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The impact of deglobalization on the Port of Rotterdam: a critical analysis of the long-term scenarios developed by the Port Authority

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Abstract

This research critically examines the long-term scenarios developed by the Port of Rotterdam Authority in the context of deglobalization, a trend characterized by the retreat from global economic integration and the rise of regionalism and economic nationalism. As global trade faces increasing challenges due to protectionist policies, trade wars, and shifting geopolitical dynamics, the Port of Rotterdam, one of the world's most significant maritime hubs, must reassess its strategic outlook to remain resilient. The primary objective of this research is to evaluate whether the Port Authority's four long-term scenarios, developed in collaboration with Oxford Economics, remain valid considering potential deglobalization. Through an extensive literature review, eight key characteristics of deglobalization are identified and used as a framework to analyze the scenarios. The analysis involves both qualitative and quantitative methods, assessing each scenario's alignment with the trends and characteristics of deglobalization. The findings of this study reveal varying degrees of alignment between the scenarios and the identified deglobalization trends. Based on this assessment, strategic recommendations are provided to enhance the Port of Rotterdam's resilience and adaptability, ensuring that it can continue to thrive in an increasingly uncertain global economic landscape.

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1. Introduction

Globalization has been a dominant force in shaping the world's economic landscape over the past few decades, with increasing interconnectedness and the rapid expansion of international trade. Ports, as critical nodes in the global supply chain, have played a pivotal role in facilitating this growth. However, the rise of protectionism, trade wars, and shifts in geopolitical dynamics have begun to challenge the long-standing trends of globalization, giving rise to what is now commonly referred to as "deglobalization."

Deglobalization, marked by a retreat from global trade integration and a shift towards regionalism and economic nationalism, poses significant challenges and uncertainties for global trade and, consequently, for port operations. For a port as strategically important as Rotterdam, the implications of these trends are profound. The port's long-term viability depends on its ability to anticipate and adapt to these changes, ensuring that its operations, infrastructure, and strategic planning are aligned with emerging global realities.

To explore various potential futures, the Port of Rotterdam Authority, in collaboration with Oxford Economics, has developed four long-term scenarios that project the port's outlook for 2050. However, in light of the increasing likelihood of deglobalization, it is crucial to critically evaluate whether these scenarios accurately reflect the challenges and opportunities that a deglobalized world might present. The primary objective of this study is to assess the extent to which the Port of Rotterdam's long-term scenarios align with the trends and characteristics of deglobalization. By juxtaposing the scenarios against eight key characteristics of deglobalization identified through an extensive literature review, this study seeks to determine whether the scenarios remain valid in the context of a shifting global landscape. Additionally, this research aims to identify which scenario, if any, most accurately reflects the realities of deglobalization and to evaluate the robustness of the Port Authority's strategic planning considering these findings. The central research question guiding this study is:

"Do the long-term scenarios developed by the Port of Rotterdam Authority remain valid in the context of potential deglobalization?"

To answer this question, this research is divided into multiple sections. First, a comprehensive overview of the existing literature on globalization, deglobalization, and their impacts on global trade and port operations is provided. Subsequently, the methodology section will outline the research design, data collection, and analysis methods used. This is followed by a summary and detailed analysis of the long-term scenarios developed by the Port Authority. Building on this previous part, section 5 will present a critical analysis of these scenarios in the context of deglobalization. Finally, the research concludes with a discussion and conclusion of the findings and offers strategic recommendations to enhance the Port of Rotterdam's resilience and adaptability.

2. Methodology

The methods employed in this study offer a nuanced understanding of the current validity of the scenarios in the context of deglobalization. The study begins with an extensive literature review to establish a robust understanding of deglobalization trends and their potential impacts on global trade and port operations. This review encompasses a broad range of sources, including academic articles, industry reports, policy papers, and relevant case studies. The goal of this literature review is to identify and synthesize eight key characteristics of deglobalization, providing a foundational basis for the subsequent analysis. Following the literature review, a detailed examination of the four long-term scenarios developed by the Port of Rotterdam Authority, in collaboration with Oxford Economics, is conducted. These scenarios project the port's outlook for 2050 and are assessed to understand their core assumptions and forecasts. This includes analyzing expected throughput volumes, economic growth projections, geopolitical dynamics, and technological advancements.

For the comparative analysis, each scenario is evaluated against the eight key characteristics of deglobalization identified in the literature review. This involves both qualitative and quantitative methods. The qualitative analysis consists of reviewing narrative descriptions and strategic goals outlined in each scenario. The focus is on determining whether the assumptions and strategies in each scenario reflect an accurate understanding of deglobalization trends. The analysis also

seeks to identify which scenario, if any, addresses the realities of geopolitical tensions, trade wars, and deglobalization. The quantitative analysis consists of evaluating throughput forecasts and growth rates to assess alignment or divergence from deglobalization patterns. This analysis will help to identify whether the scenarios adequately account for the potential impacts of deglobalization on throughput volumes. Lastly, based on the comparative assessment, recommendations are made to enhance the Port of Rotterdam Authority's strategic planning.

3. Literature review

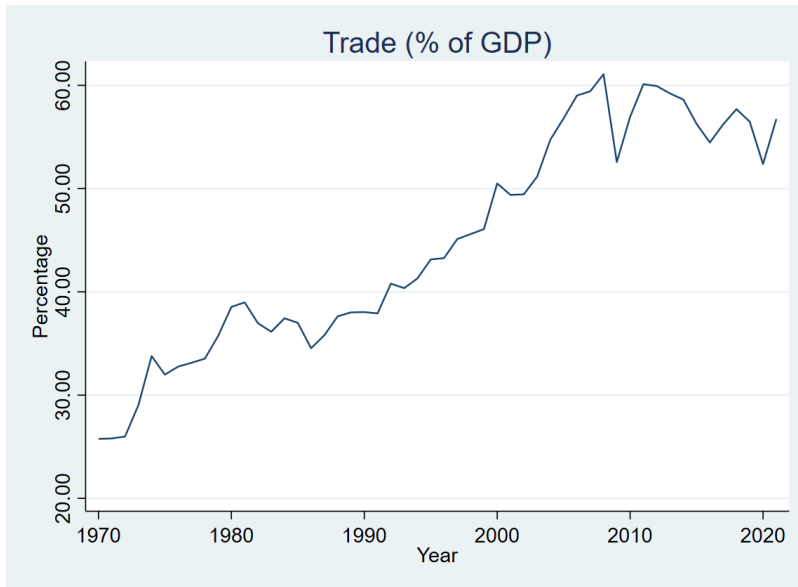
3.1. Understanding deglobalization

Researchers and experts have been studying the concept of deglobalization, seeking to understand its multifaceted nature and the implications it holds for global trade, economic interdependence, and geopolitical dynamics. According to Kim et al. (2020), deglobalization refers to a shift away from globalization, involving diminishing interdependence and integration among various entities worldwide. The term "deglobalization" is commonly employed to characterize various historical periods marked by declines in foreign direct investment (FDI) flows and the capacity of international trade, often stemming from the aftermath of regional or global economic crises (Postelnicu et al., 2015).

