Periscope Network

Market Opportunity Report

Offshore Logistic Hubs

Interreg North Sea Region PERISCOPE European Regional Development Fund

EUROPEAN UNION

PERISCOPE reaping the potential of the oceans

Dear Reader,

This report provides a summary on the prospects for developing offshore logistics hubs and their evaluation as opportunities for the maritime and offshore industries. The report's findings are based on respondents' answers to surveys and focuses on when offshore logistic hubs will come into operation and their business potential.

The data for this report is based on desk research and an analysis of survey responses. This report is produced by the PERISCOPE network.

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Enquiries
Matthew J. Spaniol
Aarhus University
Tel: +45 50126444
Denmark

Website
www.periscope-network.eu

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PERISCOPE

PERISCOPE is an initiative of the Interreg VB North Sea Region Programme working to catalyse entrepreneurial discovery and promote trans-regional partnerships to unlock Blue Growth. We are supporting the combined maritime and marine innovation ecosystem in the North Sea region to accelerate innovation for sustainable business development in emerging blue markets.

The PERISCOPE network has identified more than 60 future business opportunities for the blue economy, developed these into venture concepts, and built an engagement tool for each of these. These studies include crowd-based forecasts about when these are expected to be realized. This information supports planning activities with the intention to orchestrate action towards the realization of said opportunities, and, indirectly, to a transition to a more innovative and sustainable character of the blue economy.

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Contents

1. EXECUTIVE SUMMARY

The transition of the maritime and offshore industries toward a sustainable “Blue Growth” future is driven by incentives to unlock new growth areas, develop and apply new technologies, and increase productivity. The development and utilization of offshore logistics hubs provides an opportunity to accomplish these goals.

The rapid development in offshore infrastructure and the trend toward the electrification of the seas has provided a context for growth, and new infrastructure can support this development—both in time and cost savings. They can utilize the vast space available on the sea that remains sub-optimized. Developing new offshore infrastructure will challenge human ingenuity and accelerate innovation, as well as enable the establishment of new market opportunities and exports.

As global trade increases, ports need to adapt to cater for this increasing volume. This can be done through offshore logistics hubs capable of functioning as offshore port terminals. Such a hub can relieve the growing pressure on current ports struggling to keep up with the increases in container traffic, by rerouting containers through the use of smaller feeder vessels. This will circumvent the current practice that sees large container ships stopping several times to discharge containers along a linear route and reduce the traffic in traditional ports.

The question of the viability of offshore hubs is tested under two different assumptions, with and without a renewable energy component. Aggregating answers from 50 respondents, offshore logistics hubs will emerge in a decade; if the logistics hubs are to be powered fully by renewable energy, this could require an additional half-decade. Respondents rated this opportunity at 3,04/5 for its business potential. However, if renewable energy powers the hub, ratings on business potential increase to 3,54/5 increasing its potential by 16%.

So, while the both solutions are considered to yield business opportunities, the renewable energy powered logistics hubs are predicted to outperform non-renewable powered offshore logistic hubs. However, this increase in business potential comes at the cost of expected prolongations in the time horizon of development.

2. INTRODUCTION

The North Sea Region is a crucial area for Europe's Blue Economy with marine resources, technologically advances industries, major port areas, and vibrant offshore activities. Due to global drivers, the wider maritime, marine and offshore economies are exposed to profound challenges with some industries undergoing a significant growth and change, and others facing stagnation and decline. To ensure the region's stability and long-term prosperity, new ways are needed to increase productivity, and the implementation of offshore container terminals has been proposed. While logistical pressure on existing ports increase, questions of what's next, how, and when further developments in the current infrastructure will happen are becoming even more relevant.

To answer these questions, PERISCOPE identified the potential application of offshore container terminals and put them to the crowd for assessment and validation. Survey instruments were developed for two different use cases, each aiming to shed light on the potential of an offshore container terminal, but one of them running on renewable energy. The use cases were described, posted online, and distributed to respondents identified as having a qualified opinion. The first question that was asked concerned the question of time to implementation: "On the sliding scale below, please estimate when it will become accepted practice that [technology X] will be used to complete [task Y], i.e. commercially available" with the scale spanning a maximum of 30 "years from now." In this question, respondents were also offered an option to answer "it will never happen" or if the use case in question is "already here." The second question: "What is needed to make this happen?" offered respondents an open text box in which they could write their answers. The third question asked respondents to rate the opportunity described on a Likert scale out of 5. Finally, respondents were offered another open text box to write any additional comments.

