

Working Paper

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(No) bridge over troubled water: Maritime food transport as networked critical infrastructure of the EU

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Introduction

A number of recent events have shown that disruptions to maritime freight transport can have immediate and serious consequences for food supplies:

- The explosion at the *port of Beirut* in the spring of 2020, triggered by the explosive fertiliser component ammonium nitrate, not only claimed many lives. In addition to the fertiliser depots, port-based grain silos were also destroyed, leading to a tense supply situation in Lebanon and necessitating a fundamentally new import management system to this day: as storage capacities are limited, a continuous supply of food is now required for the country¹, which is heavily dependent on imports and food aid.
- The Russian war of aggression against Ukraine from spring 2022 onwards not only reduced the production capacity of Ukraine, a globally significant grain-producing country. It also curtailed potential delivery shortages due to transport disruption for supply from the entire delivery region of Ukraine and Russia. This initially resulted in immediate shortages of food availability for those countries that typically import from the affected region and had already finalised purchases, such as Egypt and Lebanon. However, the resulting global price increase also burdened all importing countries, specifically economically weak ones.² The international community tried to alleviate these bottlenecks through a combination of measures from very different policy areas, such as improving transport logistics, port storage and port connectivity. In particular, land alternatives to the sea passage («solidarity lanes») were supported, accompanied by trade approaches facilitating border management. Humanitarian aid was also increased to compensate for resulting burden especially for developing countries. Under the leadership of the United Nations and with the participation of Ukraine, Russia and Turkey, the «Black Sea Grain Initiative», launched in the summer of 2022, finally reopened the corresponding sea passage as a globally relevant transport route for agricultural and fertiliser products originating from Ukraine and Russia. Overall, these measures eased the transport and thus the global supply and price situation. However, Russia repeatedly threatened to cancel the «Black Sea Grain Initiative» and eventually did so in the summer of 2023. Already prior to the formal cancellation, the actual transport had been slowed down by delays linked to controls, often criticized as deliberate. Today, Ukraine has managed to resume transport close to the coast. Together with the land-based alternatives, recent export quantity almost reached pre-war levels.³

¹ United Nations World Food Programme, «More People Than Ever Rely on Food Assistance across Lebanon», 21 October 2022, <https://www.wfp.org/news/more-people-ever-rely-food-assistance-across-lebanon> (accessed 12 April 2023).

² Bettina Rudloff/Linde Götze, *War in Ukraine and food security: Developing a judicious »food first« strategy for autumn*, Berlin: Stiftung Wissenschaft und Politik, 14 March 2023 (SWP Point of View), <https://www.swp-berlin.org/publikation/war-in-ukraine-and-food-security-developing-a-judicious-food-first-strategy-for-autumn> (accessed 12 April 2023).

³ Noah Berman/Mariel Ferragamo/Sabine Baumgartner, *How Ukraine Overcame Russia's Grain Blockade*, Council on Foreign Relations, February 2024, <https://www.cfr.org/article/how-ukraine-overcame-russias-grain-blockade> (accessed 14 March 2024).

- Since the renewed Middle East crisis fuelled by the terrorist attacks against Israel in October 2023 and the following military operations of Israel in Gaza, there has also been an increase in terrorist attacks on merchant ships by the Hamas-supporting Houthi militia in the Red Sea. As a result, ships were being diverted via the Cape of Good Hope, a significantly longer route, which in itself drastically increases fuel costs – in addition to other costs such for personnel due to the extended duration of the voyage.⁴ For agricultural and agriculturally relevant products, such delays can be particularly severe, either because of perishability or because of living cargo and animal welfare: in February 2024, for example, a ship carrying thousands of live sheep and cattle from Australia had to re-route due to attack threats leading to longer transport time.⁵ In the meantime, an international naval alliance led by the US and the UK as well as an EU maritime operation have begun to protect shipping routes, including Germany.⁶

Irrespective of these recent threats, both food supply and maritime transport have long been considered essential to the functioning of national economies and societies in Germany and the EU. Therefore, they were defined as critical infrastructure requiring protection. As the two areas are closely intertwined, their joint, interconnected handling poses a particular challenge. Stronger political coordination is therefore essential.

⁴ *Tagesschau*, »Höhere Preise und leere Regale durch Huthi-Angriffe im Roten Meer?«, 20 December 2023, <https://www.tagesschau.de/inland/regional/nordrheinwestfalen/wdr-hoehere-preise-und-leere-regale-durch-huthi-angriffe-im-roten-meer-100.html> (accessed 21 December 2023).

⁵ Hilary Whiteman, »Thousands of sheep and cattle stranded at sea after Red Sea crisis turn back«, in: *CNN World*, 2 February 2024, <https://edition.cnn.com/2024/01/31/australia/australia-ship-sheep-cattle-red-sea-intl-hnk/index.html> (accessed 14 March 2024).

