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The Port of Opportunities

The Port of HaminaKotka is a versatile Finnish seaport serving trade and industry. The biggest universal port in Finland is an important hub in Europe and in the Baltic Sea region.

Welcome to the Port of HaminaKotka!





Cut a tech-dash

by **Julius Küchle**, Research Associate Ports and Transport Markets, Fraunhofer Center for Maritime Logistics and Services CML

The three-year ongoing IHATEC¹-funded project Port Energy Management Dashboard — dashPORT strives to enable port companies and terminal operators to achieve cost savings through a holistic energy-management of both the entire port and all parties that operate within. By developing a working prototype in the German Port of Brake, dashPORT aims to realize efficiency gains by using Artificial Intelligence (AI) and Internet of Things-applications (IoT) to help optimally sequence the energy needs of ports, hence improve their ecological and economic bottom line.



the Fraunhofer Center for Maritime Logistics and Services (CML) develops and optimizes processes and systems along the maritime supply chain. Within practically oriented research projects, CML supports public and private sector clients who are involved in port operations, logistics, and shipping. Visit www.cml.fraunhofer.de/en.html for more details

ultipurpose ports are highly complex and dynamic ecosystems where numerous operations intersect. This complexity is reflected in their energy consumption: electricity is needed to power cranes, lighting, pumping stations, locks, ventilation systems, charging of electric vehicles, postprocessing systems, gates, winches and office buildings.

Each of these electric consumers is involved in its own processes, which are typically scheduled independently. Such processes may be required at any time, and therefore they often overlap. This translates into highly irregular load profiles, i.e., the amount of energy being consumed at any given time. There may be times where energy consumption is very low, followed by an extreme peak when, e.g., locks need to be opened while cranes start unloading a vessel.

At the same time, energy providers need to plan energy production and the grid composition based on the maximum load required. If demand is difficult to forecast, and riddled with peaks, the network has to be operated in a way that such peaks can be levelled out. Unsteady demand patterns can also make the incorporation of renewable energy sources, with their inherently irregular input, even more difficult. To give industrial customers an incentive to avoid load peaks, grid operators measure the load in 15 minute-intervals and record the highest peak in a billing period. This peak is then used as the base for the network utilization fee (e.g. €50 per kW at the peak) for that billing period.

Therefore, the motivation to keep peaks as rare as possible in ports is twofold. First, there is the direct cost implication, which can greatly affect the overall electricity costs. Second, optimized load profiles make forecasting energy demands easier, allowing energy providers to operate on a more stable basis.

Granular outfitting

The dashPORT project started in 2019 and aims to tackle this particular

issue prototypically in the Port of Brake. The team is made up of four parties: the port owner Niedersachsen Ports GmbH & Co. KG, the terminal operator J.Müller AG. the IT house OFFIS - Institute for Informatics, and our research foundation Fraunhofer Center for Maritime Logistics CML.

Brake is a multi-purpose port located between Bremerhaven and the Hanseatic City of Bremen at the river Weser. It comprises two quays, northern and southern, and an inner harbour accessible via a sea lock. The southern port area serves as a cargo handling spot for feedstock and grains, while the northern section, with its heavy load capable quay, is utilized for taking care of forestry products, iron, steel, and project cargo like industrial machinery. In the inner harbour coasters and barges can be cleared and handled.

Historically, the involved parties used to handle their energy management individually, relying on analogue meters which were checked manually, once per billing period. Naturally, this fragmentation causes an unoptimized load profile, with abundant peaks and unpredictable cost. With digitalization in ports still just ramping up, it can be assumed that this situation is the rule rather than the exception among the ports of the world.

Within dashPORT, IoT devices are to be used to closely observe the granular energy demand per consuming machine of both parties in the Port of Brake. The live data is fed into a dashboard and simultaneously analysed by an Al decision support system. Using deep learning methods, it can incorporate the processes behind energy demands and thanks to its algorithms, also forecast the load profile of the port as well as offer advice to operators on how to improve it in the short-term.

To realize this, Fraunhofer CML together with OFFIS first analysed the processes of Niedersachsen Ports and J.Müller in the Port of Brake. Mapping the processes from the first message of a vessel which plans to arrive at the quay to a loaded truck or train leaving the port's premises, and vice versa, is the necessary groundwork to identify causal relationships between them, as well as to gauge the optimization potential. Based on the process analysis, over 500 individual electric machines and equipment have been chosen and are currently being outfitted with smart meters, which can parse live data into the dashPORT system. The selection of electrical consumers is based on several criteria. First and foremost, their wattage and frequency of use. Secondly, their controllability, i.e., whether the use can be flexibly scheduled, and if it can be operated in different intensities, and their relevance for dataconsistency and forecasting.

Once the infrastructure is outfitted accordingly, data collection begins. Over the span of six months, live data from the smart meters will be collected and analysed with the help of deeplearning algorithms. As more and more patterns arise in this analysis, the system will come up with ideal theoretical daily load profiles of the port, based on an everyday energy demand forecast. These optimal load profiles then have to be categorized and adapted regarding their operational feasibility. Finally, the researchers will refine the system in coordination with the industry partners so that it can detect deviations of the optimal load profile and provide recommendations for action to the operators at the port as to how to adapt their current energy use in order to be as close as possible to an optimal load profile, without jeopardizing the day-to-day business.

It is expected that these recommendations would range from shifting an energy-intensive process to a later point in time, to such seeminaly mundane things like suggesting turning off a running system that is not currently used for anything purposeful. After the development is finalized, dashPORT will be introduced by both parties, the port authority and the terminal operators -Niedersachsen Ports and J.Müller.

Do your dash

DashPORT will help the Port of Brake to holistically alter their electric load profile, consequently reducing unnecessary costs substantially and facilitating a more efficient grid operation. All while additionally promoting a rise in awareness regarding energy consumption in general by visualizing momentary energy demand - as any classic energy monitoring system would.

The project shows how even low-level IoT devices can simplify time-intensive processes, like in this case the periodic control of hundreds of analogue meters, while also collecting the data that is needed for any kind of further optimization and efficiency gains.

When the project ends in 2021, all findings and procedures will be published to disseminate and to communicate the adoption of such intelligent energy management systems to ports, but also to any kind of other large industrial infrastructure, by showing their obvious economic and ecological benefits.

Within the Innovative Port Technologies (IHATEC) funding programme, the Federal Ministry of Transport and Digital Infrastructure (BMVI) supports research and development projects that contribute to the development or adaptation of innovative technologies in German sea and inland ports and which help to manage cargo handling volumes and improve logistics chains. The BMVI is providing around 664m for this purpose in the period 2016-2021.



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Where are we today with port digitalisation?

by Graham Howe, Business Development Director, Operations Optimisation, ION

As we all know, 2020 has been an exceptional year. For all the negatives that the year has resulted in, it has also demonstrated how essential the port and shipping sectors are to global commerce as well as their resilience in the face of numerous challenges. One major impact of the pandemic has been to highlight the increasing need for ports to not only do more work with fewer resources but also the requirement to carry it out remotely. Now more than ever, the need for information sharing across the sector is of critical importance to stakeholders and, as a consequence, we have seen port digitalisation accelerating.



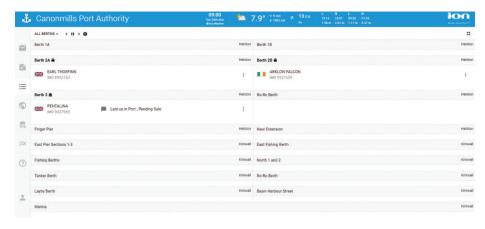
ON has been a leading technology innovator for over 50 years. While ION's traditional focus for its cutting-edge technology has been on the E&P industry, the company is now broadening and diversifying its business into relevant adjacent markets such as offshore logistics, ports, defense and marine robotics. Please head to iongeo.com/SmartPort to learn more.

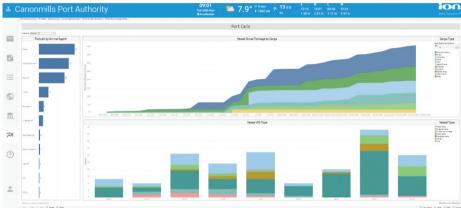
he This hasn't been brought about by the pandemic only, of course. Initiatives such as the IALA S211 and the Sea Traffic Management have been gaining momentum for a number of years now, and 2020 has seen those standards begin to bear fruit. There have been two major developments this year that have highlighted this trend. First, in October, the Digital Container Shipping Association (DCSA) launched a set of standard data definitions for just-in-time (JIT) port calls. It includes 17 timestamps covering the JIT port call process and benchmarking the core dataset within it. While this builds on the existing work - such as that of the International Taskforce Port Call Optimization, the International Maritime Organization, and the International Organization for Standardization - it is important to note that the DCSA represents over 70% of the world's container shippers, giving a single critical voice in support of the development of these standards.

This goes hand in hand with the growing importance of TradeLens launched in August 2018. Two years in, and there has been significant adoption of the platform across both ports and shippers, numbering market leaders such as Maersk, MSC and numerous major seaports around the world as users. The adoption of a single platform of this type, combined with the emergence of commonly agreed standards, have enabled the container port sector to move forward with digitalisation at a rapid pace.

Differences and similarities

These developments, however, have tended to exacerbate the growing divide between large and small ports in terms of digitalisation. If we use the EU characterisation of ports as Core and Comprehensive, we can see that the advancements noted above will immediately appeal to the former, enabling them to move TEUs seamlessly between themselves with maximum efficiency. Yet, the same cannot





be said for those listed as TEN-T Comprehensive Ports, which tend to be more diverse in nature, covering a full range of multi-purpose activities from the international and local ferry to tramp cargo traffic. It is a bit of a simplification to break down ports in this way, but it does enable us to summarise the two separate approaches to digitalisation.

On the one hand, we have large ports that have a clear interest in joining a platform like TradeLens. Engaging with this kind of large-scale initiative ensures that these ports remain competitive with their peers in a sector that needs efficiency to maximise profit margins and reduce harmful emissions. These ports tend to have well-funded IT departments that are able to remain up to date with the latest developments in the tech field.

For the medium-to-small port market, on the other hand, the capacity to stay ahead of the game in the technology race is more constrained. These multi-use ports are required to divide their resources among a broader range of needs: running efficient ferry operations does not require the same skill set as a port specialising in, say, barley, wheat, and other such crops. The IT resources that these ports have are often required to address a very wide range of solutions, from number plate recognition systems to document EDI. Not surprisingly, their resources are spread thin, and it's difficult for the port managers

to know where to turn for trusted advice.

That said, it is also important to note that these two port classes face similar challenges. All of them need to address issues created by vessels waiting to come into port and their idle time before and after unloading. The solutions adopted by the larger ports have, therefore, the capacity to benefit small and medium ports, too.