In what follows, each of the two studies will restate the prompt that was used in the survey, followed by an analysis of the responses. The crowd-based forecast provides the median estimate of the "time to accepted practice." A Political, Economic, Social, Technological, Environmental (PESTE) analysis organizes the responses into categories, the average rating on the business potential is presented, and an analysis is made based on these. After both studies are presented, general remarks are made based on the two use cases, and the report is concluded.

3. STUDY A: OFFSHORE LOGISTICS HUB

Today's 22,000 TEU (twenty-foot equivalent unit) container vessels will be small compared to the 50,000 TEU vessels forecasted 50 years from now.[1] Modifying existing port infrastructure to handle future capacity is not viable: Crane reach, quay capacity, water depth limits, and trucking and traffic bottlenecks, limit the possibilities for port expansion.[2,3]

Bundling, organizing, and handling capacity in a more economical way, will offer savings in capital and operating costs in the North Sea.[4] Built-for-purpose offshore container terminals can offer unlimited growth in volume, and flexibility to meet the requirements of future cargo types. They require no dredging and can reroute feeder traffic more efficiently, reducing congestion and overland emissions.[4] Offshore hubs, like those already in use in Abu Dhabi and China, can generate and use renewable energy and also provide artificial reefs for marine habitat.[4]

3.1 RESULTS

3.1.1 FORECAST TO IMPLEMENTATION

The survey data received for Survey A was analyzed to find the median estimation of when the implementation of an offshore container terminal will be implemented in the North Sea. This analysis is represented in figure 1 below, which shows the median, i.e. the value separating the lower and upper half of the data sample, is 2030. The median, rather than the mean, was chosen for this analysis to prevent the conclusion to be skewed a lot by few extreme outliers. When asked for the time to accepted practice, the respondents had to option to choose “will never happen”, to ensure they were able to answer the closed question in agreement to their actual beliefs. This option was used by 19% in study A, reflecting that almost every fifth respondent does not believe that this will ever be implemented.

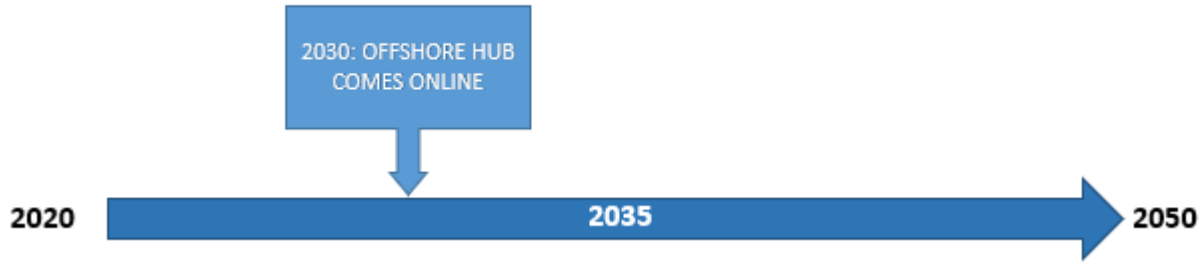

Figure 1: Median estimate for offshore container terminal

3.1.2 WHAT IS NEEDED TO MAKE THIS OPPORTUNITY HAPPEN?

Respondents, in connection to their estimates, were asked to write what is needed to make this opportunity happen. This question was open-ended.

The comments from the respondents are presented below and have been divided into 5 categories, representing a Political, Economic, Social, Technological, and Environmental (PESTE) analysis. The text in the table are the responses. In some cases, spelling, grammatical corrections, and changes to improve comment clarity have been made. Furthermore, some comments were split to categorize them accordingly to their parts. These appear in no particular order.

