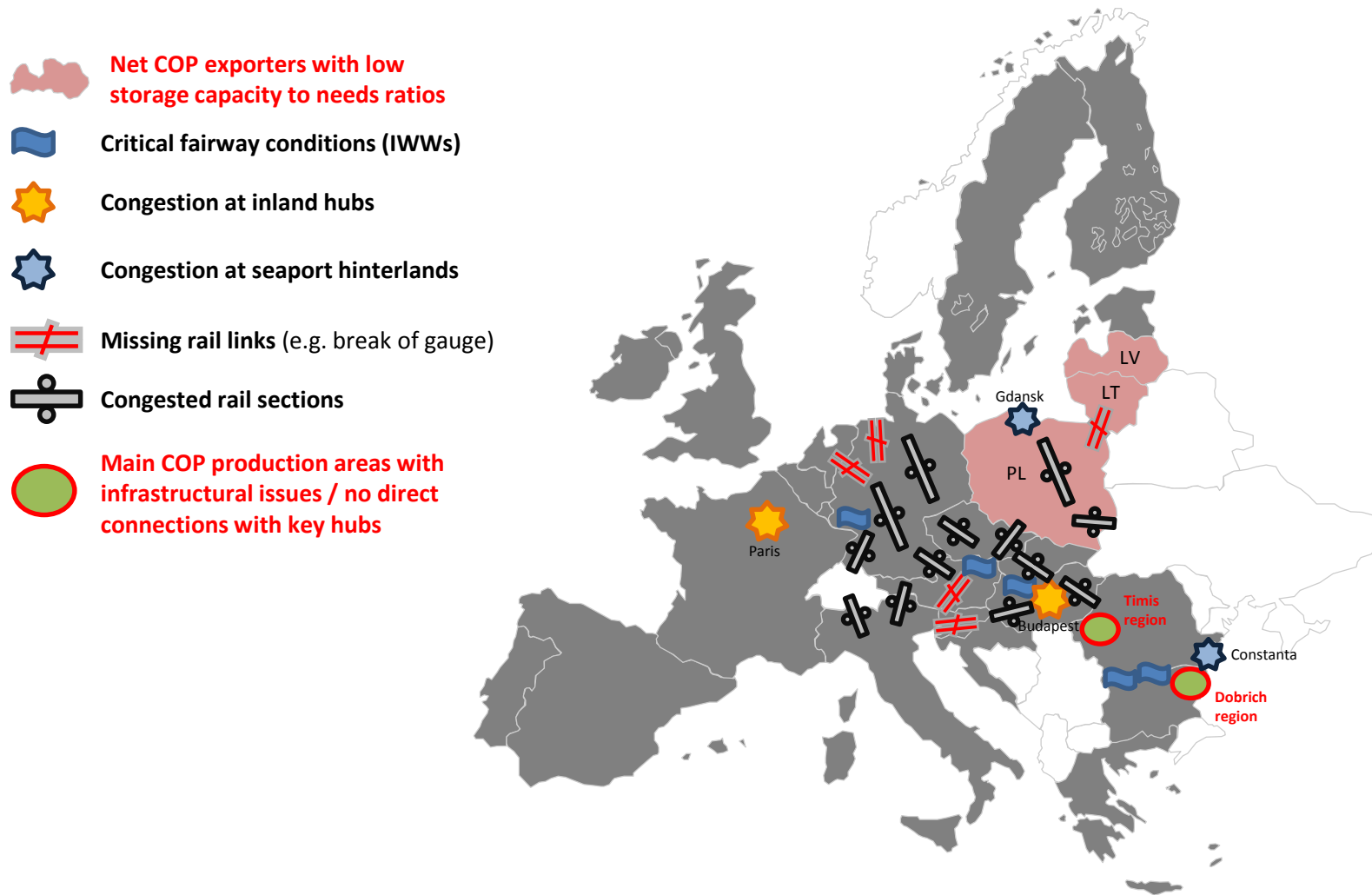
Factors related to the functioning of the agribusiness system as a whole

- Specific needs by large-scale, multinational and multi-commodity agribusiness companies
- Public policies and support
- Privatisation of former state-owned agribusiness companies (Eastern EU MS)

Other factors

- Availability of non-specialised, multi-purpose storage facilities for hire at transportation hubs
- External factors (e.g. building permits)