Trickle-down digitalisation

There are two main drivers that will encourage small-to-medium ports to adopt digitalisation. The first is regulation: as the focus on areas such as the reduction of emissions intensifies, ports will find themselves facing increasing levels of paperwork, leading them to find more efficient ways of keeping ahead of their administrative load. The second factor is the need for greater efficiency that will enable them to optimise the use of resources. If a port can halve the time taken to administer a port call, they will be able to free up resources to focus on other areas that are of benefit to their operations.

Now that we see digitalisation initiatives gaining pace in the large port sector, we can expect to see these concepts trickling down to smaller ports as solutions become more trustworthy and reliable. There will also be growing pressure on the medium and small port sector to adopt standards in order to comply with the requirements of global shipping. It is important, therefore,

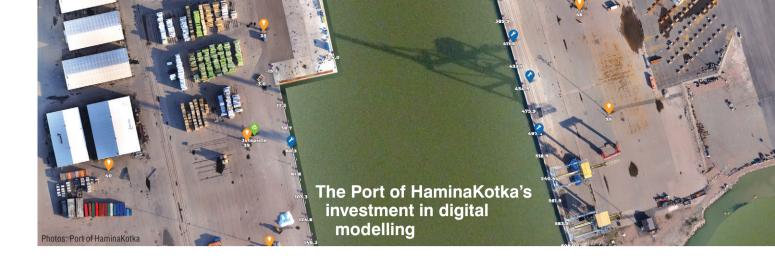
that small and medium ports are given the tools to be able to adopt these standards at a pace that is suited to their capacity.

Initiatives such as the EU-funded Connect2Small Ports project, focussed on the Baltic Sea, are developing means that enable ports to share information with peers regarding digital initiatives. These tools help resource-constrained ports to be kept in the loop on these large-scale developments and help them to find ways in which they can affordably upgrade their operations to ensure that they remain efficient and competitive in the post-pandemic environment.

Critical mass - achieved, more to come

Indeed, the year 2020 has by far been exceptional, and the port and shipping sectors can be justifiably proud of the role they have played in keeping the logistics chain unbroken and vital supplies moving around the world. It is also a year in which port digitalisation in the cargo container market has achieved a measure of critical mass. This development will change the way the sector as a whole works as new technologies trickle down across the market.

While none of us knows what 2021 will bring, I think that we can all agree that extreme change is now a constant in our lives, and we can expect to see more exciting developments in port digitalisation to meet that challenge.



At the touch of a button

by **Jaana Niemi**

Digitalization affects every aspect of society, with no exception made for seaports. Various digital applications have been in use across Finland for years now, such as the port traffic information system Portnet or various other systems used for, among many, production control and warehouse management.

igital modelling of ports and their structures (surface and underwater) has recently been the subject of a lively debate revolving around maintenance and resource management. HaaminaKotka has been one of the pioneers to digitalize its port environment. The 2019-introduced GISGRO data system - developed by VRT Finland to make better use of survey data - has been used to create a virtual port that combines conventional 2D imaging with 3D technology. "We wanted a system that would take us into a new era in one go. Our goal is to be the leading digital seaport on the Baltic Sea, and we believe that with GISGRO, we are one giant step closer to this goal. We use the system not only for maintenance purposes but also to support sales and vessel services," Ville Kuitunen, Sales Manager, the Port of HaminaKotka, highlights.

"To add every asset"

The ongoing coronavirus pandemic has put the virtual port to even more use than what was originally planned. When much of the work has to be done remotely to secure the safety of employees and customers, the digital overview of the port serves as an excellent inspection

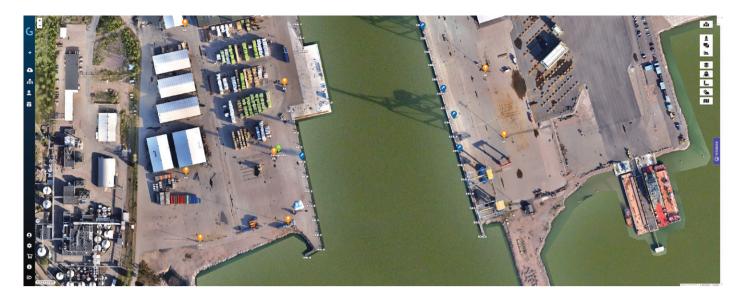
and management tool. "Our entire port is digitally modelled. Both aboveground and underwater structures are included. For example, we can view quay areas together with customers remotely without heavy camera connections. Even though nothing can fully replace face-to-face meetings, it is very important that we are able to respond to our customers' needs also when normal operations are not possible," Kuitunen explains.

By logging into the system, an employee of the Port of HaminaKotka can access the main view which opens the entire port in a virtual form. In addition to orthoimages taken by a drone from a height of 100 meters, each part of the port has been modelled in 3D, including quays, light masts, and warehouses. A uniform model has been created of the resulting image material using point cloud technology. "A two-dimensional orthoimage is very accurate, and details as small as individual manhole covers and potential surface cracks can be distinguished in it. The images can be taken again at any time, and this is actually important because our port grows and evolves at a very quick pace. It is imperative to have access to up-to-date material, and as the port changes, we will be able to add new items to the system

flexibly. Three-dimensional images, on the other hand, give the opportunity to simulate different situations related to port operations, such as various driving routes or even the location of new tracks, machines, conveyors and buildings," Kuitunen lists the benefits.

As such, the Port of HaminaKotka can reply to customer inquiries faster than before. To enable efficient operation, customers need different technical information on the port infrastructure, and it is now possible to centralize data storage in a single place. Issues ranging from load-carrying capacities of quay areas to water depth information and potential items requiring repairs are all visible in the same digital environment. The expedited flow of information not only serves the port itself but also its customers.

Maintenance work has also been facilitated following the inclusion of underground pipes, sewers, and other structures in the system. Winter conditions prevailing in Finland often cause problems, for example, when manhole covers and other equipment placed in the ground are covered by snow and ice. The Port of HaminaKotka encompasses 1,100 hectares of land, which is why nobody wants to waste time searching for what-is-where.



When all the information can be found in a virtual format in the GISGRO Building Information Modeling model, the customers' time and money are saved.

A large port houses many different activities, and the maintenance requirements are also stringent. Inspecting and reviewing each and every site is a challenging task due to long distances to cover. The virtual port allows any 'todeal-with' situation to be detected remotely. The necessary repair entries and contract orders are made directly within the system, sending the work order to the selected contractor. "The biggest job in the summer of 2020 is to add every asset of the Port of HaminaKotka to the system. Each bollard, track, manhole, firewater pumping station, gate, waste point, floodlight, electricity distribution centre - all of these will be digitally available. Moreover, later on, we will do the same work on all port properties, such as warehouses. We also want to include interior pictures, which can be used to manage

the premises and carry out any maintenance work more efficiently than before," Kuitunen specifies the work ahead.

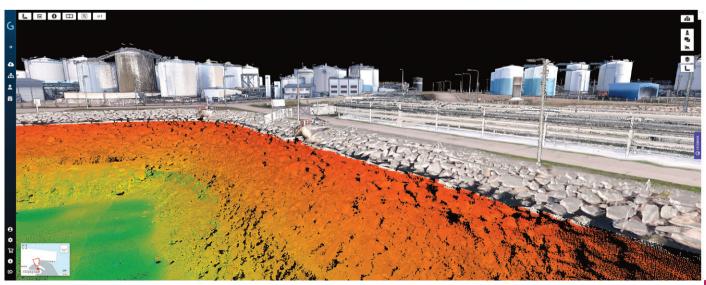
"The best outcome"

GISGRO also serves vessel traffic at the Port of HaminaKotka. The system provides up to date 24/7 weather information, while a link to the Automatic Identification System enables real-time ship traffic monitoring at and nearby the port. It is possible to enter the dimensions of the arriving vessel into the system and create a simulated port call, making it easier and faster to allocate a suitable berth. Kuitunen explains. "We have also included all the underwater areas of the port in the system. Our port has more than nine kilometres of quay wall across 76 berths, all of which have their own specific conditions. The depth of the berths varies from place to place, but with GISGRO we can quickly find the depth information and share it with, for example, the master or pilot of the vessel, if necessary. The underwater areas have

been modelled by means of sonar, after which a three-dimensional point cloud image has been created from the image material, just like with terrestrial areas."

Kirsi Hänninen, CEO, VRT Finland, is satisfied with the cooperation conducted with the Port of HaminaKotka, "The best outcome is always reached in good cooperation, listening to the customer. The Port of HaminaKotka is an excellent partner for VRT because the port wishes to exploit the opportunities offered by modern technology in an open-minded manner and be a trailblazer in its industry in Europe."

"We have access to the entire port literally at the touch of a button. By filtering the system view, we can display all the necessary features of our port at once, or we can view only the details we have selected. The developments do not stop here, though; we are constantly looking for new ways in which to serve our customers better and more flexibly. Digital tools provide a great opportunity for doing exactly that," Kuitunen sums up.





Still partying as if it was 1999

by **Aad Storm**, CEO and Founder, Eveon Containers

The container is considered one of the best trade inventions of the past century, an essential enabler of the globalized economy. Standardization is its key virtue. This makes it possible to use it across different transportation modes, giving it the possibility to sail, fly, or roll throughout vast expanses. The fact that it is standardized means that it ticks at least one of the boxes (pun unintended) for being considered a commodity. And commodity markets are always transparent, right? Unfortunately, they are not!



ad Storm is the Founder and Chief Executive of Eveon Containers, an ecommerce start-up for trading ISO containers. Storm has many years of experience in the container business, having worked as Vice-President for CARU Containers, leading the Boston office as well as the Dutch and Belgian ones. Before CARU, Storm worked for two disruptors in the telecom and the energy markets and has been ranked multiple times in the upper half of the Dutch list of top 100 marketers. For more on Eveon, please head to www.eveoncontainers.com

fter having worked in different commodity markets, I got introduced to the container one, around 2014, during my work as a consultant. And the more I learned about this market, the more I got fascinated by it. It is dynamic, prices are volatile, while the nature of the business is international in its very essence. Even more fascinating was the fact that in this industry, everybody seemed to be working as if it still were 1999.

Inefficiency galore and lack of transparency

Even today, many container traders are still laying out their orders printed in the morning on individual paper sheets to discuss today's work and try to keep track of the inventory in an Excel file that is mailed around. Nobody publishes prices. And when a customer calls, the first thing to do is to find out whether they know the market.

If not, many traders are trying to get the highest possible price from this customer who really needs a container right now. Or even worse, this forces customers into time-consuming negotiations even though they just want some boxes for their next

project, so they can go about their regular work without losing too much time.

A lot of additional winning

The majority of the containers travelling the seas, railways, and roads are owned by shipping lines and leasing companies. As containers age, there comes a time when box owners want to sell off parts of their fleet to finance the production of new containers in order to keep their stock young.