POLITICAL
• Combined investment from several neighbouring countries. • Dependent on where such a terminal was built would probably require agreement from a range of governments. • Land restrictions.
ECONOMIC
• Investment is needed. • Costs • Too many logistical issues • Funding • A lot of investment • There needs to be ubiquitous use of larger container ships to make it viable to use these offshore container terminals. • Investors • They need to build, plan and handle capacity in a more stable way. • The cost of such a project would be substantial and the long term economic and trading environments would have to be seen to be reasonably secure for governments to invest in such infrastructure. • More megavessels of 20,000 TEU.(65x430 m) in combination with the necessity of dredging of access canals and rivers. • Time and money. Investments may be needed to fund the project, due to the workload and equipment involved. • Building brand new offshore container terminals, so a lot of money is needed.
SOCIAL
• Help from China and Abu Dhabi who already use this system. • Belief in it. • The will • I cannot foresee that this would be built using private capital as the returns would likely not be high enough.
TECHNOLOGY
• All the technology is already available. • Storms at seas and how this can be protected. • Better equipment. • Technology is ready for it.

• Existing Port Infrastructure with the crane reach capability, water depth analysis, traffic management to and from the port. Offshore Containers for cargo capacity, Offshore hubs to generate renewable energy and artificial reefs • Land construction is costly and not flexible • Bigger vessels. • Terminal is only likely to appear if needed due to huge vessels needing to transhipment huge numbers of containers. But I do not believe we will have 50,000 TEU vessels. a) because the current largest vessels are already causing problems for ports and supply chains • Weather conditions are not appropriate. • R&D leading to a pilot facility
Environmental
• Meet a wide range of environmental constraints. • In 50 years time the world will be very different due to climate change.

The distribution of the comments among the 5 categories in the PESTE analysis shown above is depicted in Figure 2 below. This figure shows that only 6% of the comments were related to environmental factors, while only 10% and 13% were related to political and social factors respectively. This reflects how the respondents to a very limited degree consider these factors relevant in the development and implementation of this opportunity. However, the respondents seem to consider technological and economic factors the main challenges related to this opportunity, as these make up 32% and 39% respectively, adding up to more than two thirds of all comments.

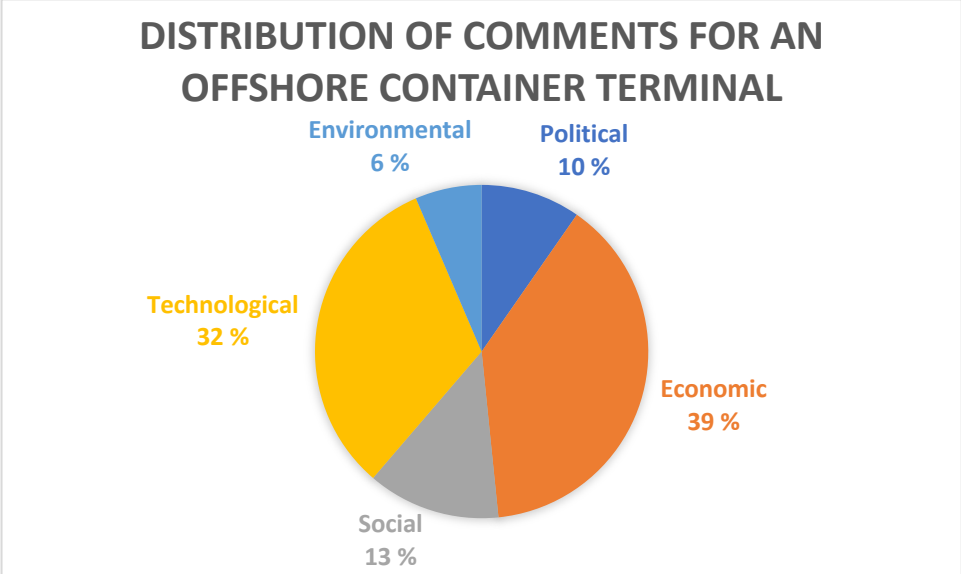

Figure 2: Respondents' comments to offshore container terminal, categorized

3.1.3 BUSINESS POTENTIAL

On the questions of business potential of an offshore container terminal, respondents, on average rate it 3/5.

3.1.4 ANALYSIS

This section reviews and provides commentary based on the responses. Respondents identified both technological and economic issues as the most important factors to realize this opportunity.

As depicted in Figure 2, economic factors seem to be the main concerns among the respondents regarding what is needed for this opportunity to become a reality. Among these comments, the focus was on especially "Investments" and the many costs involved in the creation of such a comprehensive project as an offshore container terminal. However, concerns were also raised regarding the logistical issues involved, with one respondent mentioning that the payoff for this opportunity would not become profitable until an "ubiquitous use of larger containerships" happens. This is further emphasised by a respondent who puts it, "this kind of terminal is only likely to appear if needed due to huge vessels needing to transhipment huge numbers of containers" and rests on the assumption that "50,000 TEU vessels" forecasts come to fruition. While the "largest vessels are already causing problems for ports and supply chains" it is pointed out that "in 50 years' time the world will be very different due to climate change" that call "predictions that simply predict unlimited growth" into question.