⁶ Sven Biscop, *The EU and the Red Sea: Now This Is Geopolitics*, Egmont, 22 January 2024, <https://www.egmontinstitute.be/the-eu-and-the-red-sea-now-this-is-geopolitics/> (accessed 14 March 2024).

Secure international and European food supply as a public policy objective

The Food and Agriculture Organization of the United Nations (FAO) defines countries' food security along four different pillars. These include trade, and therefore implicitly maritime transport, for a secure supply,⁷ as 80 per cent of international agricultural trade takes place by sea.

1. *Food availability* addresses any supply independent from its origin and thereby includes domestic production and storage, imports and as well food aid, which is also mainly transported by sea.
2. *Access to sufficient food (or affordability)* does not only mean physical access to markets e.g. via maritime routes but also economic access referring to the price level. The latter can increase rapidly if maritime supply structures are disrupted. It is more problematic for lower-income households and economically fragile countries, as it increases national expenditures on imports and aid supplies.
3. The *usability of available food* refers to interconnectedness as it also means the availability of other relevant infrastructure, such as energy for transport, fertiliser production and food processing, as well as drinking water for food preparation.
4. Finally, *stability* refers to security across all of the aforementioned pillars, which must be present at the same time.

European supply security: more indirectly vulnerable

Since the founding of the European Economic Community (EEC), Europe's own food supply has increased continuously as far as the FAO's first pillar of availability is concerned. This was achieved by stimulating domestic production through immense political regulation and financial incentives. With the exception of products such as fruit and vegetables and special tropical products such as coffee and tea, the EU's level of self-sufficiency is now close to or above 100 per cent in most food products, indicating that they are being exported.⁸

As a result, the EU's significance as an international trading player has also risen continuously: in recent years, the EU has been both the world's largest exporter and most important importer of agricultural products. Overall, the FAO's pillar of availability therefore

⁷ Food and Agriculture Organisation of the United Nations (FAO), *The State of Food and Agriculture 1996, Food Security: Some Macroeconomic Dimensions*, Rome 1996 (FAO Agriculture Series No. 29).

⁸ Alan Buckwell/Alan Matthews/David Baldock/Erik Mathijs, *CAP - Thinking Out of the Box, Further modernisation of the CAP - Why, What and How?* Brussels: RISE Foundation, 2017, p. 35, <https://risefoundation.eu/cap-thinking-out-of-the-box-report/> (accessed 12 April 2023).

appears stable for the EU itself.⁹ However, the FAO's second pillar on affordability may face some risks: food prices were rising in Germany and the EU even faster than the general level of inflation. According to the Federal Statistical Office, in June 2023, food price inflation rate was at 13.7 per cent in Germany, which was more than twice as high as the rates of the general inflation and four times higher than that of energy price inflation.¹⁰

One reason was the rise in international prices, pushed by the war-related disruption of agricultural transport across the Black Sea. Another reason is increasing energy costs for production and processing, but possibly also price margins that have been exhausted by retailers in a system with an already limited competitive structure. In total, this price increase primarily affects lower-income households in the EU, which already spend a high proportion of their income on food.

International supply security: highly vulnerable with indirect risks for the EU

Price increases as one dimension of risk for food security have a comparatively larger negative impact internationally in countries with high shares of lower-income households than in the EU. Economically vulnerable countries may suffer from rising expenditures for imports, which limit the purchase of food and fertilisers. Additionally, food aid supplies are also becoming more expensive, potentially limiting their availability. The war-induced blockade of the Black Sea passage highlighted supply risks for the countries sourcing grain mainly from the conflict region, for example in North Africa, especially at the beginning of the war. Overall, disruptions in the maritime transport system are more likely to lead to supply risks in poor countries than in the EU.

However, there may be indirect effects relevant for the EU as well: an increase in costs may affect its political credibility as a major international player in development and humanitarian aid. Any increases in the price of agricultural products often translate into a reduction in the amount of food that can be purchased with a fixed amount of aid over a longer period of time, at a time when the need for support is greatest.

In addition, during periods of agricultural shortages and thus rising prices, there are also calls in large agricultural countries within the EU to expand domestic production in order to curb prices (leading to an increase in farm income as well). However, this can lead to conflicts of interest with environmental protection regulations, as demonstrated by the decision in the EU in response to the Russian invasion to suspend ecologically motivated set-asides that had already been agreed.¹¹ Such a measure could also damage the

⁹ The Economist Group, *Global Food Security Index 2022*, Economist Impact, 2022, https://impact.economist.com/sustainability/project/food-security-index/reports/Economist_Impact_GFSI_2022_Global_Report_Sep_2022.pdf (accessed 12 April 2023); European Commission, *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: Safeguarding food security and reinforcing the resilience of food systems*, COM(2022) 133 final, Brussels, 22 March 2022, p. 5, https://agriculture.ec.europa.eu/system/files/2022-03/safeguarding-food-security-reinforcing-resilience-food-systems_0.pdf (accessed 12 April 2023).