Following the peak of globalization in 2008, with trade as percentage of GDP at 61.1%, economic integration has steadily declined, and the world is at an inflection point over growing fears about globalization and economic interdependence (Irwin, 2022). However, the slowdown of globalization is not unexpected, considering the extraordinary and unsustainable era of hyperglobalization (period of intense and rapid integration of the global economy) witnessed in the late 1980s, 1990s, and early 2000s (Antràs, 2020). Protectionist measures are on the rise nowadays, and trade tensions and geopolitical challenges are raising concerns about the trajectory of globalization (The World Bank, 2023).

Figure 1

World trade as a percentage of world GDP (1970-2021)



Source: World Bank's World Development Indicators

The shift to “deglobalization” presents a geopolitical risk for businesses, as many governments, businesses and civil actors are contemplating the merits of adopting a more inward-focused approach to trade and commerce, seeking to align themselves within an evolving landscape (S&P Global, n.d.). Governments and global companies are seeking security and resilience over the benefits of global value chains (GVCs), in response to COVID-19, Russia’s war with Ukraine and climate change (Keller and Marold, 2023). Hence, numerous companies that previously relied on global sourcing for their inputs currently face challenges and are compelled to adjust their strategies.

A widely recognized indicator of globalization is international trade in goods and services (Goldberg and Reed, 2023). According to the authors, when assessed as a proportion of gross domestic product (GDP), imports have experienced a slight decrease since the global financial crisis, which has led to concerns that the world has started deglobalizing after 2009. According to Kim et al. (2020) deglobalization is estimated by the decreasing trend of import share in a country’s gross domestic product. Another method for measuring deglobalization, presented by the authors, is the inverse of the globalization index, as the opposite relationship between the

two can support the notion that weak globalization results in strong deglobalization (Kim et al., 2020).

3.2. Deglobalization manifestations and trends

Exploring the literature on deglobalization manifestations and trends provides valuable insights into how this phenomenon has evolved over time and its impact on various aspects of global trade and economic relations. According to De Bolle and Zettelmeyer (2019), economic nationalism has been on the rise since the mid-2000s. From Trumpism to Brexits, there is a tendency for deglobalization to be centered on developed countries, according to Kim et al. (2020). After 2007, the KOF globalization index shows a decreasing rate of growth, reflecting the fact that the USA and developed countries implemented trade barriers on imported products (Kim et al., 2020). As geopolitical tensions escalate, there is a growing recognition that economic interdependencies can lead to geopolitical vulnerabilities, prompting governments worldwide to retreat from openness and instead adopt reshoring and decoupling strategies (Korteweg, 2022). Globalization faces geopolitical challenges, notably due to the rivalry between China and the United States, as well as the conflict between Russia and Ukraine, both which involve autocratic regimes opposing democracies (Sapir, 2022). Global value chains have contracted since 2008, trade in intermediate goods has decelerated and foreign direct investment (FDI) has declined globally (García-Herrero, 2022). According to Sapir (2022) deglobalization seems to have already started for merchandise trade, with the ratio of world trade to world GDP down significantly from its peak in 2008.

The current phase of deglobalization is marked by geopolitical uncertainties such as the conflict in Europe, an energy crisis, elevated inflation rates, a decelerating global economy, and political frictions among key stakeholders (S&P Global, n.d.). These geopolitical risks pose potential challenges for businesses and markets. In their study, Kim et al. (2020) state several observations illustrating the trend of deglobalization. Firstly, developed countries have strengthened import tariff barriers. Notably, the US Trump Administration enforced high tariffs on Korea and China, which had maintained trade surpluses against the USA. Secondly, non-tariff barriers (NTBs) have been implemented through various means. Such barriers can manifest in import bans, general or

product-specific quotas, "buy national" policies, currency overvaluation, restrictive licenses, complex regulatory frameworks, import licenses, seasonal import regulations, and similar measures. Thirdly, Kim et al. (2020) state that in recent decades the global economy has increasingly revolved around GVCs, which have reshaped world trade dynamics in terms of participants and comparative advantages.

3.3. Causes of deglobalization

Examining the literature on the drivers behind deglobalization sheds light on the factors driving this complex phenomenon and helps identify key motives shaping global economic trends. According to a report by Citigroup (2024), several indicators of global integration experienced a slowdown in the decade following the global financial crisis. Global trade as a percentage of GDP flattened out, and measures of capital flow also stabilized. The increasing challenges became apparent with events such as the 2016 Brexit referendum and the election of Donald Trump as President in the United States (Citigroup, 2024). The report by Citigroup (2024) states that global trading dynamics have faced additional strains due to the geopolitical events, such as the conflict between Russia and Ukraine, recent disruptions in shipping through the Suez Canal, and escalating tensions between the United States and China, resulting in the imposition of tariffs and sanctions. Academics argue that factors propelling deglobalization encompass trade imbalances, political pressures, populism, elevated unemployment rates, and trade tensions among nations (Kim et al., 2020). Intense supply chain disruptions and increasing protectionist measures have heightened concerns about shortages, prompting governments to explore strategies such as reshoring (bringing supply chains back home), nearshoring (establishing supply chains with neighboring countries), and friendshoring (relying on supply chains from allied nations) (S&P Global, n.d.). The WTO (2023) also states that these strategies have replaced "offshoring" and "outsourcing", reflecting a shift towards localized supply chains and trade policies based on geopolitical concerns. All this contributes to the phenomenon of deglobalization.