While investments were the factor that appeared the most, technology was also raised almost a third of the time. Among these some commented that "all the technology is already here", suggesting how this is not a matter of making the project feasible, but rather emphasising how it is most likely a matter of economic will, supporting the many comments related to economic factors. However, some respondents raised safety concerns; "how can this be protected" and "weather conditions are not appropriate", indicating that while this might be technological feasible, it is not necessarily given that it will be able to withstand the rough conditions of the ocean, and some technological developments might still be required for this to be lasting in the long-run.

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4 STUDY B: OFFSHORE CONTAINER TERMINAL, POWERED BY RENEWABLE ENERGY

The maritime shipping industry currently transports 90% of the goods traded around the world.[1] The industry is responsible for nearly 3% of the world's CO2 emissions, and this is forecasted to increase by as much as 250% by 2050.[1] The International Maritime Organization has the vision of reducing annual emissions by 50% by 2050, and coalitions of maritime stakeholders are working on zero emission vessels, striving to become carbon neutral by 2030.[2] A partial solution to decarbonizing container shipping is the creation of an offshore terminal powered by renewable energy.

An offshore terminal will provide another node in the network of ports, providing another hub for the rerouting of containers by smaller feeder vessels. Current practice sees large container ships stopping several times to discharge containers along a linear route. An offshore container terminal, powered by offshore wind, will reduce the distance to onshore terminals.[3] Excess wind power can be used to desalinate seawater for hydrogen production, that can provide a power buffer for the terminal. Furthermore, hydrogen can be stored in tanks that can be swapped onto fuel cell-powered feeder vessels.[4,5] This will make transport to and from the terminal emission free.[6] Additionally, the development of floating structures can help to increase the economic viability of offshore terminals.[7]

The challenge remains that hydrogen is still more expensive to produce, especially when taking into account the subsidies that fossil fuels receive. This, in turn, has limited the building of fuel-cell powered feeder vessels.[8]

4.1 RESULTS

4.1.1 FORECAST TO IMPLEMENTATION

According to the median answer by respondents, offshore container terminals powered by renewable energy will become and accepted practice in 2035 (see figure 3).

When asked for the time to accepted practice, only 8% used to option “will never happen”, indicating a high conviction of this opportunity being implemented in the future.

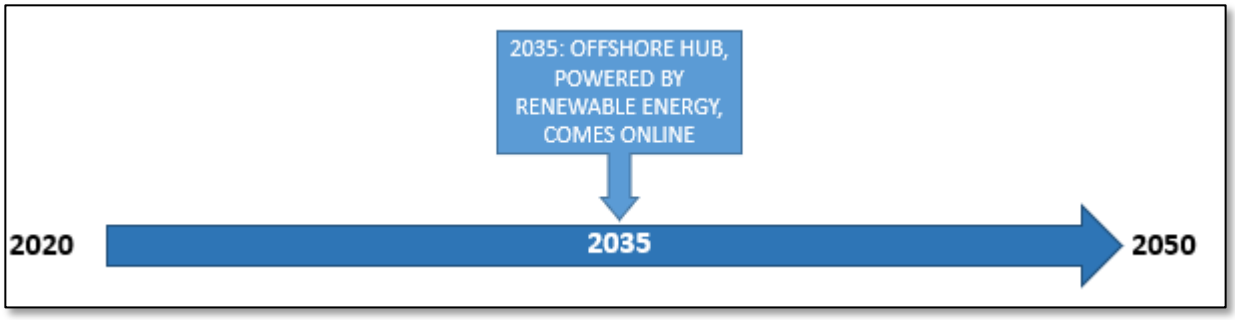

Figure 3: Median estimate for offshore container terminal powered by renewable energy

4.1.2 WHAT IS NEEDED TO MAKE THIS OPPORTUNITY HAPPEN?

The comments from the respondents per this question are presented in the table below, organized across the same 5 categories used in the analysis for survey A, i.e. Political, Economic, Social, Technological, and Environmental. In some cases, spelling, grammatical corrections, and changes to improve comment clarity have been made. Furthermore, some comments were split to categorize them accordingly to their parts. These appear in no particular order.