As selling their used containers to many often relatively small end-users is not their core activity, they can only spend limited time on selling their equipment. This also implies that containers that are flagged for sale keep on being transported around empty while the owner actually wants to sell it.

This causes unnecessary costs for repositioning their empty containers and also generates CO_2 emissions that could have been avoided if the container would have been sold at an inland destination right after unloading it.

The impact of digitalization: good and fair

In virtually every commodity market, digitalization has disrupted everything. We are



now comparing energy suppliers, insurance companies, and many other service providers on the handy devices we carry with us. Anywhen, anywhere, and faster than you can read this article. And then we buy, on that very same spot. Whenever we want to.

The transparency this digital revolution brought about has cut out players from the value chain who added no value, which has, in the end, increased efficiency. All in favour of both sellers, at least those techsavy, and buyers.

The world of container trade will follow inevitably. The impact will be huge and will clean up the value chain, benefiting the environment, container fleet owners, as well as end-users who buy containers for storage or transport. I consider it a very good and fair change.

Knock, knock. Who's there? The 21st century

It was this reasoning that was behind the founding of Eveon Containers. Our company is a new online shop that aims to make the buying process of containers as easy and transparent as possible. Eveon sells containers directly to the customer via its shop and cuts out inefficiencies in the value chain. All prices are listed on the website, and the products can be purchased there directly.

Our way of working allows container fleet owners to sell boxes at multiple inland locations in a transparent way to end-users without having to deal with the hassle. The solution's flexibility allows it to sell to endusers anywhere in the world within a few weeks' time to react to a surplus in the market or sell a continuous flow at a multitude of locations while avoiding unnecessary costs for repositioning empty containers. On a global scale, millions of unnecessary

empty container transports can be avoided, which adds up to an incredible amount of carbon footprint that can be avoided.

At the same time, we make the market more accessible for buyers and offer them a better service as well as fair prices. Customers can, for the first time, go through the entire ordering procedure in just a few minutes. And purchasing containers can be done 24/7 on any mobile device. Customers can also choose between a variety of different payment options, ranging from credit card to PayPal to prepayment options, and directly plan the delivery date. All these benefits, which have already been standard in other markets for many years, are now finally available in the container trading business, too.

For Eveon, the yardstick is not any other container trader but the best e-commerce players worldwide. As I often tell people: our benchmark is Zalando! Buying containers should be as easy as getting a new pair of shoes on the web. Or better, it ought to be even easier, as containers are standardized products, a commodity.

Time for a change

As we roll out the concept of Eveon to more locations, we sometimes notice that some players try to block the digital transformation of the market. We see this as a temporary phenomenon, their 'last hurrah,' since traditional players will sooner or later have to accept the fact that the digital disruption of the container market is going to happen. In certain areas, it's already afoot. At the moment, the market still largely operates as it did two decades ago. However, the party of the traditional container business, with its outdated pricing practices, is over. Container customers deserve to finally get what they know from other industries - a fully digital experience.



Why can't a ship be bought as easily as a car?

by Dr.-Ing. Christoph Jürgenhake, Group Manager Integrated Mechatronic Systems, Tobias Seidenberg, Research Assistant, and Stefan Pfeifer, Head of Development Methodology and Management, Fraunhofer Institute for Mechatronic Systems Design

Imagine you go to a car dealer and ask the manufacturer to produce a vehicle that has a maximum speed of exactly 218 km/h and must not weigh more than one tonne. Furthermore, it has to have a range of exactly 1,000 km with one tank filling. Surely, it must also have three airbags on each side, while the trunk cannot be bigger than 500 litres. Of course, it has to be a three-seater and painted in high gloss candy pink. Silly, isn't it? Then why does everybody do that in shipbuilding?

TFAM

Transport Advanced and Modular

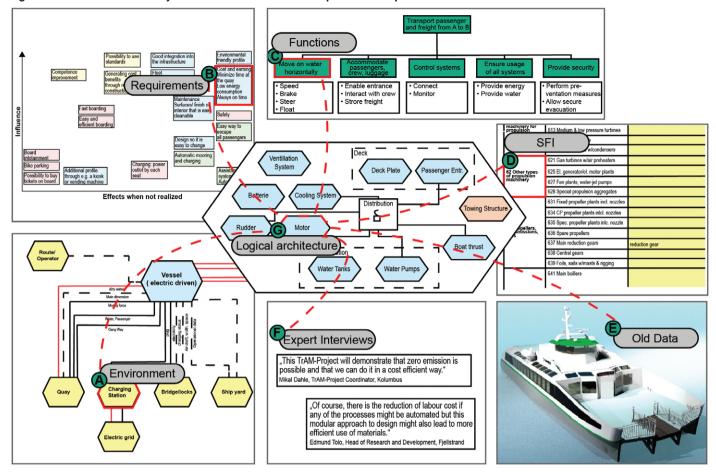
he aim of the TrAM project is to develop a zero-emission fast going passenger vessel through advanced modular production. New manufacturing methods will contribute to 25% and 70% lower production and engineering costs, respectively. The project is revolutionary both in terms of zero-emission technology and manufacturing methods and will contribute to making electric-powered high-speed vessels competitive in terms of both cost and environmental impact. This work has been supported by the TrAM H2020 project, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769303. For more information, please head to www.tramproject.eu

hip design is characterized by individual solutions like hardly any other industry. Typically, every vessel is developed from scratch to meet the specific requirements for the planned route, the designated operator, and national regulations. This is also because ships are usually ordered through bidding procedures and tenders, set up for individual cases. The requirements communicated this way are fixed; though, there are many ways in which they can be met. One can even go further by stating that there is no transparency in the actual intention behind the requirements, i.e., what the future owner actually wants to achieve (e.g., why specify a certain top speed if a vessel only uses it 10-15% of the time, while the actual intention was to keep the route sailing time according to plan?).

There is nowadays a dominant belief that complete optimisation is the only way to design a ship. This is a result of today's extremely specified tender processes, which lead to one-off ships due to all the requirements vessel owners include in their order specifications. As such, the final ship design is the result of an iterative, successive, and cost-intensive optimisation process, in which the best solution is selected from a range of possible alternative solutions. Those variants are based on a variety of optimisation criteria such as stakeholder requirements, target speed and route length, or national and international regulations. The resulting ship is then a fit-for-purpose design. As an effect, small changes in requirements have a strong impact on the final design.

The connection between compulsory technical requirements and physical restrictions is even more evident for battery-powered vessels, as there is a high degree of dependency between individual systems and physical characteristics (e.g.

Fig. 1. Interaction between System Model and different aspects of the procedure



battery weight, range, speed, the actual number of passengers on-board, etc.). However, battery-powered ships can have a significant impact on the emission reduction of the urban transport sector. When discussions of decreasing emission limits began in 2013, the European Commission presented the first measures to reduce greenhouse gases in its strategy for reducing emissions from the shipping industry; coastal & river cities such as London have also adopted their own emission targets.

The shipbuilding industry, with its described one-off design and production, faces the challenge of supplying many municipalities and cities with environment-friendly passenger ships in the short-to-medium-term. This leads to a tension between, on the one hand, coming up with (expensive) individually-designed state-of-the-art ships and, on the other hand, the need for quickly available, cheap, and ecological mobility solutions. Shipbuilders, their customers, and urban transport companies have a great (public) interest in putting eco-friendly ships into service as soon as possible, hence drive up shipbuilding demand. At the same time, though, the differing use-cases do not make the task any easier.

Internal complexity & external variety

Modularisation is an established methodology from other industries (e.g. automotive or aviation), providing the necessary instruments to solve the contradiction between individuality and standardisation. By developing modular product architectures, it is possible to combine single modules that adapt the product to individual customer needs or boundary conditions. At the same time, the reuse of modules allows for the shortening of the development and production processes.

However, modularisation is tricky and should not be mistaken for block construction. The latter method is used from a manufacturing point of view in order to be able to build large ships where crane, weight, or other production limitations are preventing an integral production. In contrast, utilising modularisation methods is an active decision already made during the product design.

From the system theoretical perspective, modularity is a concept for handling internal complexity while allowing external variety. This complexity can have different dimensions; one approach to solving it is to subdivide complex systems into individual subsystems, which are functional mostly independent from other

subsystems. The subsystems, or 'modules,' can be described by different characteristics, structured by requirements of all product life phases. Moreover, modularisation refers to the targeted development of modular product structures and the concrete definition of modules and interfaces. An essential aspect of this is to group systems by their functions, links and interfaces with other systems – and not according to their shape or proximity.

With the previously described challenges in mind, the development process has to consider incorporating the socalled 'Systems Thinking.' Model-Based Systems Engineering (MBSE), for example, is an integrated and interdisciplinary approach to achieve this goal. It defines the concept of a consistent description and analysis of a system to be developed based on models, from the early phase of conception through the entire product life cycle. The models describe the development object from different perspectives and illustrate different aspects (like the system's functions). For each of these aspects, a corresponding model can be created (also known as a partial model). The sum of all partial models, together with the corresponding links between them, results in a coherent partial model.

For the modularisation of a product, the partial models that describe the aspect of the system structure are of particular importance. These models describe the essential elements of a system and how they relate to each other. This includes the interfaces between the system elements and the system boundary. To create a system model, there are different languages (e.g. SysML), methods (e.g. CONSENS, SysMod) and IT tools (e.g. Enterprise Architect) that can be used in combination

The modularisation alphabet

Within the EU-backed TrAM H2020 project (Transport Advanced and Modular), our solution approach is based on the idea of supporting module identification using a consistent, domain-spanning system model. The logical system architecture is used to analyse relations and connections between system elements and to determine the optimal system interfaces. We have developed an overall three-step procedure to identify the modules and build up a modular architecture for the vessel-family.

The first step is to develop a universal ship architecture for a battery-powered fast ferry. In the second step, this logical architecture is adapted to real use cases. Within TrAM, a demonstrator vessel will be built and put into operation in the Norwegian Stavanger from 2022 (a replicated unit will also be developed for London). The Stavanger demonstrator will be elaborated in close cooperation with the Fjellstrand ship-yard. Both use cases differ in main requirements, e.g., route length, maximum speed, the number of passengers to be served, etc. Finally, a change impact analysis will be carried out; by comparing the individual adapted ship architectures of the different use cases, system elements in the architecture that have remained the same will be identified. These are potential candidates for future modules. It will also be relevant to see which systems will change for every use case because the definition of standard interfaces between varying and remaining parts of the architecture is what allows the individualization of the ship.

The development of the general logical ship architecture has followed a multistep procedure. Different partial models have been developed to create a logical architecture. In particular, the relationship between individual partial models, other support tools, and the resulting system architecture is illustrated in Figure 1. The starting points of the procedure are the environment analysis (A) and requirements (B) of the CONSENS

modelling method. In the former, the integration of the 'Ferry' system into its environment is systematically analysed. By evaluating the interactions of the 'Ferry' system with its environment elements, conclusions about required system elements of the logical architecture can be derived very easily. In the present case, it can be concluded from the environment element 'Water Station' of the quay, e.g., that the hull requires water to be taken up by the system element 'Water Tanks'. The requirements part specifies goals and restrictions for the later solution and might thus impose certain limitations (e.g. legal requirements of the approval authorities may require that batteries have additional fireproof insulation).