3.4. Consequences of deglobalization

Regarding the consequences of deglobalization, existing literature provides insights into the multifaceted impacts of this phenomenon on various aspects of global trade, economic development and geopolitical relations. With the bottlenecks of supply chain and more extreme climate events, far-flung production is becoming relatively less profitable in many industries, and regionalization seems the path to stronger and more inclusive growth (O’Neil, 2022). Many capitals now perceive dependence on imports and foreign producers as a risk, leading to a growing preference for reduced import reliance and the expansion of domestic sources of supply (Lewis, 2022). This shift is closely aligned with the EU’s concept of “strategic autonomy”, which refers to the capacity of the EU to act autonomously in key strategic policy areas, without reliance on other countries (European Parliament, 2022). James (2018) suggests that the stalling growth in global trade is indicative of a trend toward onshoring production. This entails relocating processes previously outsourced to low-wage production hubs back to domestic settings, often leveraging labor-saving technologies such as robotization.

Wei (1996) studied the home country bias in the goods market among OECD countries. On average, a country imports approximately two and a half times more from its own territory compared to an otherwise identical foreign country (Wei, 1996). However, Bonadio et al. (2021) found that the "renationalization" of global supply chains doesn't necessarily enhance a country's resilience to pandemic-induced disruptions in labor supply, as this leads to increased reliance on domestic inputs that are also susceptible to disruption. Reshoring may also have drawbacks, as less geographical diversification leaves a country more vulnerable to domestic shocks (Di Sano et al., 2023). According to Di Sano et al. (2023), transferring production back from overseas can eliminate previous benefits from international comparative advantages, and increase domestic production expenses. The first two decades of 21st century have already seen substantial disruptions, including the global crisis of 2008 and the COVID-19 pandemic, hence it is understandable to have concerns that protectionist pressures may intensify, potentially harming the progress achieved in the past (Piekutowska and Marcinkiewicz, 2020).

Geopolitical tensions have begun to fragment global trade. Research indicates that since the start of the Ukraine war, international trade has become more influenced by geopolitical distance (WTO, 2023). Consequently, trade in goods between hypothetical geopolitical “blocs” has grown 4-6 percent more slowly compared to trade within these blocs (Blanga-Gubbay and Rubínová, 2023). Additionally, foreign direct investment (FDI) shows significantly lower levels between more geopolitically distant partners from 2018-21, compared to the years before (IMF, 2023). Since FDI, global supply chains, and international trade flows are closely linked, fragmentation in FDI along geopolitical lines may suggest potential similar shifts in global trade flows in the future.

James (2018) states that there are more protectionist measures, but they have not radically cut trade. However, according to the author, political deglobalization has progressed significantly, leading to the possibility of heightened conflicts over trade and financial regulation in the future. The political momentum is aimed at challenging existing regulatory methods and the complex rules established to oversee globalization (James, 2018). Hillebrand (2010) concludes that if globalization comes to a halt or recedes, the outcomes will be significantly detrimental for most countries and income groups. It is essential to consider not only the potential economic consequences but also the risks linked to disrupting vital industries and global supply chains in a deglobalized scenario, as certain critical industries may struggle to operate if the current global trade system were to be overturned (World Bank, 2023). Kim et al. (2020) predict that more countries will be closing the doors for international business activities. As global supply chains undergo restructuring on a global scale, there is a potential for the emergence of a new international economic framework, characterized by increased reliance on bilateral and regional agreements, as well as partnerships among allied nations (Goldberg and Reed, 2023). This evolution could present opportunities for countries strategically positioned to capitalize on this shifting economic landscape.

3.5. Implications of deglobalization on port operations

The literature surrounding the implications of deglobalization on port operations reveals a complex array of factors and influences, that collectively redefine the role and functionality of

ports within the evolving global trade environment. For numerous products, production and consumption are scattered worldwide, with ports serving as crucial connectors between these various points of production and consumption, thereby facilitating the establishment of global supply chains (Zuidwijk, 2017). Verschuur et al. (2022) found that 50% of global trade in value terms is maritime, and maritime transport and global supply-chain networks exhibit interactions across various spatial scales. According to the authors, fluctuations in freight flows mirror shifts in trade demand, supplying dynamics and modal distribution (Verschuur et al., 2022). Heijman et al. (2017) study the economic impact of world trade on the throughput in the Port of Rotterdam and the regional economy of Rotterdam-Rijnmond. The authors found that the global business cycle determines the port activities, and that the port activities are essential for the regional economic development. In their paper, Cho et al. (2020) attempt to estimate the shrinking demand for shipping logistics due to global protectionism. Their study proposes that tariffs combined with non-tariff barriers (NTBs) could significantly diminish international trade and the demand for maritime logistics services. According to Cho et al. (2020), depending on the scenario, port cargo is projected to decline by 3.95 to 6.9 trillion tons, potentially representing half of global cargo.

The fact that 60% of the global trade consists of intermediate goods and services has led to the creation of a highly complex network (Postelnicu et al., 2015). The authors state that fragmentation of production has reached such elevated levels in certain industries that these production chains can no longer be disrupted without significantly impairing costs and overall economic efficiency. Global protectionism, consisting of tariffs and NTBs, has the potential to inflict severe harm on the world economy and global logistics services (Cho et al., 2020). Nations deeply entrenched in GVCs would experience the most pronounced impact from a decline in demand for intermediate inputs (United Nations, 2019). It is therefore interesting to study how such disruptions ripple through maritime logistics networks, influencing cargo volumes, vessel traffic, and overall port efficiency. UNCTAD (2019) states that recent moves by some major global container lines to acquire regional carriers, such as Maersk's acquisition of Hamburg Süd, or CMA CGM's purchase of the logistics company Containerships, could signal industry endeavors to adjust and respond to changing conditions. If tariffs and retaliatory measures are scaled up and

prolonged, the impact can be significant on all countries, as this will likely reduce global volumes, redirect trade flows, and disrupt operations within global value chains (UNCTAD, 2019).

However, the dynamics of global trade are not solely driven by deglobalization. The Review of Maritime Transport 2023 report underscores the shipping sector's resilience in the face of significant challenges, including the impact of global crises. It states that containerized trade is recovering, and projected to grow by 1.2% in 2023, following a 3.7% decline in 2022 (UNCTAD, 2023). Nevertheless, trade volumes continue to lag behind pre-COVID-19 levels. The World Trade Report 2023 notes that the decline in world trade is not primarily due to the end of trade liberalization, but rather changes in the composition of global trade (WTO, 2023). This further complicates the narrative of a straightforward deglobalization trend.