¹⁰ Statistisches Bundesamt, »Inflationsrate im Juni 2023 bei +6,4 %«, press release, Berlin, 22 July 2023, https://www.destatis.de/DE/Presse/Pressemitteilungen/2022/12/PD22_529_611.html#:~:text=Food%20increased%20in%20price%20over%20the%20year%20as%20high%20as%20the%20overall%20inflation%20rate (accessed 12 April 2023).

¹¹ Bettina Rudloff/Christine Wieck, »Zukunftsfähige Agrarpolitik«, in: *Internationale Politik* (online), 27 February 2023, <https://internationalepolitik.de/de/zukunftsfahige-agrarpolitik> (accessed 16 September 2023).

international credibility of Germany and the EU with regards to compliance with the sustainability goals of the United Nations.

Finally, supply problems in other countries can also entail security policy destabilisation risks for Germany and the EU or be used as a threatening tool. This includes the current accusation by Russia and some African actors that Western sanctions – though not directly applied on food – not only affect sanctioned Russia, but also African regions. Such unintended effects and accusations make foreign policy coalitions more difficult for the EU and were criticized as being misused by Russia as a pretext for ending the Black Sea Grain Initiative.¹²

¹² Bettina Rudloff, »Nahrungsversorgungsrisiken im Sanktionsumfeld strategisch begrenzen«, in: Janis Kluge (ed.), *Wirtschaftssanktionen gegen Russland - internationale Perspektiven und globale Auswirkungen*, Berlin: Stiftung Wissenschaft und Politik, 11 July 2022 (SWP 360 Grad), <https://www.swp-berlin.org/publikation/wirtschaftssanktionen-gegen-russland-internationale-perspektiven-und-globale-auswirkungen#publication-article-59> (accessed 12 April 2023).

Sea routes and ports: vulnerable choke points for the global food supply

Which sea routes and ports are relevant for the maritime trade of food products depends first and foremost on the underlying global spatial allocation of production and consumption. This determines the direction of export and import flows and thus ports of origin and of destination. The patterns of transport routes and relevant ports vary considerably depending on the agricultural commodity or fertiliser product.

From a global perspective, many agricultural commodities originate and are therefore exported from the major producing regions of the USA, Brazil, and Argentina (grain, oilseeds, meat). Conversely, ports of entry for these products tend to be concentrated in the importing regions of Europe and Asia.¹³

Different routes are relevant for the European market than for other global import regions (Table 1):

- In terms of *global* fertiliser supply, for example, the Strait of Malacca, together with the Strait of Gibraltar, dominates transport originating in China, Russia, and Morocco. Malacca also plays a role in global grain transport, but hardly any for the EU. The Turkish waters, the Suez route and the Bab al-Mandab Strait, which are used to supply grain importers in Africa, the Middle East, and Asia, are the most important for global grain transport.
- For the *European supply*, the Turkish sea routes and the ports of Gibraltar and Dover are currently of critical importance for both fertilisers and grain. It remains to be seen how Brexit will affect these transport routes in the long term. As far as grain supplies are concerned, the Suez Canal and the Bab al-Mandab Strait are also of importance to European grain supplies.

¹³ Rob Bailey/Laura Wellesley, *Chokepoints and Vulnerabilities in Global Food Trade*, London: Chatham House, 27 June 2017 (Chatham House Report), p. 48, <https://www.chathamhouse.org/sites/default/files/publications/research/2017-06-27-chokepoints-global-food-trade-embargoed.pdf> (accessed 20 May 2023).

Table 1

Product-specific transport importance of individual sea routes using the example of grain and fertiliser (share of import volume, average 2018–2020, bold and blue: most important routes)

	Turkish sea routes (Bosporus, Dardanelles)	Suez	Bab al- Mandab	Malacca	Gibraltar	Panama	Hormuz	Dover
Grains								
EU	11.0 %	4.7 %	4.7 %	2.0 %	5.1 %	2.3 %	0.0 %	5.9 %
World	16.7 %	14.6 %	13.6 %	13.5 %	10.7 %	9.5 %	6.4 %	3.2 %
Fertiliser								
EU	6.0 %	1.2 %	1.2 %	0.7 %	4.0 %	1.4 %	0.2 %	6.8 %
World	11.8 %	14.5 %	14.4 %	15.7 %	17.6 %	7.2 %	8.5 %	6.8 %

Adaptation: 2023 Stiftung Wissenschaft und Politik (SWP); source: Richard King, *Exploring the Cascading Impacts from Climate Shocks to Chokepoints in Global Food Trade*, London: Chatham House, 2022, Figure 2, resourcetrade.earth, <<https://resourcetrade.earth/publications/cascading-impacts-from-climate-shocks-to-food-trade-chokepoints>> (accessed 20 April 2023).