POLITICAL
• Reduction in the cost of doing this - certain authorities need to reduce this in some way to make sure this occurs and the benefits can be reaped. • Stop the subsidies for fossil fuels to the shipping companies, instead use that money for renewable energy. • Governments should hit companies that continue to pollute with fines. • International approval • A lot of governments backing it and providing financial support for it • Government subsidies • Subsidies to be a viable competitor to fossil fuels. • Remove the subsidies for fossil fuels. • If hydrogen became as subsidised as fossil fuels are, it would make things a lot smoother going forward.

• Political will • Gaining massive subsidies from the government in-order to make that happen.
ECONOMIC
• Investments are needed. • Infrastructure cost needs to drop significantly to onshore costs that already exist. • More investment and incentive to change to renewable energy • What needs to happen to enable this is the sacrifice of profit to develop hydrogen fuel-cell powered feeder vessels. • Investors to fund the project • Investment in these technologies. • Hydrogen technology need to have increased investment. • It will have a massive cost to even plan and develop. • It would obviously need to be profitable too. • Large investments to pay for building it.
SOCIAL
• Need a lot of energy and a backup power if something happens. • This is a bold idea and will need a lot of investment and confidence in this idea, as well as buy in from shipping companies as they will be the ones who choose to use it or not. • Patience is needed. • Shift in attitudes • A project as big as this would take years to complete so there would need to be full commitment to it.
TECHNOLOGY
• More innovation and technology to make this easier and more cost effective. • Hydrogen needs to become more affordable to produce. • As the technology is relatively advanced and requires different technologies that might be used in a novel way, for example fuel cell powered feeder vessels, this will require a lot of time spent to get it right. • Improved hydrogen extraction. • An offshore terminal, that utilises renewable energies such as wind power, needs to be created to enable the re-routing of smaller vessels. • Hydrogen needs to be less expensive to use. • Wind power needs to produce more energy. • Time to build the fuel-cell powered feeder vessels. • Producing hydrogen to be much cheaper. • Immediate production of fuel cells.

Environmental
•

The distribution of comments among the 5 categories in the PESTE analysis is depicted in figure 5 below. This shows that none of the comments (0%) were related to environmental factors and only 14% were related to social factors. The remaining comments were distributed somewhat evenly among the other free factors, Technological, economic and political, as they had 28%, 28% and 30% respectively.