In 2023, ING stated that global container volume struggles to grow after pandemic surge. The surge in empty containers throughout 2022 was an early indicator of worsening market conditions, and the Port of Rotterdam experienced a decline in container volume in 2023 (ING, 2023). The shipping industry is heavily impacted by black swan events, including the Red Sea crisis, ongoing restrictions in the Panama Canal, and escalating tensions in the US-China trade war (Stausbøll, 2024). For instance, in the first week of January 2024, the number of container ships at the mouth of the Red Sea on their way to or from the Suez Canal was 90 per cent lower compared to the beginning of 2023 (Wright, 2024). According to the WTO (2024), about half of the freight volume transiting the Suez Canal is made up of containerized goods, which saw a 72% drop from November 2023 to February 2024. During this period, freight costs more than tripled after months of decline (WTO, 2024). Since the beginning of May 2024, ocean freight container spot rates have surged significantly on the world's major trade routes, with the most substantial increase occurring on the Far East to North Europe route, rising by 30% (Stausbøll, 2024). Emily Stausbøll, Xeneta Senior Shipping Analyst, notes that the rapid increase in these rates has caused nervousness in the market, as demand hit record highs in Q1 2024 amid the Red Sea crisis, exacerbating pressure on shipping capacity. The recovery of trade could be hindered by rising trade costs and uncertainty in international relations (WTO, 2024). Geopolitical conflicts, like those in the Middle East, have notably disrupted sea shipments between Europe and Asia, and other tensions could contribute to trade fragmentation (WTO, 2024).

3.6. Linking current literature with the research question

It is interesting to study the impact that deglobalization might have on the Port of Rotterdam, as this port significantly enhances the international competitiveness of firms in the Netherlands, particularly those engaged in import and export activities (Van Den Bosch et al., 2011). Regarding the level of degree of protectionism, the Netherlands was found to have the most liberal trade of the EU countries (Piekutowska and Marcinkiewicz, 2020). As containerization reaches its peak growth phase, several processes and trends are either accelerating the global adoption of containerization or, conversely, could impose a ceiling on the remarkable impact of containers on freight distribution and globalization (Notteboom and Rodrigue, 2009). According to Guerrero and Rodrigue (2017), the five primary waves of containerization serve as illustrations of significant macroeconomic, technological, and occasionally political transformations within the global economy. However, they also offer compelling evidence that containerization exhibits cyclical behavior and that inflection points are ultimately reached, marking the end of the spread of containerization in a particular port or port range (Guerrero and Rodrigue, 2017). Port authorities are encouraged to actively embrace and enhance the regionalization process as a means of tackling present port-related challenges, mainly congestion, rising costs, limited handling capacity, and the generation of additional traffic (Notteboom and Rodrigue, 2005). According to the authors, by doing so, port authorities can better meet the demands of modern freight distribution.

The existing literature on deglobalization and on port operations offers valuable insights into the complex dynamics at play. Investigating the specific case of the Port of Rotterdam, and its dynamics amidst deglobalization can reveal insights into its operations and competitiveness. Addressing this will deepen our understanding and provide actionable insights for stakeholders navigating evolving global trade dynamics. By delving into the challenges and opportunities faced by individual ports, this research can contribute to the existing literature on port economics, trade policy analysis, and globalization studies.

3.7. Summary of key characteristics of deglobalization

In conclusion, there are some important characteristics that collectively define the phenomenon of deglobalization and help identify its occurrence in global economic trends. These aspects need to be met by port industries as well, to indicate deglobalization is occurring.

Key characteristics of deglobalization for port operations:

1. Reduction in international trade:

Deglobalization is marked by a decline in the volume of international trade, which ports can mainly manifest with a reduction in container throughput. Post-2008, the share of global trade in GDP has decreased, and FDI flows have contracted (Sapir, 2022; García-Herrero, 2022).

2. Rise of protectionism:

Increasing protectionist measures such as higher tariffs, non-tariff barriers, and trade barriers signal deglobalization, reducing the volume of international trade and the demand for port services. Developed countries, particularly the USA, have strengthened these barriers since the mid-2000s (Kim et al., 2020; James, 2018).

3. Reshoring and nearshoring trends:

Increased trends toward reshoring, nearshoring, and friend-shoring reduce reliance on global supply chains, leading to decreased long-distance shipping demands. This shift towards localized supply chains is driven by geopolitical concerns and a desire for greater resilience (S&P Global, n.d.; WTO, 2023).

4. Geopolitical tensions and trade fragmentation:

Increased geopolitical tensions lead to trade fragmentation, impacting port operations. For example, geopolitical conflicts like those in the Middle East have disrupted sea shipments between Europe and Asia (WTO, 2024).

5. Volatility in freight rates and market uncertainty:

Significant fluctuations in freight rates, as seen with the sharp increase in ocean freight container spot rates, can be indicative of a less stable and more fragmented trade environment. Rapid increases in freight rate during crises such as the Red Sea situation, reflect this volatility (Stausbøll, 2024).

6. Decline in global value chains:

The contradiction of GVCs, with a noticeable deceleration in the trade of intermediate goods, signifies deglobalization. This results from companies and countries seeking to reduce vulnerability to global disruptions (García-Herrero, 2022; United Nations, 2019).

7. Decreased efficiency and increased costs:

Deglobalization often leads to increased operational costs and decreased efficiency due to disrupted supply chains and trade flows. The overall economic efficiency is impaired when production chains are disrupted (Postelnicu et al., 2015).

8. Slower growth in inter-bloc trade:

Trade in goods between hypothetical geopolitical blocs has grown more slowly compared to trade within these blocs (Blanga-Gubbay and Rubínová, 2023). Research indicates that since the start of the Ukraine war, international trade has become more influenced by geopolitical distance (WTO, 2023).