In addition to sea routes and concentration of ports, the domestic transport connections (»Hinterland«) of the ports also play a relevant role. Not only the availability of food, but also its affordability, i.e. the price as a supply-relevant parameter is affected by transport costs.¹⁴ These are made up of vessel hire (time charter), fuel (bunker), fees for using ports and canals, and insurance costs. Related to trade policy, customs inspections and standards controls also play a role. Fluctuations in these transport-related costs are, on average, greater than those in the underlying commodity prices. According to the OECD, transport costs have been particularly volatile recently. Overall, the share of transport costs in the total costs of grain and oilseeds have fluctuated between 2 per cent and 30 per cent between 2007 and 2021.¹⁵ Developed countries are affected more by transport than by production costs compared to developing countries. One reason for this may be their larger participation in international trade.

¹⁴ Annelies Deuss/Clara Frezal/Frederica Maggi, *Maritime Transportation Costs in the Grains and Oilseeds Sector. Trends, Determinants and Network Analysis*, Paris: OECD Publishing, June 2022 (OECD Food, Agriculture and Fisheries Papers No. 179), p. 21, <https://www.oecd-ilibrary.org/docserver/b1cdf6b7-en.pdf?expires=1681295352&id=id&accname=guest&checksum=1624E83706E850B99806BD7B40151493> (accessed 12 April 2023).

¹⁵ Ibid.

Criticality: Sea routes and ports at risk

Risks to a safe food supply provided by maritime transport arise across the entire spectrum of factors influencing routes and differ depending on the respective passages:

Starting point for transport criticality is already the *underlying vulnerability of the production and consumption pattern*. Natural disruptions such as major weather events (droughts, floods) or disease and pest pressure (fungal infestations, locust plagues) can shift production regions. This shift may result in changing origins of food deliveries and thereby in changing export routes. The destruction of arable land or the confiscation of production and stocks in one region, as is currently happening in Ukraine by Russia, also affects whether and how much can be produced and exported from a particular region. This can also result in alternative transport routes like the current solidarity corridors for Ukrainian exports.

Maritime transport risks in the narrower sense include intended and unintended disruptions:

- *Weather events and climatic factors* can destroy ports and their connections, or make transport conditions at sea more difficult.
- *Security factors* like war and terrorism can increase directly the costs of transport through detours or rising insurance premiums or indirectly restricted trade routes due to sanctions. Although international consensus explicitly states that the latter should not apply directly to food, non-food related sanctions can also have an indirect unintended impact on supply due to general economic uncertainty.¹⁶ Cyber-attacks and piracy can also cause disruption to transport and port logistics. For example, there were almost 100 pirate attacks off the coast of West Africa in 2019.¹⁷ And in the wake of the recent escalation of the Middle East conflict, attacks by the Hamas-affiliated Houthi militia on large transport vessels in the Red Sea are on the rise.
- *Political and institutional factors* can prevent exports, for example in the form of export bans, while the capacity of customs authorities affects dwell time and therefore the speed of supply. Food transport, in particular, proves to be extremely vulnerable when it comes to dwell time. Agricultural products are perishable, meaning that delays usually lead to a loss of quality and therefore to a rise in price.¹⁸ In addition, these products are subject to a particularly high number of quality control regulations which, depending on administrative capacity, also affect the speed and thus the security of food supply. The average demurrage time in ports varies greatly: the global median in 2022 for

¹⁶ Rudloff, »Nahrungsversorgungsrisiken im Sanktionsumfeld strategisch begrenzen« (see note 12).

¹⁷ Bettina Rühl/Benjamin Moscovici, »Unsichere Handelswege, Piraten vor Afrikas Küsten«, in: Deutschlandfunk, 28 February 2021, <https://www.deutschlandfunk.de/unsichere-handelswege-piraten-vor-afrikas-kues-ten-100.html> (accessed 12 April 2023).

¹⁸ J. Verschuur/E. E. Koks/J. W. Hall, »Ports' Criticality in International Trade and Global Supply-Chains«, in: *Nature Communications*, 13 (2022) 4351, doi: 10.1038/s41467-022-32070-0.

the type of vessel relevant to agricultural transport, *bulk carriers*, was 2.11 days.¹⁹ Germany is on average at almost two days. By contrast, turnaround times in Turkish ports on the important East Africa route are twice as slow at over four days. The pace has been slowed further in the context of the Black Sea Grain Initiative to overcome war-related frictions, which required special controls to prevent clandestine arms shipments.²⁰ There have been some accusations that these controls also were being used by Russia as political leverage for concessions.