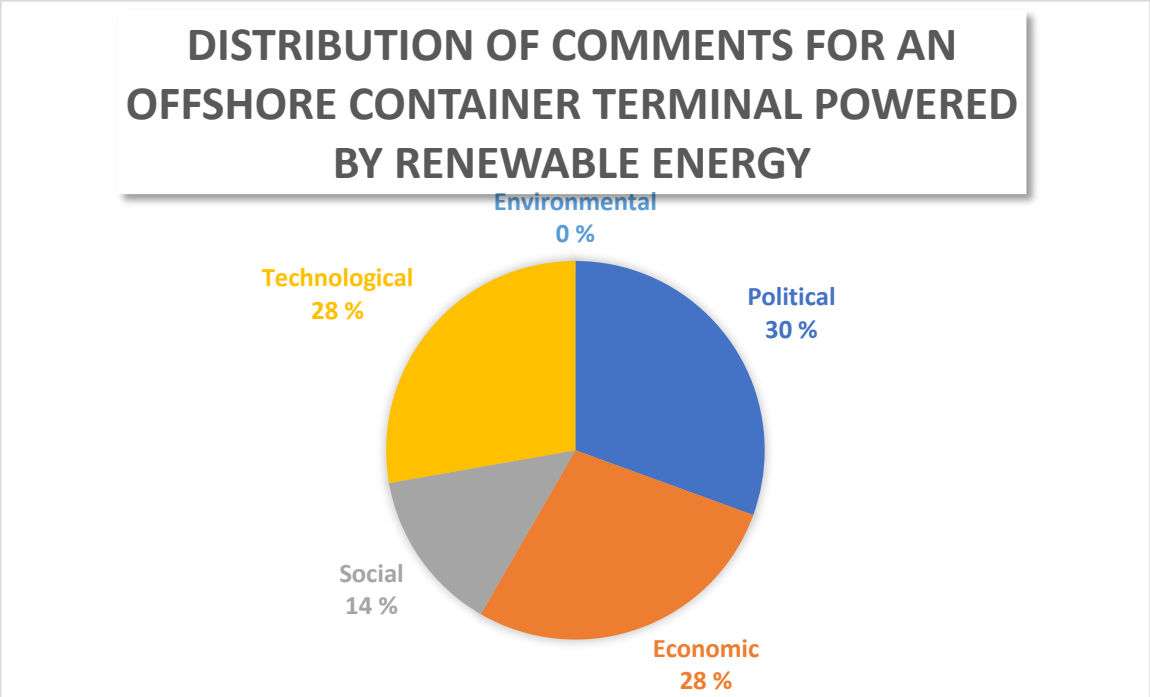

Figure 4: Respondents' comments to offshore container terminal powered by renewable energy, categorized

4.1.3 BUSINESS POTENTIAL

On the question of the business potential of an offshore container terminal powered by renewable energy, respondents, on average, rated it 3,5/5.

4.1.4 ANALYSIS

The respondents to this survey were, as shown in figure 4, mostly divided among 3 factors when stating what was needed for this opportunity to be developed. The first of these were political factors with the majority of these relating to subsidies, either the removal of existing subsidies on fossil fuels "remove the subsidies for fossil fuels" or the implementation of subsidies on hydrogen

"if hydrogen became as subsidies as fossil fuels are, it would make things a lot smoother going forward". This picture is further emphasised among the economic factors, where one of the main challenges the lack of profitability, "It would obviously need to be profitable too", which claims to be solvable through increased investments "Hydrogen technology need to have increased investment". The political and economic factors are therefore intertwined, as the call for profitability and investment in hydrogen technology is directly connected to the need for subsidies, making hydrogen more beneficial.

This need is also shown in the technological comments, where it is mentioned several times that the technology needs to be improve to make the hydrogen creation more cost-efficient "Hydrogen needs to become more affordable to produce", indicating that the issues is not one of technological feasibility, but rather the efficiency of current technology. This concern does not only relate to the hydrogen production, but also the harvesting of the renewable energy, "Wind power needs to produce more energy."

Thus, it does not seem to be a question of whether it is possible, but rather about when it will become economical beneficial, which was also reflected in the low percentage of people answering "it will never happen" (8%). This seems to be further indicated by the social factors, where it is mentioned that it is a matter of "patience" and "shift in attitudes" towards this opportunity.

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5. BUSINESS OPPORTUNITIES

While growth rates in maritime trade volume has been historically correlated with global GDP growth, future prospects are uncertain. While the Covid19 has caused a major slump in trade, there has, over the last years, been a relatively small-and at times negative-growth in trade, and it is uncertain how this will play out in the near future, e.g. will the current trade wars continue, will globalization continue, etc. The discussion below will not take into account the current Covid19 situation, as it can be assumed that the dramatic fall will be recovered over time as it happened after the financial crisis [1]. On the other hand, the world population is forecasted to growth for the next seventy years [2], which would indicate that there is a likely increasing demand for moving good around at least for the next seventy years as the global middle class grows.

Currently, there is pressure on existing ports to keep up with the demand for throughput despite the relatively modest growth in trade, e.g. Durban [3] where container shipping company MSC has had to reroute ships due to missing capacity. Many ports find themselves short of space for the needed expansions, and many of the expansions that are planned extend out onto the seas, come with high price tags.

Port investment is a complex decision for a number of reasons.

- It is major investment, prices vary depending on location, type of port, size, etc. However, it runs from hundred of millions USD to billions. [4]
- Ports generally have a long lifetime, with an average lifespan of seventy years. [5]

Most ports have plans for how they can expand, by adding capacity in terms increasing the berthing, increase the effectiveness of the port, i.e. being able to use less time per ship, e.g. by adopting digital technologies, however, this can only create so much new capacity. This is where the option of offshore logistic hubs come in.

The world has already seen the development of offshore terminals, but the question about whether this is something we should expect to happen in the North Sea remains an open question. Offshore container terminals are expensive to build. An example was the creation of the Khalifa Port which amounted to $7.2bn for just the first of 5 phases. However, the port is expected to contribute with up $22bn to Abu Dhabi-s GDP in 2030, and the payoff is therefore expected to be worth the high investments [7]. It should be noted that this is backed by a state actor, not a commercial company.