4. Long-term scenarios presented by the Port of Rotterdam Authority for 2050

The Port of Rotterdam Authority, together with Oxford Economics, has developed long-term scenarios and throughput forecasts up to 2050 for the Port of Rotterdam. The two main directions as of 2022 are called primary paths. Primary path I leads to a world in which countries and companies decide to jointly strive for a CO₂-neutral and digitally transparent world. Consumers and markets opt for quality and transition, and broad well-being. There is broad support for the policy being pursued. In primary path II the world continues more or less on its current trajectory. The COVID pandemic, and recently the war in Ukraine, lead to nationalistic

behavior, geopolitical tensions, and short-term focus. The energy transition is getting off to a slow start and is delayed by a lack of cooperation and trust. A joint global vision is lacking to take the steps necessary to achieve the Paris targets on climate control. In this fragmented world, a shift in power relations is taking place, in which self-sufficiency is important in addition to resilience and defense.

After 2035, the two primary paths then each split into two secondary paths. These ultimately lead to four scenarios for possible world views in 2050, according to the Port Authority. The Connected Deep Green and Regional Well-Being scenarios develop from a world view in which global cooperation, a 1.5°C target, and broad prosperity are leading. Protective Markets and Wake-Up Call arise from a world with geopolitical tensions, and a focus on efficiency, financial prosperity, resilience, and defense.

4.1. Connected Deep Green

The Connected Deep Green (CDG) scenario is one of the long-term visions developed by the Port of Rotterdam Authority for the year 2050. This scenario outlines a future where sustainability and digital connectivity are paramount, driving economic, social, and environmental transformation.

In this scenario, the world is characterized by global cooperation, free trade, unity, and mutual trust, with minimal need for reshoring and nearshoring. The European Union (EU) is strong, and forms targeted alliances with the United States and China. There is a global commitment to addressing climate change and transitioning to a circular economy. Logistics chains are transparent, and digital transformations lead to decentralized data ownership. Shared interests in optimizing sustainability and efficiency drive digital innovation, accelerating progress. These structural changes and associated investments result in strong and sustainable economic growth, particularly benefiting the energy-intensive industries in Northwestern Europe.

The Rotterdam Port Model was developed in collaboration with Oxford Economics and is used to make throughput forecasts to 2050 for various new goods flowing through Rotterdam. The

scenario of Connected Deep Green shows the strongest overall growth. For the CDG scenario, Oxford Economics and the Port Authority present the following throughput forecast for 2050, as well as the compound annual growth rates (CAGR):

Dry bulk is 69 million tons (CAGR 0.3%), liquid bulk of 163 million tons (CAGR –0.6%), containers of 295 million tons (CAGR 2.3%), and breakbulk of 50 million tons (CAGR 1.7%). The total throughput forecast for CDG in 2050 is then 576 million tons.

The forecast for containers in the CDG scenario by the Port of Rotterdam Authority states that strong growth in the global economy and world trade is driving an increase in direct deepsea (DDS) volume. Exports are increasing due to the strong position of the European industry that sells sustainable products on the world market. The Maasvlakte is one of the few places in Europe where the latest generation of large container ships can be handled. The port has acquired a central position in efficient and logistics chains and is physically and digitally linked to a network of container terminals in the European hinterland. International circular flows result in additional DDS and shortsea (SS) volumes. Draft restrictions in competing European ports and increases in capacity in Rotterdam ensure an increase in transshipment (TS) via Rotterdam. Integrated logistics chains result in an increase in mainport volume. The SS volume is increasing slightly less quickly than DDS and TS, because networks are mainly intercontinental oriented and there is strong competition between SS ports.

4.2. Regional Well-Being

The second scenario that stems from primary path I is Regional Well-Being (RWB). In this scenario, developed by the Port of Rotterdam Authority, there is an increasing regional attention to quality of life, with a clean and healthy living environment, within the clusters of countries. Regional cooperation arises from idealism (partly inspired by modal differences in focus and speed of approach to energy transition), and a desire for privacy and well-being. This leads to declining growth of the world economy, only regional trade is growing. The energy-intensive industry in Northwestern Europe is shrinking. The EU is divided and weak at a global level, and the power of China and India, as leaders in knowledge and IT, among others, is big. Moderate decrease in

energy demand and increasing share of renewable raw materials is committed to the development and change of operating models, towards “supply chain as a service”. This requires flexible network systems and trust and transparency between chain players. Data ownership is decentralized, and digital transformation and innovation are aimed at improving the living environment, social care, and privacy and security.

For the RWB scenario, Oxford Economics and the Port of Rotterdam Authority present the following throughput forecast for 2050, as well as the compound annual growth rates (CAGR):

Dry bulk is 33 million tons (CAGR –2.2%), liquid bulk is 105 million tons (CAGR –2%), containers is 232 million tons (CAGR 1.4%), and breakbulk is 57 million tons (CAGR 2.2%). The total throughput forecast for RWB in 2050 is then 427 million tons.

Regarding container traffic in the primary path, DDS and TS are growing strongly. The Port Authority states that due to flattening economic growth and global trade, and increasing consumer awareness, this is followed in the secondary path of RWB by a stabilization of TS and DDS volumes. Compared to other scenarios, RWB has a strong intra-regional European market in the secondary path (after 2035), resulting in a strong increase in volumes in the SS area.

4.3. Protective Markets

The Protective Markets (PM) scenario presented by the Port of Rotterdam Authority stems from primary path II. This scenario is characterized by a world with distrust between power blocs and global geopolitical tensions. There are competing economic interests in a fragmented world with a focus on self-sufficiency, financial prosperity, resilience and defense. The integration into logistics chains is suboptimal. High government debts, high healthcare costs due to an aging population and extreme weather conditions because of inadequate climate policy have led to tight government budgets. This means less investment in education, (digital) infrastructure and scientific research. Social divisions and unrest are growing due to increasing unemployment and decreasing purchasing power. Confidence in the government and therefore their effectiveness decreases. This creates a fragmented global economy, with institutions and companies

developing more and more power through knowledge and technological developments. There is a slow transition to clean technologies, with an emphasis on increasing energy efficiency and energy availability. CO₂ neutrality will not be achieved before 2100. The EU is weak in the world order, and there is low economic growth.

For the PM scenario, Oxford Economics and the Port of Rotterdam Authority present the following throughput forecast for 2050, as well as the compound annual growth rates (CAGR):

Dry bulk is 69 million tons (CAGR 0.3%), liquid bulk is 124 million tons (CAGR -1.5%), containers is 176 million tons (CAGR 0.5%), and breakbulk is 33 million tons (CAGR 0.3%). The total throughput forecast for PM in 2050 is then 402 million tons.