The limited analyses to date of occurring disruptions show varying degrees of vulnerability for different globally relevant food transport routes. Overall, Bailey and Wellesley identified more climatic and institutional-political disruptive events up to 2017, whilst other security factors played only a minor role. However, even before the Russian invasion, transit and handling via the Black Sea ports were heavily burdened in that time period by trade measures and related controls.²¹

Figure 1
 »Criticality traffic light« for chokepoints for maritime transport (2002-2017)

Maritime Food Transport

Disruptions (2002-2017)

- **High Risk**
Three or more known events
- **Medium Risk**
One or two known events
- **Low Risk**
No known events

Turkish Straits Black-Sea rail networks Black-Sea ports Suez Canal Bab al-Mandab Strait of Malacca Strait of Gibraltar Panama Canal Strait of Hormuz Strait of Dover

Weather and climate risk

Temperature extremes	●	●	●	●	●	●	●	●	●	●
Flood and drought	●	●	●	●	●	●	●	●	●	●
Storms	●	●	●	●	●	●	●	●	●	●
Haze and fog	●	●	●	●	●	●	●	●	●	●

Security risk

Conflict	●	●	●	●	●	●	●	●	●	●
Terrorist attack	●	●	●	●	●	●	●	●	●	●
Piracy	●	●	●	●	●	●	●	●	●	●
Cyberattack	●	●	●	●	●	●	●	●	●	●

Political and institutional risk

Trade and transit controls	●	●	●	●	●	●	●	●	●	●
Malfunctions (repair damage)	●	●	●	●	●	●	●	●	●	●
Other unforeseen incidents	●	●	●	●	●	●	●	●	●	●

Adaptation: 2023 Stiftung Wissenschaft und Politik (SWP); source: Rob Bailey/Laura Wellesley, *Chokepoints and Vulnerabilities in Global Food Trade*, London: Chatham House, 27 June 2017 (Chatham House Report), p. 48, <https://www.chathamhouse.org/sites/default/files/publications/research/2017-06-27-chokepoints-global-food-trade-embargoed.pdf> (accessed 20 May 2023).

¹⁹ César Ducruet/Hidekazu Itoh/Olaf Merk, *Time Efficiency at World Container Ports*, International Transport Forum, August 2017 (Discussion Paper No. 2014-08), <https://www.itf-oecd.org/sites/default/files/docs/dp201408.pdf> (accessed 12 April 2023).

²⁰ United Nations Conference on Trade and Development (UNCTAD), *Port Call and Performance Statistics. Time Spent in Ports, Vessel Age and Size, Annual*, UNCTAD database, 2021, <https://unctad-stat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=170027> (accessed 12 April 2023).

²¹ Bailey/Wellesley, *Chokepoints and Vulnerabilities* (see note 13), p. 48.

Lack in interconnected regimes for secure food and maritime transport

There are numerous approaches for protection at different regime levels for both food supply and maritime infrastructure. However, they tend to operate in isolation, although they should be interlinked, as food security is directly realised via maritime transport.

Basis: Secure food supply as a human right

Protection of food security has a long-standing political tradition in many countries and, ultimately, globally. It is enshrined as a human right in Article 11 of the UN Social Covenant of 1966, which has since been ratified by over 170 countries. This starting point for protection results in specific governmental obligations to respect and guarantee this human right. The respective governmental duty to protect also extends vis-à-vis threats by third parties and non-state actors such as corporations. Under certain circumstances, this duty can have extraterritorial effects, for example the protection of the right to food in third countries. The human right to food also gives rise to some policy rules for the EU: for example, there is an international consensus based on human rights to exclude food products from sanctions such as the current ones against Russia.²²

International approaches

Firstly, general *maritime law regulations* are relevant to important maritime transport:²³ Thanks to strong sovereign rights, a port state can determine whether and how to grant entry. In this respect, there is no fundamental right to entry into foreign ports for trade purposes.²⁴ However, in the case of trade in food, such a right can be relevant to the realisation of the global human right to food.

²² Diane Desierto, »The Human Right to Food, Freedom from Hunger, and SDG 2: Global Food Crisis and Starvation Tactics from the Russian Invasion of Ukraine«, *EJIL:Talk! Blog of the European Journal of International Law* (Blog), 9 June 2022, <https://www.ejiltalk.org/the-human-right-to-food-freedom-from-hunger-and-sdg-2-global-food-crisis-and-starvation-tactics-from-the-russian-invasion-of-ukraine/> (accessed 12 April 2023).

²³ See Christian Schaller, »Völkerrechtliche Grundlagen des Schutzes maritimer kritischer Infrastruktur«, in: Daniel Voelsen (Ed.), *Maritime kritische Infrastrukturen*, Berlin: Stiftung Wissenschaft und Politik, February 2024, <https://www.swp-berlin.org/publikation/maritime-kritische-infrastrukturen#hd-d66993e981> (accessed 26 February 2024).