In the next step, functions are derived from the results of the requirements analysis and, starting from the main function 'Generate mobility,' are transferred to a function hierarchy (C). The system elements of the logical architecture realize functions very concretely so that there is a link between the functions and the system elements. Individual functions can be implemented by one or more logical system elements. As a high-level example, the system element 'Engine' can provide the function 'Generate Propulsion.'

The SFI code (D) describes a design and production-driven classification system. Due to its highly functional subdivision of a ship into generic categories (hull, equipment or machinery), it provides an ideal basis for the derivation of the logical ship architecture's system elements. After passing through the environment and requirements analyses as well as the establishment of the functional hierarchy, the system elements already created can be compared with the elements of this quasi-standard, restructured and, if necessary, renamed.

In addition to the SFI code, other resources can be used to develop the logical architecture. For example, ship architectures from previous similar projects (E) can be used to supplement the logical architecture. The resulting architecture is finally reviewed through interviews with ship development experts (F).

As simple as

Despite the high potential, modularisation approaches can hardly be found in the maritime industry due to the high degree of dependency between the ship's individual system elements. If approaches like the presented procedure and Systems Thinking become more popular, effects on the current tender processes should become visible - forming a future where you can buy a ship as simple as a car.



A game changer

by Ragnar Johansson

By rethinking road freight from scratch, the Swedish tech-company Einride is developing a solution that has the potential to revolutionise transport by being both cost-competitive and sustainable. Einride's Autonomous Electric Transport (AET) system is based on self-driving, all-electric vehicles, the so-called Pods. The company has already attracted global interest for its solution, including the Port of Helsingborg, Sweden's record-breaking second-largest container seaport.

E/NRIDE

pinride provides the mind and the muscle to transform transport. The company offers a complete Autonomous Electric Transport (AET) solution consisting of an intelligent shipping platform and electrically-powered, driverless vehicles, aka Pods. Einride is making the movement of goods more intelligent: emission-free, safe, costeffective, and ultimately sustainable. To challenge conventional thinking, please head to www.einride.tech

eavy-duty road transport is responsible for around 7% of global CO₂ emissions. By substituting electricity for diesel, Einride believes it can reduce the level of pollution by as much as 90% for countries with a low-carbon electricity mix like Sweden. Emissions of nitrogen oxides and ultrafine soot particles that can be harmful to people's health can be eliminated as well (read more in BTJ 4/14's Driving out of last breath. The cost of air pollution from road transport).

There are also strong business incentives for transport-intensive companies to transition to a sustainable electric transport system. Fleets of Einride's Pods can be coordinated by an intelligent routing system, which optimises delivery time, battery life, and energy consumption. The company thinks its solution could reduce operating costs by around 60% when compared to a traditional diesel engine truck with a driver. As such, CB Insights, a cutting-edge research and technology firm from New York City, has named Einride one of three Sustainable Shippers in its Game Changers 2020 report, in which it identifies emerging trends and high-momentum start-ups with world-changing potential.

Building the roster

Einride was founded in 2016 by the engineer and former automotive executive Robert Falck and has already had a significant impact on the transportation industry since its start. In May 2019, it became the first company in the world to put an electric, driverless truck on a public road. It did so with its customer and partner, DB Schenker, at the global logistics provider's facility in Jönköping. "This day represents a major milestone in Einride's history, and for our movement to create a safe, efficient and sustainable transport solution, based on autonomous, electric vehicles, that has the potential to reduce CO, emissions from road freight transport by up to 90%. I can't begin to describe how proud I am of our team that made this happen in collaboration with our great partner and customer DB Schenker," said Falck about the occasion.

Einride has to date built an impressive roster of customers, apart from DB Schenker also Coca-Cola European Partners, the Michelin Group, the Swedish arm of Lidl, and Svenska Retursystem (a Stockholmbased company that develops and operates reusable systems used to simplify and improve the logistics and distribution

of goods). One of the more recent additions is the Port of Helsingborg. The port is located in a booming part of the Nordic region and functions as a rail & road freight hub. This is one of the factors that have made it one of Sweden's most used seaports - its container turnover reached a new peak in 2019 (+10.8% year-on-year up to 267,652 TEUs). "The Innovation Partnership with Einride means exploring new and uncharted territory together. In the third quarter of 2021, we hope to have a pilot in place to transport containers between two different parts in our port area. As the last level and step three, the vehicles should be able to drive 4-5 kilometres outside the port," commented Mats Fernebrand, Purchasing Manager, the Port of Helsingborg. Falck added to this, "The Innovation Partnership with the Port of Helsingborg will enable us to explore how autonomous, electric trucks can contribute to both effective and safe transport in harbour areas while radically reducing CO₂ emissions. We look forward to the partnership with the Port of Helsingborg and the opportunity to be part of their continued journey to become the most modern port in the Nordic region."

Meanwhile, Einride partakes in other eco-friendly undertakings, too, One of them is a research project - carried out within the framework of the Triple F (Fossil Free Freight) initiative - conducted by the Stockholm Environment Institute with the help of the Forestry Research Institute of Sweden and involving players from across the Swedish forest industry that will study how the most innovative fossil-free

Tab. 1. Main characteristics of Einride's pallet and timber Pods

Truck	Loading capacity	Range per charge	Top speed	Battery capacity	Size	Weight fully loaded
Pallet	15 pallets	- 200 km	85 km/h	200 kWh	7 x 2.5m	26 tonnes
Timber	16 tonnes	200 KIII	03 KIII/II	300 kWh	7.3 x 2.5m	20 torines

solutions, and the combination thereof. could reduce CO2 emissions from transport in the industry.

Tech-enabled sustainability

Einride's solution for self-driving, electric trucks, is based on a variety of technologies, including advanced safety systems and sensors like lidars, radars, and cameras used to position the vehicle and observe its surroundings. The pioneering Pods are equipped with specialized modular trailers for transporting pallets, timber, and perishable goods, while future vehicles will be pretty much able to take on-board any shipment. Self-driving technology for Einride is not an end in itself but is seen as an important enabler for future sustainable transport. Vehicles without a cab are naturally lighter and can be developed and designed for electric propulsion (Tab. 1).

Another important milestone for the company came just after summer 2019 when Einride announced it had closed its first big funding round of \$25m, co-led by the EQT Ventures fund, a European multistage venture capital fund with commitments of over €566m, and NordicNinja VC, a deep tech-focused €101m Nordic & Baltic fund backed by Panasonic, Honda, Omron, and the Japan Bank for International

Cooperation (JBIC). Other investors joining the round included Ericsson Ventures, Norrsken Foundation, Plum Alley Investments, and Plug and Play Ventures.

The funds will support both organizational growth and continued investments in Einride's software platform as well as further international expansion, enabling the company to keep on building demand for sustainable transport and delivering on its growing number of customer contracts. "Our ambition is to disrupt the transport industry and closing our series A brings us one step closer to that goal. The funding will allow us to start expanding in the US. deliver on our technology roadmap and to meet rapidly increasing customer demand," sums up Falck.

"Robert has a bold vision and a great way of attracting the right people," said Claes Hemberg, the man synonymous with personal finance in Sweden for more than 20 years and, for some time now, also one of Einride's investors. Hembera continued, "He wants to challenge the status quo and change road freight transport by introducing a more intelligent system, based on self-driving, electric trucks, that is both sustainable and costefficient. The last part is crucial. Companies need a compelling business incentive to change. Einride has that."





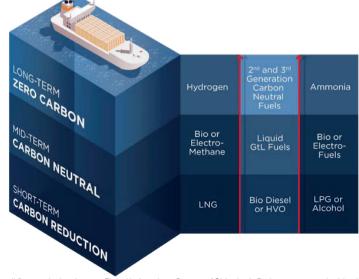
Not enough?

by Przemysław Myszka

We've been reporting on the topic of cutting down the sea shipping industry's carbon intensity for a long time now and have done so from multiple angles — technological, financial, regulatory, and even political. One of the latest analyses comes from the American Bureau of Shipping (ABS) which has investigated alternative fuel pathways toward reaching the International Maritime Organization's (IMO) greenhouse gas (GHG) emission reduction target: down to half of what was emitted in 2008, by 2050 (meaning to 460.5 million tonnes). Whereas there are a plethora of more or less mature technologies that promise to supply low- or zero-carbon bunker, that alone won't be sufficient. More worryingly, implementing measures that would slow global warming, in line with the +1.65 centigrade goal (with a 50% probability) set forth by the International Energy Agency (IEA) in its Sustainable Development Actions (SDA) scenario, hence limit the demand for shipping fossil fuels (even carried in the holds of a green fleet), probably won't get the job done either. That said, one is inevitable, ABS observes, "[...] there is consensus that adapting to the new rules and challenges aimed at lowering its collective carbon footprint will be another period of uncertainty driven by disruptive environmental legislation, and defined by the innovative solutions which emerge."

he ABS' research revolves around three non-mutually exclusive pathways: light gas fuels; heavy gas oil and alcohol; and bio/synthetic. These are structured into the framework of two scenarios, base (with and without the adoption of less carbon-intensive fuels) and the so-called Accelerated Climate Action (ACA). Both are informed by the projections made by the Intergovernmental Panel on Climate Change, with the latter assuming the implementation of IEA's SDS and their impact on the world trade of dry and liquid bulk as well as containerized goods. ABS has partnered with Maritime Strategies International (MSI) to calculate how international sea shipping will fare carbon-wise by 2050 under these scenarios, all in order to, "[...] reference available carbon-reduction strategies and inform the shipping industry as it enters the uncharted waters of the [...] emissions challenge."

Fig. 1. Three fuel pathways to carbon-neutral and zero-carbon shipping



Source for all figs. and tabs. (except Fig. 12): American Bureau of Shipping's Pathways to sustainable shipping

LIGHT GAS FUELS

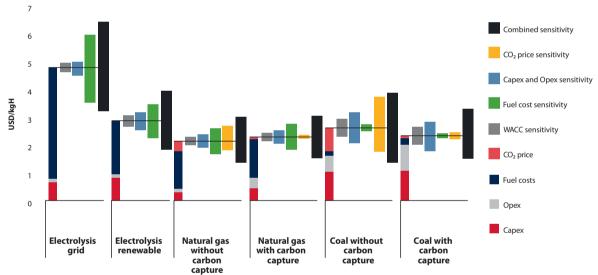
This category comprises fuels made of small molecules with low-carbon-to-hydrogen (C/H) ratio such as hydrogen itself but also liquefied natural gas (LNG) along with its variations depending on how they're produced, e.g., synthetic natural gas (SNG) or renewable natural gas (RNG).