According to the Port Authority, in this scenario, lower economic growth and lower world trade ensure limited growth in container throughput, despite extensive logistics chain optimization and low transport costs. Nevertheless, volumes will still grow reasonably strongly until 2035. However, after 2035 this will become negative due to further deterioration of trade relations, stagnant economy and low population growth. Rotterdam continues to hold a strong position as a transshipment hub. Reshoring and nearshoring reinforce the decline in DDS volumes and increases the relative share of shortsea in the volumes. Due to the deteriorated economy, further investments in port development are lagging behind in the Hamburg-Le Havre range.

4.4. Wake-Up Call

The second and last scenario developed by the Port of Rotterdam Authority stemming from primary path II is the Wake-Up Call (WUC) scenario. In this scenario, increasing concerns about the economic consequences of extreme shocks (related to, for example, food and energy availability, extreme weather or cyber hacks) represent a turning point. The dependencies within systems are too great to tackle in isolation. This increases awareness that strategic cooperation and rigorous measures are needed to limit CO₂ emissions. The pursuit of financial prosperity continues. Energy demand is decreasing due to increasing efficiency and the development of circularity. There is a degree of standardization and transparency that is necessary for efficient

supply chain development. The EU pursues a strategically strong policy, with effective regulation, thereby increasing its power on the international stage. Critical sectors and products are supported, and the EU effectively organizes parts of the value chains, leading to moderate economic growth. The energy-intensive industry is becoming a leader in the energy transition in Northwestern Europe.

For the WUC scenario, Oxford Economics and the Port of Rotterdam Authority present the following throughput forecast for 2050, as well as the compound annual growth rates (CAGR):

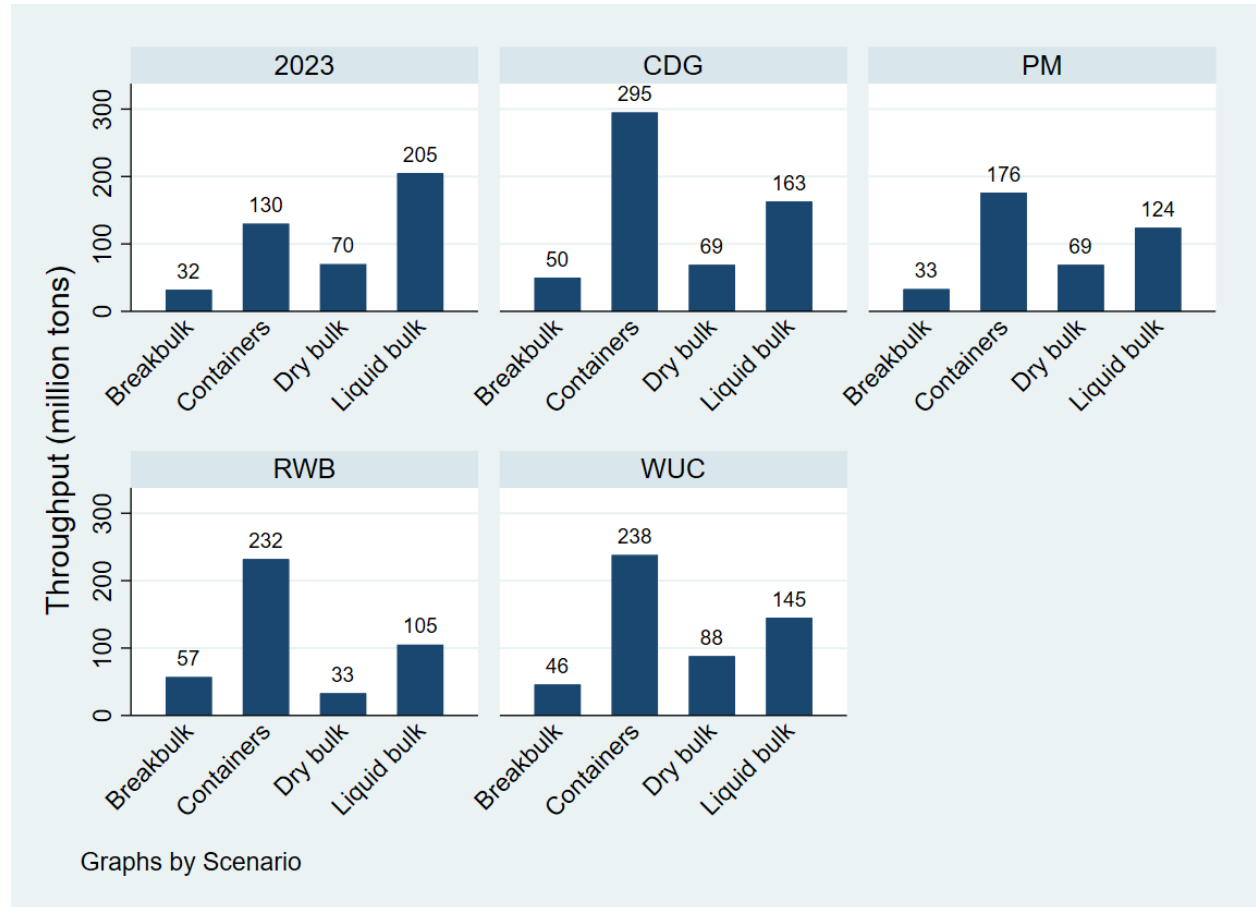
Dry bulk is 88 million tons (CAGR 1.1%), liquid bulk is 145 million tons (CAGR –1%), containers is 238 million tons (CAGR 1.5%), and breakbulk is 46 million tons (CAGR 1.5%). The total throughput forecast for WUC in 2050 is then 518 million tons.

Regarding containers in the WUC scenario, the Port Authority states that in the secondary path the economy is growing relatively strong, and trade intensity is also increasing, resulting in a further revival of direct deepsea volume. A strong focus on efficiency and optimization of supply chains increases Rotterdam's competitive position, with a strong position as both a mainport and transshipment hub.

Figure 2 showcases the throughput forecasts for 2050, for the four scenarios, per cargo type. It also shows the throughput volumes for 2023 of the Port of Rotterdam, to allow for a better comparison with the forecasted numbers.