²⁴ Moritz Bollmann et al, »Das Internationale Seerecht – ein potentes Regelwerk«, in: *World Ocean Review*, 1 (2010) 10, p. 207, https://worldoceanreview.com/wp-content/downloads/wor1/WOR1_de_Kapitel_10.pdf (accessed 12 April 2023).

Trade policy regulations can, in turn, influence the underlying route pattern of maritime transport. For example, customs concessions make certain countries of destination more attractive than others. Food security explicitly justifies many exceptions to the basic WTO's aim of open trade.²⁵ For example, a country can impose strict export bans in the event of supply shortages (GATT XI). If utilised by large agricultural exporting countries, they reduce the world market supply for import-dependent countries and thus drive up prices. On the import side, tariff increases on agricultural products are usually bound to a maximum limit and used to protect domestic production (WTO Agreement on Agriculture, Art. 5), which in turn can depress global prices in countries with high demand. Additional *trade facilitation measures* in the 2017 WTO agreement include accelerated border processing through digitalisation and technical support to the specific port organisation. This can reduce handling time, which is a particular relevant for perishable agricultural products.²⁶

Existing monitoring and early warning systems can link different dimensions of trade and maritime transport. In response to the last major global agricultural price crises in 2008 and 2011, the G20 established the Agricultural Market Information System (AMIS). It aims to stabilise markets through better communication of shortages and to avoid counterproductive political measures such as export restrictions, which are particularly prevalent in the agricultural sector. In addition to prices of selected agricultural products and fertilisers it also includes other relevant parameters like energy costs, which are tracked in the database through oil and ethanol prices. Transport information, on the other hand, has so far only been collected in the form of average freight costs for maritime transport.

European and German approaches

In the EU and Germany, regulations for the protection of maritime food supplies originate from very different political frameworks with their respective own logics. They also differ depending on whether state or private actors are at the centre of obligations:

Explicit regulations for the protection of critical infrastructure in the narrower sense primarily define the role and duties of private operators. Maritime agricultural trade combines two often individually defined critical infrastructures – food security and maritime transport. These are approached differently in existing regulatory frameworks:

- For a long time, the *food sector* was defined as critical infrastructure in Germany. At EU level this is the case only after the reform of the two European directives on critical entities and cyber security in 2023. However, the definitions differ between the two EU directives: under the new *directive on resilient critical operators (CER)*, food is considered one of the eleven »critical« sectors that are subject to risk assessment, management and documentation obligations as well as defined monitoring rules. In contrast, under the new *Cybersecurity Directive (NIS-2)*, food – unlike drinking water, for example – is only considered one of the seven »important« sectors. These are subject to less stringent operator obligations with regard to cyber management and weaker controls than the eleven so-called essential sectors, which also cover shipping.

²⁵ Bettina Rudloff, *Trade Rules and Food Security - Scope for Domestic Support and Food Stocks*, Berlin: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), September 2015, https://snrd-asia.org/download/sector_project_agricultural_trade_and_value_chains/Trade-Rules-and-Food-Security.pdf (accessed 12 April 2023).

²⁶ UNCTAD, *Review of Maritime Transport 2021, Chapter 6: Legal and Regulatory Developments and the Facilitation of Maritime Trade*, 18 November 2021, p. 135, https://unctad.org/system/files/official-document/rmt2021ch6_en.pdf (accessed 12 April 2023).

- *Maritime transport in Germany* is included in the transport sector component »Verkehrssystem in Binnen- und als Seeschifffahrt« (»Transport system in inland and maritime shipping«). According to the new BSI-KritisV of 2021, this sector also explicitly includes ports, differentiated into three types of facility including transshipment facilities. The EU's CER confirms transport as a critical entity. As in Germany, maritime transport is differentiated according to different types of facilities in ports.

These two infrastructures, food and maritime transport, also refer to other policy approaches that pursue specific protection goals beyond the mentioned operator obligations:

In *foreign investment screening procedures*, investments in infrastructure, for example, may be excluded if they are likely to jeopardise what is known as »public order«. ²⁷ Corresponding reviews in Germany under the »Außenwirtschaftsgesetz« (AWG, Foreign Trade and Payments Act) and the »Außenwirtschaftsverordnung« (AWV, Foreign Trade and Payments Ordinance) do not treat food supply as a sector with a particular risk potential. The EU provisions consider food hazards as a screening factor for determining whether public order is jeopardised by foreign investments. Maritime transport is covered only to the extent that transport, in general, is referred to as physical critical infrastructure.