Logistical infrastructure – bottlenecks



Storage capacity – influence of bottlenecks on trade

Member States	2005 (Shortage)/ Surplus (000 tonnes)	2015 (Shortage)/ Surplus (000 tonnes)	2005 - 2015 Evolution	Ranking	Total trade average 04-06 (000 tonnes)	Total trade average 13-15 (000 tonnes)	2005 - 2015 Evolution	Ranking
Austria	142	-15	-158	18 th	2.940	4.691	1.751	12 th
Belgium	489	7	-482	20 th	14.323	16.056	1.733	14 th
Bulgaria	1.258	5.131	3.873	2 nd	2.374	7.021	4.647	5 th
Croatia	-250	-449	-199	17 th	560	1.925	1.365	16 th
Cyprus	-128	135	264	10 th	657	594	-63	26 th
Czech Republic	727	1.119	392	9 th	2.801	4.696	1.895	10 th
Denmark	-1.407	-2.619	-1.212	25 th	4.070	4.890	820	18 th
Estonia	192	-319	-510	21 st	320	878	558	21 th
Finland	2.119	2.726	607	8 th	1.047	1.196	149	22 th
France	19.451	18.745	-706	23 rd	38.430	44.463	6.033	3 rd
Germany	-8.169	-9.791	-1.622	27 th	26.719	38.558	11.839	2 nd
Greece	-1.354	-1.398	-44	12 th	3.142	2.462	-679	27 th
Hungary	1.054	5.817	4.762	3 rd	5.456	8.151	2.695	7 th
Ireland	-701	-652	49	13 th	1.494	2.068	574	20 th
Italy	-3.459	-2.561	899	6 th	14.826	16.379	1.553	15 th
Latvia	91	-1.028	-1.119	24 th	595	2.785	2.190	9 th
Lithuania	1.618	-1.344	-2.962	28 th	1.238	3.851	2.614	8 th
Luxembourg	-151	-57	94	14 th	205	301	95	23 th
Malta	-31	56	87	15 th	162	146	-16	25 th
Netherlands	-780	-1.071	-291	19 th	26.170	29.741	3.571	6 th
Poland	-10.501	-6.623	3.878	4 th	4.035	9.838	5.803	4 th
Portugal	464	370	-94	11 th	5.063	5.129	67	24 th
Romania	-2.836	5.264	8.099	1 st	2.265	14.808	12.543	1 st
Slovakia	1.814	1.184	-630	22 nd	1.285	2.585	1.300	17 th
Slovenia	80	61	-19	16 th	1.297	3.038	1.741	13 th
Spain	12	2.984	2.973	5 th	20.387	19.465	-922	28 th
Sweden	-1.531	-604	927	7 th	1.794	2.477	683	19 th
United Kingdom	-8.836	-10.370	-1.535	26 th	9.106	10.949	1.844	11 th
EU 28	-10.624	4.698	15.321		192.762	259.142	66.380	

↑ Countries succeeding in overcoming 2005 shortages

↑ Top 10 Member States in shortages reductions / surplus improvements which are also among top 10 Member States in trade increase

- Out of the top 10 MS with the greatest reduction of 2005 shortages, **five MS** are also in the top-10 ones recording the highest increases of total trade in the 2005-2015 period: Bulgaria, Czech Republic, Hungary, Poland and Romania.
- Among them, **Romania** moved from a situation of shortage of storage capacity to a situation of surplus, while **Poland** reduced its shortage of storage capacity in the same period.

Solutions to overcome bottlenecks

- **Investing** in additional storage capacity, both through expansion of existing facilities and through construction of new greenfield ones. These two processes can also be combined with a rationalization of the storage system.
- In order to effectively address bottlenecks, the **linkages between the storage system, COP crops logistics and the related infrastructure should be carefully considered**, with a view to implementing **integrated solutions** addressing bottlenecks in both storage and transportation of COP crops.
- Trend towards the adoption of **JIT inventory management models**
- For farming areas where producers are also focused on **export trading**, investments in additional storage capacity towards two types of locations:
 1. Locations offering access to efficient transport solutions
 2. Sites located at the main inland transportation hubs in the transport corridors of interest

Solutions to overcome bottlenecks

Logistical infrastructure

- Improve **fairway conditions** along critical IWWs (especially the Danube)
- Close **missing links**, especially on railways (electrification and/or double tracking; dual-gauge lines to link Baltic MS; construction of critical base tunnels; etc.)
- **Improve rail interoperability** (alignment of electrification systems, control and command systems, signalling systems, etc.)
- **Improve regional transport connectivity** / address congestion from interference between regional and inter-regional traffic flows => increase **capacity** on congested rail sections / construction of **bypasses** at congested hubs