Figure 2

Throughput volume for 2023 and throughput forecasts for 2050 for the scenarios CDG, PM, RWB, and WUC, for the Port of Rotterdam



Source: Port of Rotterdam Authority, and Oxford Economics

5. Critical analysis of the scenarios

In this section, a critical analysis is conducted on the four long-term scenarios for 2050 developed by the Port of Rotterdam Authority. The scenarios are evaluated against the eight key characteristics of deglobalization, to determine the extent to which each scenario aligns with or diverges from the trends indicative of deglobalization. This analysis will reveal how each scenario reflects or contradicts the potential realities of a deglobalized world, providing insights into the readiness of port operations and strategies in the face of global economic shifts. Through this assessment, the robustness and realism of the scenarios are tested against the backdrop of

increasing protectionism, reshoring, geopolitical tensions, and other deglobalization forces that could reshape global trade and, consequently, port operations.

5.1. Critical analysis of Connected Deep Green

Table 1

Analysis of the Connected Deep Green scenario with the eight characteristics of deglobalization

Key characteristic	Alignment	Analysis
1. Reduction in international trade	No	The CDG scenario forecasts robust growth in container throughput, driven by a strong global economy and increased international trade. The forecast assumes the highest container volume of all scenarios, namely 295 million tons by 2050, with a CAGR of 2.3%.
2. Rise of protectionism	No	CDG envisions minimal protectionism, with global cooperation fostering open trade and strong alliances, particularly between the EU, the USA, and China, which underpins the expected growth in both dry bulk and container volumes.
3. Reshoring and nearshoring trends	No	In this scenario, there is minimal need for reshoring or nearshoring, as global supply chains remain intact and are even enhanced by digital connectivity and transparency.
4. Geopolitical tensions and trade fragmentation	No	CDG foresees a world of cooperation and trust, with geopolitical tensions minimized through targeted alliances and a shared commitment to sustainability.

5. Volatility in freight rates and market uncertainty	No	The CDG scenario assumes a stable and efficient trade environment. While CDG’s emphasis on digital connectivity might reduce some market uncertainties, it underestimates the potential for volatility inherent in global markets, especially in an era where deglobalization might introduce new uncertainties.
6. Decline in global value chains	No	The scenario’s focus on sustaining and enhancing GVCs through digital and environmental innovations contrasts with the deglobalization trend of GVC contraction.
7. Decreased efficiency and increased costs	No	CDG predicts increased efficiency and reduced costs through digital innovation and sustainable practices. It may be overly optimistic to assume that efficiency gains from digitalization and sustainability initiatives will be sufficient to counteract the inefficiencies and higher costs that can arise from supply chain disruptions and geopolitical uncertainties.
8. Slower growth in inter-bloc trade	No	CDG projects robust inter-bloc trade, especially in sustainable goods, driven by strong global cooperation and alliances. It assumes that blocs like the EU, USA, and China will maintain strong trade relations without significant disruptions.

5.2. Critical analysis of Regional Well-Being

Table 2

Analysis of the Regional Well-Being scenario with the eight characteristics of deglobalization

Key characteristic	Alignment	Analysis
1. Reduction in international trade	Yes	The shift toward regional supply chains, and the decrease in dry bulk and liquid bulk volumes, reflects the decline in international trade. Even though the container throughout shows growth, this may reflect a shift towards regional trade and intra-European markets.
2. Rise of protectionism	Partially	While the scenario describes a divided and weak EU, leading to regional focus, it does not explicitly emphasize protectionist policies. The forecast reflects an optimistic view of intra-regional trade growth despite potential protectionist trends. However, the fragmentation of the EU could imply some degree of protectionism within Europe.
3. Reshoring and nearshoring trends	Yes	The RWB scenario supports the trend of reshoring and nearshoring, as it emphasizes regional supply chains and the development of "supply chain as a service" models within Europe. As regions seek to enhance economic resilience by bringing production closer to home, long-distance shipping volumes may decline, while shortsea volumes increase.
4. Geopolitical tensions and trade fragmentation	No	The RWB scenario depicts a fragmented global environment, focusing on regional cooperation driven by idealism and a desire for well-being. There is a shift in power dynamics, with big influences from regions like China and India, but the scenario does not explicitly address geopolitical tensions or trade fragmentation.

5. Volatility in freight rates and market uncertainty	No	The scenario suggests a stable regional trade environment with a focus on regional cooperation and innovation. The forecast anticipates stable growth in container and breakbulk volumes, if digital transformation and regional cooperation stabilize market conditions.
6. Decline in global value chains	Yes	The RWB scenario anticipates a decline in GVCs as regions focus more on local production and consumption. This shift away from globally integrated supply chains will likely reduce the volume of intermediate goods moving through ports like Rotterdam.
7. Decreased efficiency and increased costs	No	The scenario focuses on efficiency improvements through digital transformation and innovation, which contrasts with the characteristic of decreased efficiency and increased costs seen in deglobalization.
8. Slower growth in inter-bloc trade	Yes	The scenario suggests a slowdown in inter-bloc trade, with regions focusing more on internal markets rather than engaging in significant trade with other regions. The emphasis on regional trade over international trade may lead to stagnation in port throughput.

5.3. Critical analysis of Protective Markets

Table 3

Analysis of the Protective Markets scenario with the eight characteristics of deglobalization

Key characteristic	Alignment	Analysis
1. Reduction in international trade	Yes	The PM scenario indicates a fragmented global economy, with a significant reduction in international trade, as seen in the throughput forecast for 2050 and minimal growth rates. There is a focus on self-sufficiency and reduced reliance on global markets.

2. Rise of protectionism	Yes	The PM scenario explicitly mentions a focus on self-sufficiency and competing economic interests in a fragmented world with a focus on defense, which are classic indicators of protectionism. The emphasis on nationalistic behavior and reduced global cooperation is supported by the negative growth in liquid bulk, which can indicate a decrease in trade for commodities like oil, that are often heavily impacted by geopolitical factors.
3. Reshoring and nearshoring trends	Yes	The PM scenario mentions reshoring and nearshoring as factors that reinforce the decline in deepsea shipping volumes. This is a clear indication of a trend towards localized production and supply chains.
4. Geopolitical tensions and trade fragmentation	Yes	The PM scenario is characterized by geopolitical tensions and trade fragmentation, with blocs forming around regional or national interests. Geopolitical conflicts and distrust between power blocs lead to a fragmented global economy, impacting trade flows and creating a less integrated global market.
5. Volatility in freight rates and market uncertainty	Partially	The PM scenario suggests economic instability and a fragmented world economy, but it does not directly discuss volatility in freight rates. However, the underlying market uncertainty implied by the scenario suggests a partial alignment with this characteristic.
6. Decline in global value chains	Yes	The PM scenario sees a significant decline in GVCs, with countries focusing on localized or regionalized production. The emphasis on self-sufficiency leads to reduced international integration of production processes.
7. Decreased efficiency and increased costs	Yes	The scenario mentions suboptimal integration into logistics chains and delayed investments in infrastructure, which could lead to decreased efficiency and increased operational costs.