Other protection approaches originate from *disaster and crisis management*, including the recently adopted »resilience approaches«, which are primarily concerned with disaster preparedness. In the German »resilience strategy«, for example, food and transport – although not specified as maritime transport – are named as relevant topics. ²⁸ In the food sector, this understanding of resilience leads, for instance, to the creation of crisis food reserves. At EU level, the strategic foresight is used to raise awareness of different dimensions of resilience. However, unlike food supply, maritime transport has not yet been included in the concrete and regular monitoring of vulnerabilities as part of dashboards. ²⁹ However, given the interdependence of maritime transport with food supply, joint monitoring appears to be urgently required.

The new *Single Market Emergency Instrument (SMEI)* proposed by the European Commission in 2022 aims to ensure that the single market continues to function even in times of crisis, such as during the coronavirus pandemic. Various measures are proposed for goods and services defined as critical, ranging from rather loose formats for dialogue between agricultural stakeholders to state stockpiling or state production targets. The highly interventionist proposals, in particular, have been strongly criticised by individual member states and the business community. They can be considered risky in terms of economic policy, as such measures are often inefficient. The state, as a market player, may misallocate resources. In the food sector, the European Food Security Crisis Preparedness and Response Mechanism (EFSCM) seems less interventionist. ³⁰ This approach is part of a

²⁷ See Raphael Bossong, »Vorhaben und Mehrwert der EU zum Schutz kritischer maritimer Infrastrukturen«, in: Daniel Voelsen (Ed.), *Maritime kritische Infrastrukturen*, Berlin: Stiftung Wissenschaft und Politik, February 2024, <https://www.swp-berlin.org/publikation/maritime-kritische-infrastrukturen#hd-d66993e6291> (accessed 26 February 2024).

²⁸ Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, *Deutsche Strategie zur Stärkung der Resilienz gegenüber Katastrophen*, Berlin, July 2022, https://www.bbk.bund.de/DE/Themen/Nationale-Kontaktstelle-Sendai-Rahmenwerk/Resilienzstrategie/resilienz-strategie_node.html (accessed 12 April 2023).

²⁹ European Commission/Council of the European Union, *Joint Communication to The European Parliament and the Council on the update of the EU Maritime Security Strategy and its Action Plan 'An enhanced EU Maritime Security Strategy for evolving maritime threats'*, Brussels, 10 March 2023, https://oceans-and-fisheries.ec.europa.eu/document/download/7274a9ab-ad29-4dae-83fb-c849d1ca188b_en?filename=join-2023-8_en.pdf (accessed 15 March 2023).

³⁰ Bettina Rudloff, *Wirtschaftliche Resilienz: Kompass oder Catchword? Welche Fallstricke und Folgeeffekte die EU im Krisenmanagement beachten muss*, Berlin: Stiftung Wissenschaft und Politik, February 2022 (SWP-

specific »emergency plan« that was established in response to the Covid crisis.³¹ Another contingency plan to react to crises exists for transport, including maritime transport, and includes various focal points such as the coordination of transport actors and coordination with international partners.³²

There are further protective approaches for individual aspects of food supply, such as *the raw material act* that defines some fertiliser-relevant raw materials as critical ones. Special political awareness and support of international partnerships and investment subsidies are provided for their international procurement.

Finally, the *EU's Common Agricultural Policy* has defined the supply of food to the population as a relevant policy objective from the outset, not least following the experience of its own supply deficits after the Second World War.³³

The *European Maritime Security Strategy* of 2014 was updated in 2023. It explicitly mentions economic and transport-related security as a protection objective. Food is only addressed implicitly in the context of ensuring transport of humanitarian aid.³⁴

All of these approaches at different regulatory levels and with different focuses have one major shortcoming: they are not sufficiently networked across the two critical infrastructures of food and maritime transport. However, food security can only be realised as a networked critical infrastructure if they work in tandem.

Studie 1/2022), <https://www.swp-berlin.org/publikation/wirtschaftliche-resilienz-kompass-oder-catchword> (accessed 12 April 2023).

³¹ European Commission, *Contingency Plan for Ensuring Food Supply and Food Security in Times of Crisis*, COM(2021) 689 final, Brussels, 12.11.2021, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:689:FIN> (accessed 12 April 2023).

³² European Commission, *A Contingency Plan for Transport*, COM(2022) 211 final, Brussels, 23.5.2022, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A211%3AFIN> (accessed 12 April 2023).

³³ Rudloff, *Wirtschaftliche Resilienz* (see note 30).

³⁴ Council of the European Union, *Council Conclusions on the Revision of the European Union Maritime Security Strategy (EUMSS) Action Plan (26 June 2018)*, Brussels, 26.6.2018, https://oceans-and-fisheries.ec.europa.eu/system/files/2021-03/2018-06-26-eumss-revised-action-plan_en.pdf (accessed 30 October 2023).