Within the North Sea region, it is too early to say to which degree this will happen. One might add a further criterion to this. Looking at Figure 1 (below) which show the largest 25 ports in the North

Top 25 North Sea Ports (thousand tonnes of gross goods weight)		
1	Rotterdam	439.633
2	Antwerpen	214.030
3	Hamburg	117.152
4	Amsterdam	103.913
5	Le Havre	60.172
6	Immingham	54.081
7	London	54.035
8	Bremerhaven	47.586
9	Bergen	44.173
10	Dunkerque	42.558
11	Zeeland Seaports	38.911
12	Göteborg	38.891
13	Gent (Ghent)	33.336
14	Southampton	33.151
15	Zeebrugge	28.994
16	Wilhelmshaven	28.867
17	Tees & Hartlepool	28.156
18	Felixstowe	25.344
19	Forth	25.221
20	Dover	23.433
21	Calais	18.099
22	Medway	13.141
23	Bremen	12.125
24	Porsgrunn, Rafnes, etc	11.864
25	Tønsberg	10.709

Sea region, we might consider which of these might first run out of land. One reasonable assumption is that ports like Rotterdam or Antwerp is more likely to run out than places like Bergen, given the population density and size—and Rotterdam has extended quay onto the sea in 2013 [7]. Furthermore, the large ports might have the financial strength and to decide to keep being the largest ports making it more likely that they will be the first to look at the possibilities of investing in offshore hubs.

The data provided by the respondents in the two surveys covered in this paper, suggests that while the development of an offshore container terminal can be expected as soon as 2030 in the North Sea, there is a greater conviction that such as project will be undertaken if it relies on renewable energy. This is shown as 19% answered that the opportunity in Study A "will never happen", while only 8% of the respondents answered that for survey B. This reflects the general push for renewable energy experienced throughout the region, as well as the belief that the international targets set in relation to the climate, have a great say on the potential of these opportunities.

This seems to be a clear case of the conjunction fallacy, but a curious one, in that while respondents think that a renewable-powered logistics hub is more likely to happen than a normal one (fallacy), the time horizon is longer when we add renewable energy to the equation, which would seem to correct this bias.

It is too early to forecast what will happen with the technology for offshore logistics hubs, but it is reasonable to assume that there will be developed new ways of constructing and operating these over the next decade, thought making them more affordable and a real option for ports who can no longer expand on land.

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6. CONCLUSION

The development in offshore infrastructure and the trend toward the electrification of the seas has provide a new context for blue growth. Offshore infrastructure can support this development by utilizing the vast space available on the sea. Such large-scale challenges will put human ingenuity to the test and could accelerate learning and innovation, as well as enable the establishment of new market opportunities and exports.

Based on the data acquired through the surveys we see that the respondents estimate implementation of an offshore logistic hub to happen in 2030, with 19% thinking it will never happen. This estimation changes to 2035 for a hub connected renewables but is considered more likely to happen as only 8% of the respondents said it will never happen.

However, political, economic, social, technological, and environmental barriers remain. Among the political factors especially a need for subsidies are pointed out to make offshore logistics hub using renewables possible, as one of the current challenges currently seem to be low costs for fossil fuels. This required political motivation to change, but face an uphill battle against entrenched interests in maintaining the status quo. While social pressure to transition to green energy is strong, an increase the demand for electricity will put pressure on the capacity to create green hydrogen.

Among the economic challenges the main obstacle is the investment size needed for this opportunity. Profitability of such large scale offshore infrastructure is necessary if it is to be a sustainable investment. Meanwhile, concerns over safety and the harsh weather conditions on the North Sea point toward needs for increased automation of operations. While the technological feasibility is seemingly mature, the cost-benefit analysis points to a critical issue that remains unaddressed: the question of logistics—where should such infrastructure be located, and how will countries share the responsibility of its development? Nonetheless, these challenges are expected to be overcome by the respondents. It is a matter of time.

7. RESPONDENTS

The two surveys combined have 50 respondents. The study benefited from respondents identifying themselves as actors on these opportunities:

SmartPort
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Rusatom Cargo LLC
University of Gothenburg
KEDGE Business School
MSE
KF Energieberatung

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