Conclusions on storage capacity

- Current **total storage capacity** for COP in the EU28: around **359 million tonnes** (up 20% from 300 million tonnes in 2005); over the same period, EU production of COP crops increased by 11% (312 million tonnes => 346 million tonnes)
- The detection of storage capacity shortage is influenced by the **methodology followed for the estimation of storage needs**; in general **there is no structural shortage of COP storage capacity in the EU**; only a limited number of MS, principally the Baltic MS and Poland, may be affected
- Available storage capacity for COP has **increased in all 28 Member States** since 2005; substantial increases mostly in Eastern EU MS (Bulgaria, Poland, Romania); focus on rationalisation, expansion and/or technological upgrading of existing storage facilities in Western EU MS
- **Key factors behind evolution of storage capacity** (often interlinked): growth in COP yields and production; increase in COP exports; increased volatility of COP prices; switch to just-in-time (JIT) inventory management models by processors; plans aimed at expanding/upgrading storage capacities for COP
- **Prominent investors**: agribusiness co-operatives; operators in the processing stage; export-oriented traders operating at transportation hubs. **Funding solutions**: internal resources and venture capital; public funding (EAFRD via RDPs)

Conclusions on logistical infrastructure

- **Road transportation, rail transportation and inland waterways** are often used in combination to move COP crops from cultivation areas to their final destinations
- Infrastructure used for COP crop transportation is generally used also for transportation of other goods, and often also handles passenger traffic
- Inland waterways (60-70%) and railways (30-40%) handle almost all **long-distance** COP tonnage; trucks are very important in short-distance moves
- **Four core TEN-T corridors for long distance transportation** of COP crops: Baltic-Adriatic, North Sea-Baltic, Rhine-Alpine and Rhine-Danube
- **Core logistical hubs for COP transportation:** especially along inland waterways (Rhine; Moselle; North-South axis: Netherlands ⇔ Belgium ⇔ northern France; Mittelland Canal: Rhine-Ruhr region ⇔ Lower Saxony ⇔ Saxony-Anhalt; Danube)
- **Railways:** important for COP crop moves from Hungary to Italy (via Austria), and from the Czech Republic and Poland to the North Sea ports (no IWW connections)
- **Key factors** behind infrastructural evolution: strategic governmental actions; planning and approval procedures for infrastructural projects; “Public Private Partnerships” (PPP); user financing (mainly through toll charges); R&D
- Critical role of the **European Union as the leading investor** in logistical infrastructure

Conclusions on bottlenecks and related solutions

- **Evolution of bottlenecks in storage capacity:** 13 MS improved their situation; 15 MS where the situation worsened. Most improvements in Eastern EU. **Key factors** behind evolution: increase of storage capacity (in all 28 MS); evolution of storage needs (growth in all MS except Cyprus and Romania)
- Critical **bottlenecks for logistical infrastructure** in all the four **core corridors** (critical fairway locations on the Danube; missing rail links; congested rail sections and hubs); deterioration of the overall logistical performance (LPI) in Austria and Germany; significant improvements for most of the Eastern EU MS
- Possible **impact of bottlenecks on EU internal and external trade in COP. Poland, Lithuania and Latvia:** bottlenecks may limit strategic stock management and future production and export performance. **Hungary, Romania and Bulgaria:** reliance on Rhine-Danube corridor (serious bottlenecks) may hinder future export performance
- **Solutions → investment opportunities: “integrated approach”** (addressing bottlenecks in both storage capacity and logistical infrastructure); location of additional storage capacity at key transportation hubs or export terminals; improvement of fairway conditions on IWWs; completion of missing links; improvement of interoperability of railways (→ efficiency); improvement in regional transport connectivity (addressing congestion); enhancement of intermodality

Thank you for your attention

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Mapping of storage facilities



Main classification criteria

Indications about the **criteria to classify individual storage facilities under the relevant categories** were given to national experts in charge of mapping at MS level

The application of the criteria implied a **certain degree of “expert judgment”**

- **Farming cooperatives**: operators mainly dealing with storage and handling of **COP production of farmers which are members of the cooperative**; where **downstream activities** (*trading and/or processing => vertically integrated agribusiness cooperatives*) and/or storage and handling of **COP production of non-members prevailed => “trading/wholesale”** or “processing industry”
- **Processing industry**: operators **managing COP processing capacity** (including compound feed production) **besides COP storage capacity** (*irrespective of the location of facilities within or outside logistical hubs*)
- **Transportation hubs**: all operators managing COP storage capacity (*but excluding those also managing COP processing capacity*) **within the area of logistical hubs with dockside or rail-side handling capacity**
- **Trading/wholesale**: operators not falling in the above categories (“**exclusion approach**” => no processing capacity, facilities outside the area of logistical hubs, facilities inside the area of logistical hubs without dockside/rail-side handling capacity)