Recommendations: Full speed ahead towards networking and internationality

The identified criticality of maritime sea routes and ports reveals different risks of disruption depending on the region. Hence, also different protective measures are required. Some existing approaches are already well developed, but could be expanded further:

The international monitoring system AMIS, initiated by the G7, could be used to *continuously monitor* disruptive factors and should be examined for possible expansion. To date, disruptions to the maritime transport system have only been recorded if they are reflected in global freight prices on the international agricultural market. In the »policy module« of AMIS, where trade policy and market disrupting measures such as export bans by individual countries have been recorded, information on disruptions in maritime passages should be differentiated more strongly by region. In addition, the risk traffic light already introduced by Baily and Wellesley 2017 (Fig. 1) could be further developed by continuously inputting any disruptions that occur, such as the current war of aggression by Russia.

Alternative routes that can be used quickly should be assessed on an ongoing basis. This requires not only forward-looking cooperation with relevant partners, but also timely communication to ensure political acceptance. This can currently be seen in the conflicts over solidarity corridors for agricultural exports from Ukraine, which mean increased competitive pressure for Eastern European member states.

In view of the interconnectedness of the two infrastructures of food and maritime transport, *policy coordination* is particularly important. The variety of suitable and existing protective measures stems from very different policy areas such as trade, development, environment, civil protection, defence and security policy. The trade-related responses to the war against Ukraine show that it is possible to bring together different actors and policy areas in order to mitigate the consequences for food supply. For example, the EU's assistance package for Ukraine includes measures to facilitate trade and support alternative routes to the Black Sea passage, partly by land and partly by waterways such as the Danube.³⁵ However, this cooperation has been more of an ad hoc crisis response than a systematic, forward-looking, and policy-based coordination. Existing

³⁵ Bettina Rudloff, »Politischer Umgang mit Nahrungsrisiken: Herausforderungen, Optionen und Verbesserungsansätze«, in: *Wirtschaftsdienst: Zeitschrift für Wirtschaftspolitik*, Konferenzheft: Ökonomische Folgen des Krieges, 103 (2023) 13, pp. 50–56, <https://www.wirtschaftsdienst.eu/inhalt/jahr/2023/heft/13/beitrag/politischer-umgang-mit-nahrungsrisiken-herausforderungen-optionen-und-verbesserungsansaetze.html> (accessed 12 April 2023).

interconnected approaches, which have so far tended to be national, could be scaled to the European and international level.

However, apart from monitoring, there is still little evidence of increased international coordination of critical infrastructure protection. Within the framework of the G7, a better and more intensive exchange on maritime and food-related infrastructures would provide an opportunity to find coordination approaches. The US and Canada, for example, have a similar approach to critical infrastructure protection as the EU and have been pursuing bilateral cooperation for some time.³⁶ In view of the fact that the G7 brings together major agricultural producing, exporting and thus, transporting countries, better coordination between these countries could contribute to the overall protection of critical transport infrastructure. In the event of transport disruptions, they may ensure a fast cooperation. These infrastructure approaches usually define private commitments, but they should be considered together with other approaches by government actors, such as trade policy. In this way, trade policy approaches and infrastructure measures can be mutually supportive. Based on monitoring of criticality, the EU could also seek corresponding transport partnerships with countries that are crucial for strategically relevant and vulnerable passages and ports – for example with Turkey for the Black Sea passage and with Egypt for the Suez Canal (Table 1). This could also counterbalance China's New Silk Road project, which already includes at least partnership agreements on port projects in numerous countries.

In some cases, it may also make sense to secure sea routes or ports militarily: for example, military operations such as the EU's »Atalanta« mission have already been carried out to curb supply-threatening piracy. The decisive factor here is the respective threat situation and thus the possible justification for military operations. The US has recently initiated an international alliance for the military protection of merchant ships in the Red Sea against Houthi attacks.³⁷ Another operation followed by the EU including Germany since early 2024.

All of the aforementioned recommendations could prioritise the bottle necks that have been identified as crucial for food supply. International synergies should be utilised and joint action taken where especially critical chokepoints for transporting food and energy do not affect one country alone.

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³⁶ Public Safety Canada/US Homeland Security, *Canada-United States Action Plan for Critical Infrastructure*, 2010, <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/cnd-ntdstts-ctnpln/index-en.aspx> (accessed 12 April 2023).

³⁷ See Göran Swistek, »Der Schutz maritimer Infrastrukturen aus militärisch-sicherheitspolitischer Perspektive: Nato und Bundeswehr«, in: Daniel Voelsen (Ed.), *Maritime kritische Infrastrukturen*, Berlin: Stiftung Wissenschaft und Politik, February 2024, <https://www.swp-berlin.org/publikation/maritime-kritische-infrastrukturen#hd-d66993e5412> (accessed 26 February 2024).