Compared to other future fuel candidates, LNG has over the past several vears established itself as a fairly mature bunker not limited to the gas carrier segment. On paper, LNG promises a CO_o emission reduction of up to 21% vs heavy fuel oil (HFO), provided that methane doesn't slip from engines (an issue for any shipowner going for a lowpressure Otto cycle engine and who also makes no investment in methane oxidation catalysts and other exhaust gas after-treatment systems). The carbon

footprint of LNG can be further lowered by blending it with liquefied gases that have been sourced in a more renewable way, a solution already explored in Sweden through the addition of sustainable liquefied biogas (LBG) produced in Lidköping (e.g., by using LBG, the ferry line Destination Gotland wants to achieve a climate goal of reducing its CO, emissions by 70% by 2030). According to a 2011 analysis prepared by the Gas Technology Institute, RNG produced from waste biomass (e.g., agricultural) has the potential to offer up to 2.5 quadrillion British thermal units/year, the equivalent of what the half of homes in the US consume. SNG can be produced from biomass, too, yielding >90% methane by volume mixtures and with the same physical and chemical properties as

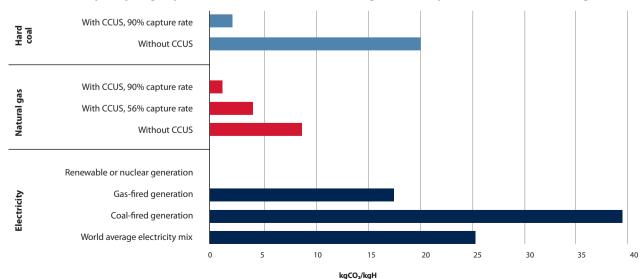
fossil natural gas. Biomass can be used to source SNG/RNG at an efficiency of up to 70%. There's also the coal-to-SNG option, though, the conversion results in more CO_a emissions than burning coal, so additional measures would have to be implemented to make it climate-friendly such as carbon capture and sequestration (CCS). Alternatively, there's the power-to-gas lane to explore where hydrogen can be used to react with CO, to produce methane or SNG/RNG, or when hydrogen is used to upgrade lowquality biogas. The 4-9% (hydrogen by energy) hydrogen-compressed natural gas blend can be used either in internal combustion engines or in fuel cells (obviously, the eco-friendliness of this method depends on the energy source used to produce hydrogen). Because

Fig. 2. Hydrogen production costs for different technologies in 20301



¹ WACC - Weighted Average Cost of Capital

Fig. 3. Carbon intensity of hydrogen production with and without utilizing Carbon Capture Utilization and Storage



LBG, SNR, and RNG do not significantly differ from LNG, they can be used as drop-in bunker necessitating no engine or fuel system modifications. Lastly. SNG/RNG biomass facilities can be set up in or nearby ports, thus cutting transport-related emissions (the Lidköping plant is located some 360 km away from the Port of Nynäshamn where Destination Gotland's ships are bunkered).

Although still a fossil fuel, LNG was very much praised in the past; maybe not as the ideal solution but far better than

oil-based bunkers - to the extent that the European Commission (COM) rushed a few years ago to entwine the whole EU with LNG infrastructure (within the sustainable energy security package, which included a non-legislative strategy for LNG and gas storage). Fast forward to present times and one gets the impression that LNG is already passé; instead, the new COM has put hydrogen in the centre of attention of its European Green Deal.

Having said that, the story behind hydrogen is no breaking news; it has always been portrayed as the silver bullet. In all fairness, it's a solution that also repeatedly came with its set of caveats. As things stand today, the production of hydrogen is very carbon intensive: from 10t CO₂/1.0t H2 when natural gas is used (75% of world hydrogen output), up to 19t for coal (23%). Some 275mt oil equivalent of hydrogen is produced annually, roughly 2% of the global energy demand. The allure of hydrogen is that it can be zero-carbon if "only" produced with renewable electricity.

Fig. 4. Cost of delivering hydrogen or ammonia produced by electrolysis from Australia to Japan in 2030

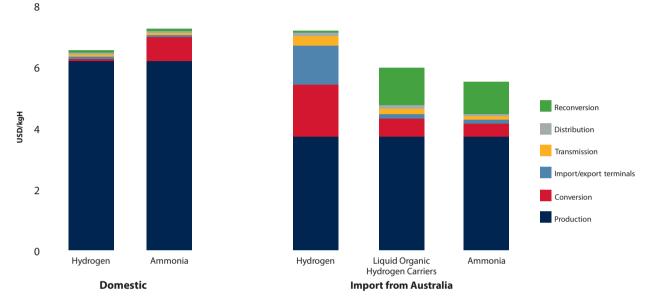
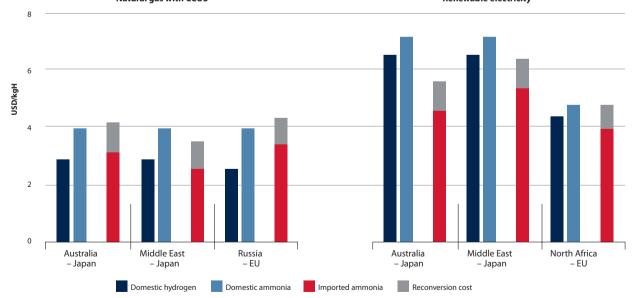


Fig. 5. Comparison of delivered hydrogen costs for domestically produced and imported hydrogen for selected trade routes in 2020 Natural gas with CCUS Renewable electricity



Heavy gas & alcohol fuels

This group consists of fuels based on larger molecules than the light gas group as well as having less favourable C/H ratio eco-wise.

Interestingly, while liquefied petroleum gas (LPG) has considerably penetrated the private vehicle market in certain countries (e.g., around 14% of cars in Poland

run on it, 9% in Italy, and 7% in Latvia), the shipping sector has to this day been reluctant to give it a try. Unlike LNG, this non-toxic and not harmful to soil or water

by-product of natural gas processing or oil refining can be liquefied at low pressures and ambient temperature, making it possible to store and transport in pressure vessels at around 18 bar or semi-pressurized/ refrigerated tanks at five to eight bar and -10 to -20°C. LPG has a lower C/H ration than diesel, thus its burning results in lower CO, emissions. For instance, using LPG in the ME-LGIP engines reduces CO, emissions by up to 18% and particulate matter by 90%, compared to HFO, according to MAN (the first commercial ME-LGIP engines were installed in two of EXMAR's very large gas carriers in 2019; on behalf of BW LPG. MAN has also retrofitted four MAN B&W 6G60ME-C9.2 HFO-burning engines to 6G60ME-C9.5-LGIP LPG-propelled DF ones). The lifecycle GHG emissions of LPG have been reported to be 17% lower than those of HFO or marine gas oil (MGO), on a par with LNG. The carbon footprint of LPG can be further axed by bunkering bio-LPG, a by-product of biodiesel production, purified to make it identical in composition to conventional LPG. Bio-LPG can be produced from a variety of feedstock, including agricultural waste and residue, wood, and vegetable oils. Since end-2016, Neste has been running what's said to be the world's first bio-LPG production facility, part of the company's renewable product refinery in Rotterdam. Neste's bio-LPG is used in transportation, residential and commercial heating, and as a drop-in biofuel in marine applications. Unlike LNG, however, current two-stroke LPG engines will need to employ exhaust gas recirculation (EGR) to control rising temperatures during combustion or selective

Tab. 1. GHG emissions of HFO, MGO, LPG, and LNG (kg CO₂eq/GJ)

	HFO	MGO	LPG	LNG (Qatar)
Well-to-tank	9.79	12.69	7.15	9.68
Tank-to-propeller	77.70	74.40	65.50	61.80
Total	87.49	87.09	72.65	71.48

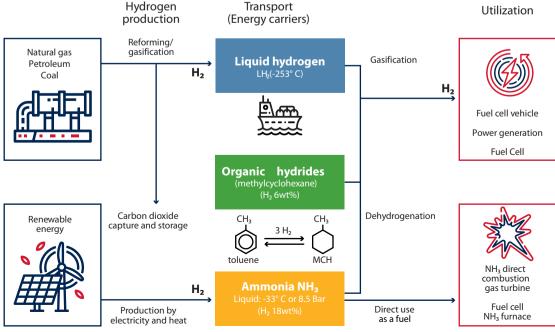
catalytic reduction (SCR) systems to treat the exhaust gas in order to comply with Tier III NO_x emissions regulations (there's some evidence that four-stroke engines can be efficient enough to ensure compliance without the need for after-treatment).

Methanol, primarily produced from natural gas and already widely used in the chemical industry, is an alcohol fuel with low C/H ratio, which can offer similar CO₂ emission reductions as natural gas. Its low-reactivity requires the presence of an ignition source (pilot diesel injection in dual-fuel engines) to ignite the fuel-air mixture. The energy content of methanol is comparatively low, creating issues with how much bunker can be actually stored on-board a ship (e.g., deep-sea vessels would require two-tothree times more frequent bunkering). On the plus side, it is liquid in ambient conditions which simplifies storage. It also has a lower adiabatic flame temperature than diesel, which can reduce the peak cylinder temperature and limit NO_v formation during combustion. Methanol contains no sulphur and requires limited modifications to the engine and fuel supply system compared to LNG. "In 2019, Marinvest announced that two of its vessels using the ME-LGI engine accumulated more than 50,000 operating hours using methanol and showed a

slight improvement in fuel conversion efficiency compared to baseline diesel operation. [...] Engines that use direct fuel injection have shown very little methanol slip," ABS' authors write in Pathways. Similar to LNG and LPG, there's also bio-methanol, sourced from a variety of feedstock, most commonly from natural gas but also more renewable sources like wood, municipal solid waste, waste CO₂, and sewage water.

While the light gas group has its 'top of the class' in the form of hydrogen, here the same can be said about ammonia, "a disruptive, zero-carbon fuel that has the potential to enter the global market relatively quickly and significantly contribute to meeting the GHG reduction target for 2050 set by the IMO," ABS highlights. Just as methanol, ammonia has been on the market for years, predominantly used as a fertilizer as well as a building block for the synthesis of pharmaceutical and cleaning products. Although ammonia is nowadays produced from hydrocarbon fuels, renewable sources can be used to make hydrogen from the electrolysis of water and then synthesized to ammonia. making it what's called an electro-fuel. More importantly, it's an electro-fuel that is characterized by zero-carbon intensity during production or use, as it is free of carbon (and sulphur, for good measure).