8. Slower growth in inter-bloc trade	Yes	The PM scenario describes a fragmented global economy with competing power blocs, which suggests slower growth in inter-bloc trade. The focus on regional self-sufficiency at the expense of global cooperation indicates a direct alignment with this characteristic.
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5.4. Critical analysis of Wake-Up Call

Table 4

Analysis of the Wake-Up Call scenario with the eight characteristics of deglobalization

Key characteristic	Alignment	Analysis
1. Reduction in international trade	No	The WUC scenario mentions moderate economic growth, as well as the revival of direct deepsea volume and the increase of Rotterdam's competitive position. This suggests that while international trade may face challenges, it is not as significantly reduced as in more pronounced deglobalization scenarios. The forecasted growth in container throughput, dry bulk, and breakbulk shows this as well.
2. Rise of protectionism	No	The scenario emphasizes strategic cooperation and the EU's stronger role on the international stage. The focus on enhancing supply chain efficiency and international standardization implies a more open and cooperative global environment rather than one characterized by increasing protectionism.
3. Reshoring and nearshoring trends	No	The WUC scenario describes the further revival of DDS volumes, and a strong focus on development of supply chain efficiency. It also mentions Rotterdam's strong position as both a mainport and transshipment hub, which could imply a continued reliance on global supply chains rather than a full shift to local production.

4. Geopolitical tensions and trade fragmentation	Partially	The WUC scenario reflects a degree of geopolitical awareness and strategic cooperation in response to extreme shocks. While there are mentions of increased awareness and strategic regulation, the scenario also describes moderate economic growth and effective EU policies.
5. Volatility in freight rates and market uncertainty	No	The WUC scenario does not explicitly address volatility in freight rates or market uncertainty. Instead, it focuses on strategic cooperation, efficiency improvements, and the development of circularity, suggesting a more stable and predictable market environment.
6. Decline in global value chains	No	The scenario indicates some reorganization of value chains, particularly with the EU effectively organizing parts of these chains to enhance resilience. However, the emphasis on cooperation and standardization suggests that GVCs may not be declining but rather be restructured.
7. Decreased efficiency and increased costs	No	The WUC scenario actually emphasizes improved efficiency and the development of circularity. The focus on optimizing supply chains and strategic cooperation suggests efforts to enhance operational efficiency rather than decrease it.
8. Slower growth in inter-bloc trade	Partially	The WUC scenario mentions moderate economic growth and strategic policies by the EU, which might imply a more balanced approach to inter-bloc trade. The emphasis on efficiency and strategic cooperation suggests that while there may be some impact on trade between blocs, it is not the primary focus.

6. Discussion and recommendations

The analysis of the Port of Rotterdam’s long-term scenarios using the eight criteria framework has provided insightful conclusions. Among the four scenarios, Protective Markets stands out as the most aligned with key deglobalization characteristics. This scenario accurately captures

several critical elements, such as the reduction in international trade, the rise of protectionism, reshoring and nearshoring trends, geopolitical tensions, and the decline of global value chains. These elements reflect a world where economic nationalism, trade fragmentation, and regional self-sufficiency dominate, providing a plausible outlook for the port in a deglobalized world.

However, the PM scenario falls short in addressing the volatility in container freight rates, a critical factor in today's global trade environment. In August 2023, long-term ocean freight rates continued their downward trend, making it the 12th consecutive month of declines for struggling carriers, as prices had dropped 62.7% since August 2022 (Barrios, 2023). Conversely, by 2024, rising freight rates have emerged as a new source of concern in the global supply chain, with forecasts predicting ocean cargo prices could soar to \$20,000 (LaRocco, 2024). These significant fluctuations highlight a gap in the PM scenario, indicating a need for further refinement to more accurately capture the complexities and unpredictability of future trade dynamics. If this factor were included in the Protective Markets scenario, the growth projection for container volumes might be less optimistic, potentially showing a negative trend. Volatility in freight rates can significantly impact trade flows, especially in a deglobalizing environment where market uncertainties are heightened.

Furthermore, the scenario Regional Well-Being appears less consistent when evaluated against the same criteria. Although this scenario was initially considered as representing a world with strong regional cooperation and sustainable growth, it also contains elements that could fit within a deglobalizing world. This duality raises questions about the scenario's coherence and suggests that it may not be as distinct from the deglobalization trend as initially thought. The overlap with deglobalization indicates that the RWB scenario might need to be redefined or clarified to better differentiate it from the other scenarios, particularly Protective Markets.

Based on the analysis, and given these insights, it is recommended that the Port of Rotterdam revisits the scenario of Protective Markets to incorporate the volatility of freight rates as a critical factor in the analysis. Additionally, a closer examination of the Regional Well-Being scenario's consistency is advised to ensure that each scenario presents a clear and distinct possible future. This refinement will not only enhance the accuracy and relevance of the scenario's but also

provide the Port of Rotterdam with a more robust strategic tool to navigate an increasingly uncertain global trade environment.

7. Conclusion

This study has provided a thorough analysis of long-term scenarios for the Port of Rotterdam Authority in the context of a deglobalizing world, using a framework based on eight criteria. The analysis revealed that the Protective Markets scenario is notably consistent and aligns well with the characteristics of deglobalization. This scenario fits seamlessly within the framework, indicating that it is a plausible and robust outlook for the future.

While the Protective Markets scenario shows strong consistency, the analysis could be enhanced by incorporating container freight rate volatility, which might reveal a more cautious growth outlook for container volumes. Additionally, the Regional Well-Being scenario overlaps with deglobalization trends, suggesting it may require further clarification to differentiate it from the Protective Markets scenario. These refinements would provide a more comprehensive understanding of the complexities and uncertainties facing the Port of Rotterdam in a deglobalizing world.

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