Fig. 6. Hydrogen and ammonia production and use



Ammonia has a higher energy density by volume than hydrogen and is easier to liquefy - at 8.6 bar and at ambient temperature or, alternatively, by bringing it below -34°C; it can also be carried in liquid form at ambient temperature, typically compressed to around 18 bar. As such, C-type or prismatic tanks can be used for storage. Moreover, ammonia requires significantly lower re-liquefaction energy compared to hydrogen or LNG. It also has a narrow flammability range, thus isn't considered an explosion hazard. Yet, ammonia can be toxic in concentrated form and very reactive. That's why the International Gas Carrier Code specifies strict requirements on the materials that can be used to contain ammonia, alongside the design features that a plant needs to have in order to minimize the risk of exposing personnel to poisoning. Gases other than natural gas can be used as fuel, according to the International Code for the Construction and Equipment and Ships Carrying Liquefied Gases in Bulk (IGC) as well as the International Code of Safety for Ships Using Gases or Other Low Flashpoint Fuels, granted safety isn't compromised; however, the use of cargo identified as toxic is explicitly prohibited by IGC.

Ammonia is a low-reactivity fuel, requiring a pilot injection; on the flip side, it's conducive to spark-ignition combustion.

These are fuels similar in proprieties to diesel but sourced renewably. This makes it easy to use them as drop-in bunker as well as take advantage of the existing transport and bunkering infrastructure and services. "However, the carbon reduction potential, economics, and viability of different biofuels depend on their source feedstock and production pathways," ABS notices.

Fatty Acid Methyl Ester (FAME) is the most common first-generation biodiesel, characterized by a higher cetane number than diesel, which promotes autoignition and may reduce the ignition delay and noise during combustion. FAME is produced from a variety of plant and animal feedstock, including canola, soybean, coconut, palm, corn, rendered beef, poultry litter, and used cooking oil. It has a higher flash point (149°C) than diesel and a high cloud point which may result in clogging of fuel filters and lines and poor fuel flow below 32°C. While FAME is non-toxic and has good lubricity properties thanks to which fuel pumps and injectors are protected against wear, it's also biodegradable, degrading in the

Tab. 2. Well-to-tank emissions for ammonia by energy source for the production process (g CO₂eg/MJ)

	Electricity source	Production	Transmission and distribution	Total
	Municipal waste	18.31		18.73
	Hydro	20.46	0.42	20.89
	Nuclear	45.23	0.42	45.66
_	Biomass	45.77		46.20

Ammonia has a high heat of vaporization, helping to control NO_x formation. Then again, this may be offset by the fuel-bound nitrogen, which may increase nitrogen oxide formation. The MAN ME-LGIM dual-fuel engine, designed for running on methanol and diesel, can use ammonia instead of the former, following slight modifications to the fuel delivery system to supply ammonia at 70 bar and inject it into the cylinder at 600-700 bar.

The 2012 study Developing Fuel Injection Strategies for Using Ammonia in Direct Injection Diesel Engines showed that combustion with ammonia results in similar or lower NO_{X} formation than diesel and two-to-six times lower CO_2 . If injected into the cylinder during the exhaust valve event, however, ammonia slip can occur; this can be avoided in high-pressure direct-injection systems that inject fuel late in the compression stroke. Nonetheless, SCR will have to be used for ammonia engines to comply with NO_{X} emission regulations.

Identically to hydrogen, ammonia can be burned in internal combustion enaines or used in fuel cells (discussed in more detail later in the article). In the latter case, hydrogen contained in the molecule needs to be extracted, and hightemperature solid oxide fuel cells (SOFC) can be a more efficient and compact solution than the polymer electrolyte membrane (PEM) technology. ABS notes in this regard, "There are also other advantages of using ammonia in SOFC, such as the high electrical efficiency achievable, the absence of NO_x production and the lack of vibration. However, SOFC currently have a [...] very high comparative cost. [...] An additional shortcoming [...] is the sensitivity of the solid oxide ceramic materials used to heat gradients, which cause relatively long and careful start up and shut down procedures, which often last for hours." To avoid that, SOFC plants should operate continuously, coupled with an energy storage system (batteries) to balance load demand fluctuations.

BIO/SYNTHETIC FUELS

presence of water, and has low oxidative stability, meaning FAME breaks down over time, forming peroxides, acids, and other insoluble compounds; oxidation can also lead to bacterial growth in tanks and sludging of fuel lines, filters, and injectors. There are certain tradeoffs to consider when blending FAME and diesel, ABS cautions, such as when fuel-bound oxygen can decrease carbon monoxide and non-methane hydrocarbon emissions in blends up to 20% but which, at the same time, increases NO_v formation. Larger blends also lead to the degradation of fuel filters and oil sludging. The International Council on Combustion Engines published in 2013 its Guideline for Ship Owners and Operators on Managing Distillate Fuels up to 7.0 % v/v Fame (Biodiesel), which includes recommendations such as avoiding >6-month-long storage, especially of biodiesel in isolated individual unit tanks, and implementing fuel condition monitoring. Overall, ABS voices its scepticism toward first-generation biofuels, "The production of first-generation biodiesel generally results in high fuel cost

due to the limited supply of feedstock and competition from the food, pharmaceutical and cosmetic industries. In addition, the feedstock supply for biodiesel is significantly less than petroleum diesel, so present biodiesel production cannot fully replace the consumption of diesel. Based on these limitations, biodiesel can be used in blends, but as a long-term solution, it would be economically and logistically unattractive to use it as a large-scale marine fuel."

Hydro-treated vegetable oil (HVO) represents the second generation of biofuels (i.e., those not produced from food crops). HVO comes from plant oils or animal fat through hydrotreating and refining. Hydrogen is used to remove the oxygen from oil to avoid FAME's oxidation issues. A mixture of paraffin, HVO is free of sulphur, esters, and aromatics (which form soot precursors). It has a very high cetane number, a heating value that is slightly higher than diesel, and good stability for storage. Combustion with HVO results in 28-46% fewer particulate emissions and Filter Smoke Number (FSN) than diesel as well as 5-14% lower NO_x formation. Less

CO₂ is emitted, too, following HVO's better C/H ration than diesel. Overall, specific fuel consumption is 3-4% lower (but 4-5% higher volumetric consumption since HVO has a lower density than diesel). Alike FAME, however, the capacity for producing HVO is limited. Because it's dependent on access to renewable feedstock, HVO prices can vary greatly depending on the source and season (palm oil cost \$1,250/t in February 2011 vs \$650/t in 2016; cooking oil \$720/t in January 2013 vs \$400/t in 2016).

A number of companies in the Baltic are already using HVO, i.a., the Port of Södertälje to propel its two new reachstackers, APM Terminals Gothenburg to run the container handling equipment (incl. over 40 straddle carriers), or the Port of Norrköping for its machinery and car fleet. Then there's GoodShipping Program, an initiative dedicated to decarbonizing ocean freight, i.a., by scaling up the supply and use of low carbon marine biofuel oils. In March 2019, the organization, together with IKEA Transport & Logistics

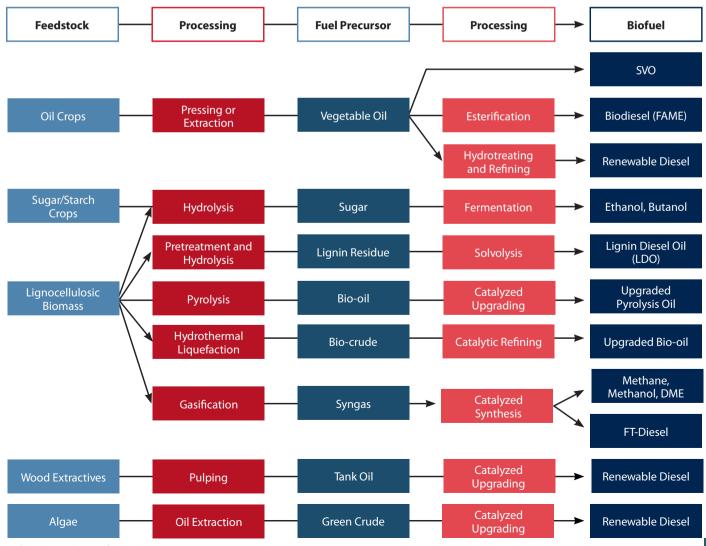
Services and CMA CGM, bunkered the shipping line's container carrier biofuel derived from forest residues and waste cooking oil. According to GoodShipping Program, its product is expected to deliver 80-90% well-to-propeller $\rm CO_2$ reduction vs fossil equivalents. In addition, the product eliminates sulphur oxide ($\rm SO_x$) emissions – and does so without any requirement for engine modifications.

Syngas (CO + $\rm H_2$), converted biomass under high temperature and pressure in the presence of oxygen, is another alternative. It can be either directly used in internal combustion engines or further processed to liquid form. Although synthetic diesel, a high-quality clean fuel, demonstrates reductions in regulated emissions in comparison to diesel, its production and refining are energy-intensive.

Syngas can also be converted to dimethyl ether (DME), a colourless, non-toxic, and low-carbon content gas, easy to liquefy and transport. "Combustion with DME has been experimentally

tested on automotive heavy-duty diesel engines [...]. The results verified that the absence of carbon bonds and the presence of oxygen in the fuel eliminates soot formation and enables engine optimization for minimizing NO_x formation and fuel consumption," ABS reports. Because DME has a higher cetane number than diesel, the ignition delay is decreased, resulting in less pressure during combustion, hence lower noise. On the other hand, DME has lower energy content than diesel as well as low viscosity and lubricity, requiring the use of additives to avoid supply line leakages and surface wear of moving parts. That said, DME production is ramping up, e.g., in China as a replacement/supplement for propane (up to 5mt/year); other facilities are also coming online (Japan, South Korea, Brazil) or are in the pipeline (Egypt, India, Indonesia). In the Baltic, Sweden is experimenting with Bio-DME produced from waste streams from pulping. Last but not least, DME production doesn't require large-scale plants.

Fig. 7. Overview of biofuel production pathways from different biomass feedstocks



Tab. 3. Comparison of energy and sulphur content, and cost of alternative fuels

	HFO	MGO	LNG	FAME	HVO	Ethanol	Methanol
Lower Heating Value (MJ/kg)	39.0	43.1	47.1	37.1	44.1	26.7	19.9
Sulphur (% m)	<3.5	2	_	_	-	_	_
Cost (\$/t)	290	482	270	1,040	542	503	464

Tab. 4. Storage requirements of different fuels

	MGO	Methane	Ethane	Propane	Butan	Hydrogen	Ammonia	Methanol	Ethanol
Flashpoint (°C)	>60	-188	-135	-104	-60	_	132	11	16
Boiling point (°C 1 bar)	180-360	-162	-86	-42	-1	-253	-33	65	78
Density (kg/m3 liquid)	900	450	570	500	600	76.9	696	790	790
Conventional or cryogenic pressurized tank	CONV	CRYO	CRYO	CRYO	CRYO	CRYO	CRYO	CONV	CONV
Secondary tank barrier required	NO	YES ¹	NO	NO					
Additional cofferdam or hold space requirements	NO	YES	YES	YES	YES	YES	YES	YES	YES
Volume comparison MGO (energy density)	1	1.78	1.41	1.66	1.40	4.16	2.45	2.44	1.82

¹ Except type C tanks

CARBON CAPTURE AND SEQUESTRATION, HYBRID ELECTRIC POWER, FUEL CELLS, DC SYSTEMS, JUST-IN-TIME AND OPTIMUM SHIP ROUTING

ABS identifies a set of additional measures the sea shipping industry will have to implement in order to hit the IMO's GHG goal.

Carbon capture and sequestration (CCS) aims to tackle the inherent issue of CO, formation as a complete combustion product in proportion to the carbon content of fuel. The plan is to absorb CO₂ into a solid or liquid. Next, in the desorption/regeneration step, CO2 is selectively desorbed, resulting in a flow of pure CO. gas and the regeneration of the original capture absorber for further use. In a pioneering trial, Mitsubishi Heavy Industries has installed a CCS unit on a very large crude carrier. The system comprised four towers (each roughly the size of a scrubber) and liquefaction and storage facilities, an additional 4,500t in total. The plant was designed to produce methane or methanol by combining hydrogen from water electrolysis with the captured CO₂. The initial capture rate was 86%. The entire CAPEX came at around \$45m, out of which the CCS installation cost \$30m and the methane/methanol plant \$15m.

More and more shipping lines are also equipping their vessels with batteries, either for hybrid or purely electric propulsion (the former are optimized for a narrow operating range in order to maximize the number of discharge cycles, while the latter for a wide operating range). Although lithium-titanate (LiT) batteries have lower cell voltage and specific energy than the more commonly known lithium-ion (Li-ion) ones, they aren't troubled by Li-ion's ageing problem, hence the technology is more promising for the sea shipping industry (today's marine batteries have a life cycle

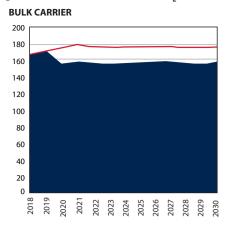
of 7-10 years, which according to ABS should be extended beyond 15 years). Irrespective of the chosen solution, the organization also cautions, "Batteries can be a source of catastrophic failure resulting in dangerous and possibly life-threatening consequences. Battery packs must undergo rigorous testing in order to ensure benign failure modes. As general guidelines, the battery should not emit particle or any toxic and hazardous gases. Care must also be taken in manufacturing, transporting, using and recycling of batteries. Many safety standards exist to define the level of danger from batteries; safety tests include penetration, crash, thermal stability, overcharge/discharge, and externals short." A number of companies have already blazed the battery trial (incl. Scandlines, ForSea, Color Line, Blidösundsbolaget, Waxholmsbolaget, the Swedish Transport Administration, Västtrafik, and FinFerries in the Baltic); SEACOR Marine has hybridized its diesel platform supply vessel SEACOR Maya with a Li-ion system (operational within 90 days), saying that her average fuel consumption went down by one-fifth.

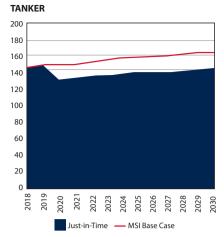
Just like batteries, fuel cells are also electrochemical devices that supply DC power. In contrast to batteries, the fuel and oxidant are stored outside the cell and brought into it as the reactants are consumed. In essence, fuel cells are energy converters, not storages (that's why it's faster to refuel them than recharge/replace batteries; however, both operate within a DC system, so that fuel cells can be accommodated into a hybrid electric architecture). While the already-mentioned SOFC technology seems better suited for

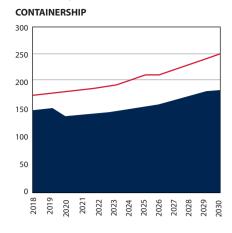
ammonia fuel cells, ABS also highlights its competitor, the polymer electrolyte membrane (PEM) solution characterized by lower operating temperature range (<100°C vs 650-1,000°C for SOFC), small size, high efficiency, and wide operating range. That said, there's a set of challenges - other than the cost of producing and transporting hydrogen or ammonia standing against the widespread use of fuel cells, which includes the cost of exotic materials (e.g., platinum for electrodes) or sensitivity to impurities but, above all, the so-called balance of plant, an accessory system required to operate the fuel cell (fuel and air processing; thermal and water management; electrical controls; protection; and AC-DC conversion). Balance of plant can take up to 10-20% of the fuel cell output for low- and high-pressure systems, respectively. Then again, combined with heat recovery, fuel cells can achieve system efficiency of up to 85% vs 30-55% for diesel engine-generators. Once an issue, because fuel cell performance weakened with time, the lifetime of fuel cell systems has been improved to the extent suitable for marine applications. Currently, however, the unit cost of a fuel cell system can be up to 10 more expensive than competing power generation technologies.

Quite a few projects have been initiated to bring the fuel cell technology onto the market. ABS' own initiative, SF-BREEZE, was tasked with designing and building a high-speed passenger ferry with hydrogenfuelled PEM fuel cells for operation in the San Francisco Bay. ABS is also involved in developing a prototype hydrogen fuel cell unit to power on-board reefers. The

Fig. 9. Potential reduction of CO₂ emissions with just-in-time shipping vs baseline (million tonnes)







Norwegian ship technology company Havvard Group is working to design, certify, and deliver a large-scale hydrogen power solution that can be retrofitted onto a ropax. Wärtsilä is said to develop the world's first big-scale ammonia fuel cell for ships. The Finnish company will take part in the ShipFC project the aim of which is to install a 2 MW-big ammonia fuel cell on-board Eidesvik's currently LNG-run offshore vessel Viking Energy by 2023 (Wärtsilä has also carried out combustion trials using ammonia to assess its potential to serve as ship fuel and is investigating several other alternatives, including synthetic methane, hydrogen, and methanol). The ShipFC consortium believes that an ammonia fuel cell of that magnitude will make it possible to sail on clean energy for up to 3,000 hours/ year. Tokyo Kisen Co. and e5 Lab are working on developing the design and regulatory baseline for a hydrogen fuel cell-powered tugboat, possibly in operation in 2022. Last but not least, Ballard Power Systems has

presented a modular 100 kW PEM fuel cell stack that can be used in various combinations to provide power (main or auxiliary) and redundancy needed by a vessel.

Direct current (DC) distribution is another technological solution that promises to improve fuel efficiency. DC energy sources, fuel cells and batteries, can also be directly connected into the ship's electrical systems via power-electronic converters (PEC), producing additional fuel savings. Nevertheless, ABS notes, "It is only in the past few years that full DC networks have been used in small vessels. New systems require crew training, awareness, and familiarity. Also, the supporting components do not have a long history of operations in marine environments (operability, reliability and historic data for failure rates)."

Technology can also aid shipowners in optimizing ship routing. Analysis of various data sets (ship performance, weather, ocean currents, etc.) can be used to adjust vessel speed in order to avoid unnecessary

anchorage, which is often the result of ships speeding in the hope of arriving before others, only to get stuck in a queue waiting for a free berthing slot, meanwhile burning bunker to keep on-board systems running. According to models prepared by ABS' partners from MSI, just-in-time shipping (incl. an average 5% reduction in speed, and assuming no impact on cargo-carrying capacity and no adjustment to the size of the fleet) can deliver 10-11%/year CO2 emission savings. However, it might be hard to enforce a global speed reduction scheme. not counting the toll this might take on importers who will have to increase their inventories to accommodate the longer delivery time (according to research carried out by Erasmus University Rotterdam - following the slow steaming practices introduced by shipping lines in response to the negative impact on trade of the financial crisis of 2007-2008 - while liners could achieve fuel savings of up to around \$70m, shippers would accrue \$170m in inventory costs).

TRADE, SHIPPING, AND EMISSIONS

Given the superfluity of alternative fuels that can take shipowners and operators to the other side where the grass is in fact greener, how come ABS arrives at a conclusion that transitioning sea shipping toward climate-friendly operations, by means of exchanging one bunker for another, won't be enough to get the industry to the IMO's 2050 goal? "Based on the projected fuel mix for the five vessel segments analysed in this study, shipping can meet the IMO's target to reduce CO₂ emissions per transport work (g CO_a/dwt/nm) by 70 percent by 2050, relative to 2008. However, to achieve a 50 percent reduction in absolute CO. emissions (ton), the market share of petroleum fuels will need to be further reduced by 2050 (below 40 percent)," ABS clarifies.

It ultimately boils down to two issues. First, lowering as much as possible the share of fossil fuels in the 2050 demand mix. This may be quite a challenge from a tonnage renewal perspective, as demonstrated on an exemplary dry bulk carrier company that gradually mixes its fleet (HFO, MDO, LNG, biofuels, putting slow steaming on top of it all). "With so many combinations of options on the

table – and more certain to emerge in the next few years – devising a sustainable fleet-wide decarbonization strategy that meets company goals is complex; more so, when each ship requires a bespoke solution that fits its age and operating profile, etc.," ABS stresses.

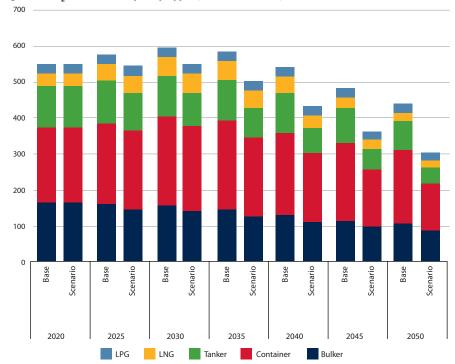
Second, the global demand for sea shipping, hence how much GHG will be emitted from taking goods from point

Tab. 5. Key ship types, gross tonnage, number, and typical emissions (g CO₂/dwt/nm)

Туре	Total gross tonnage (million)	Total no.	Emissions
Dry bulk carrier	482	11,536	3-9
Oil and chemical tanker	352	8,681	2.5-7.5
Container ship	246	5,170	6-19
LNG carrier	58	518	6-11
LPG carrier	21	779	7-15
Other	221	40,620	N/A

A to B. This might be the biggest unknown, particularly if one ventures to predict how much will be traded in three decades from now. The foundations can be a little shaky, including the decoupling of trade and GDP; growing demographics don't necessarily have to contribute to greater consumption (either because future cohorts are poorer than generations born in the 20th century, a trend already visible, or because they chose to lead more sustainable lifestyles); alternative models of production will kick in, notably 3D printing which could lead to both less transportation and products with a longer lifespan; reshoring much of today's production; embracing the circular economy model; electrifying, automating, and having access rather than owning private cars; socioeconomic havoc wrecked by climate change and other black swans; whatever the development of Artificial Intelligence will bring, also factoring in the emergence of a Superintelligence which may come up with solutions beyond the grasp of humankind - for good or ill of our species.

Fig. 10. CO, emissions by ship type (million tonnes)



Tab. 6. Lowering the carbon intensity of a bulk carrier company

- Fleet of ten bulk carriers: 10 x 80k dwt built in 2010 (prior EEDI)
- Operating profile: 50% laden, 35% ballast, 15% idle
- Newbuildings are assumed with negligible fouling, whilst existing vessels with a fouling allowance

Timeline	Fleet composition	Main engine fuel	Auxiliary engine fuel	Speed (knots)	Carbon intensity ¹	Reduction in carbon intensity vs baseline
2019: ten vessels, prior to the 2020 sulphur cap	10 x 80k dwt	HFO	MDO	13	4.4	BASELINE
2020: after the sulphur cap	10 x 80k dwt	MDO	MDO	13	4.5	+2%
2021: slow steaming	10 x 80k dwt	MDO	MDO	12	3.2	-27%
2025: replacement with three EEDI III LNG vessels ²	7x 80k dwt 3x 85k dwt	MDO LNG	MDO LNG	12	2.82	-36%
2030: replacement with two EEDI III biofuel vessels ³	5x 80k dwt 3x 85k dwt 2x 85k dwt	MDO LNG BIOFUEL	MDO LNG BIOFUEL	12	2.23	-49%

Calculated as an average of the fleet; CO, emissions per transport work – calculated using nominal deadweight, not cargo carried
The newbuildings are assumed with a 20% gain in specific fuel oil consumption (SFOC) and a 5% gain in power from design optimization
The newbuildings are assumed with no gain in SFOC and a 10% gain in power from design optimization; the carbon factor is assumed as 0.4 for the biofuel

Fig. 11. Projected marine fuel use to 2050

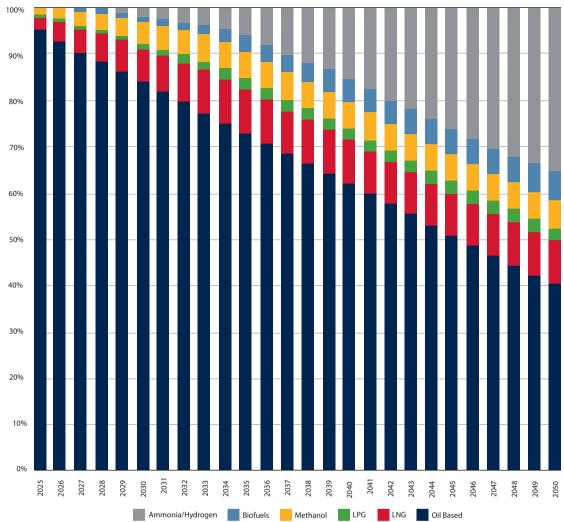
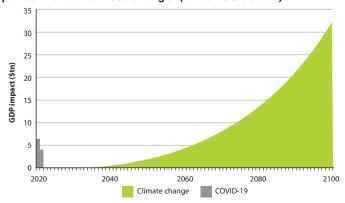


Fig. 12. Projected economic cost of the coronavirus pandemic¹ and climate change² (trillion US dollars)



¹ According to the International Monetary Fund ² According to the Organisation for Economic Co-operation and Development Source: AFRY

Fig. 13. Trade growth by key commodity (billion tonnes)

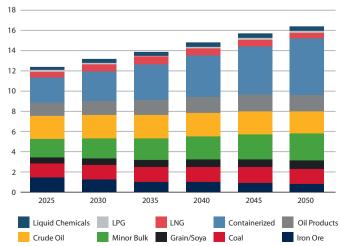


Fig. 14. Iron ore seaborne trade (million tonnes)

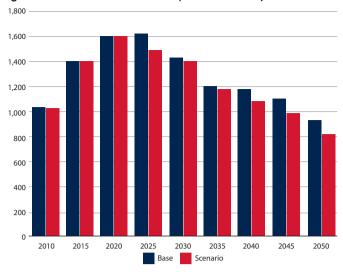


Fig. 14. Iron ore seaborne trade (million tonnes)

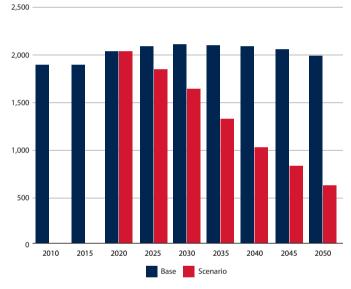


Fig. 18. Edible oil, in- and organic chemicals seaborne trade (million tonnes)

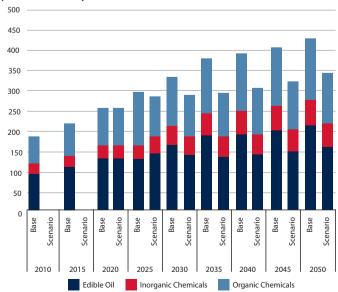


Fig. 15. Coal seaborne trade (million tonnes)

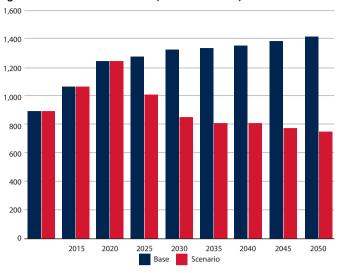


Fig. 15. Coal seaborne trade (million tonnes)

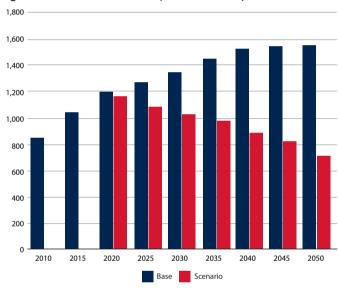


Fig. 19. Global container trade evolution (million TEUs)

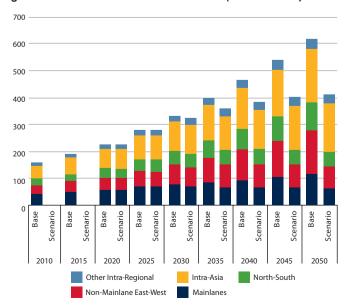


Fig. 20. LNG imports by region (million tonnes)

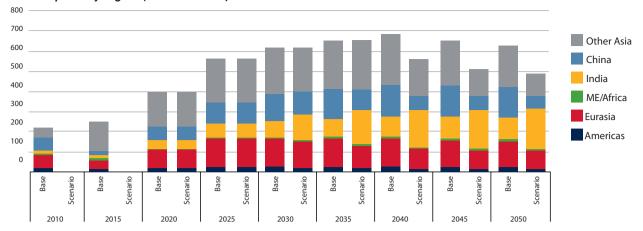


Fig. 21. LPG imports by region (million tonnes)

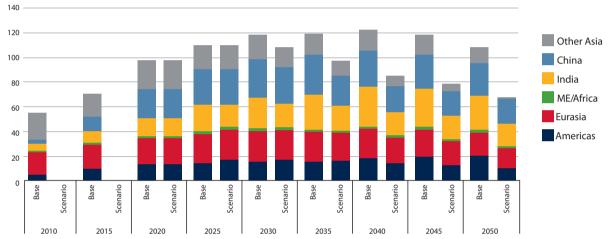


Fig. 22. Fuel consumption by ship type (million tonnes heavy fuel oil equivalent)

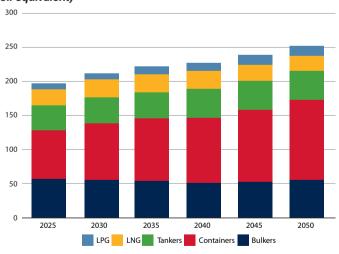
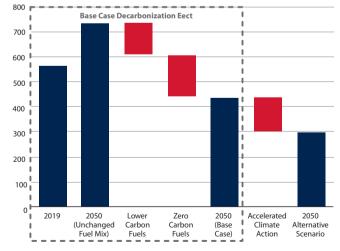


Fig. 23. Key vessel segments pathways to decarbonization (million tonnes ${\rm CO_2}$)



SURVIVAL OF THE FASTEST AND GREENEST

At the end of the day, it appears that decarbonizing sea shipping isn't within the full reach of the industry itself. As blunt as it may sound, greener shipping also means less shipping. "As with any large-scale industry transition, success will

not come easily or without the significant disruptions that pose unique and unprecedented challenges and opportunities, especially for early adopters," ABS sums up its *Pathways to sustainable shipping*.

"Early adopters," seem to be the

keywords here. It may as well mean "survivors." After all, combating climate warming isn't about the survival of planet Earth, in the past, it handled far worse disasters than us, but a liveable future for all earthlings, with or without sea shipping.



Energy transition is well on its way (yet not fast enough)

by Ewa Kochańska

The Energy Transition Outlook 2019 (Outlook), prepared by DNV GL, is a forecast of developments in the global and regional energy sector to the year 2050. The report estimates that while the energy transition will be swift, it won't be quite fast enough to reach the "well below 2°C" global warming goal of the Paris Agreement. On the positive side, the Outlook also determines that global energy will peak by 2030, as energy efficiency gains overtake economic growth. Additionally, electrification fuelled by renewables will help lower energy intensity, allowing governments to spend less GDP on energy and more on innovative energy solutions. Their choice to do so, however, will depend largely on the public pushing lawmakers to act on climate.

he study presents a "central case"
– a single forecast of the future of
the energy sector, instead of the
more traditional scenario-based approach (Figs. 1-3). Additionally, the prognosis only took under consideration proven solutions in the industry, leaving out
emerging technologies, at the same time
recognising that some of the innovations
could potentially become significant
enough to alter the Outlook's predictions.
However, the authors consider it unlikely
that their growth would be rapid enough
to affect the industry by 2050.

Hail to the new king, electron

The Outlook estimates that worldwide demand for energy will peak in 2033, varying across sectors and regions, with transport, buildings, and manufacturing requiring most of it (Fig. 4). In the building sector, space cooling, in particular, contributes to higher energy use. The

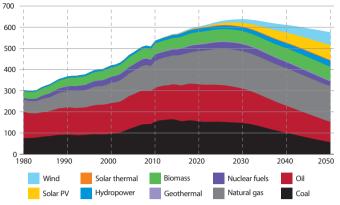
rising global temperatures will make air conditioners a necessity, especially in the Indian Subcontinent, where usage will grow ten-fold, and in Latin American, Middle East, and North Africa, where usage will grow four-fold. In manufacturing, while demand is set to increase by 60% by 2050, the circular and sharing economic activities will contribute to efficiency gains. And transport, consuming 28% of global energy – most of it in the form of fossil fuel – is what the authors call "one of the great engines of the energy transition, as the electron gains primacy over the fossil molecule."

Road transport is the biggest offender in terms of greenhouse gas emissions, and vehicle density is a particularly important element of the puzzle, e.g., North American vehicle density exceeds 80% because people drive a lot and in large cars, owing to low fuel-efficiency standards and fuel prices. In contrast, in China, it's estimated that the vehicle density will not exceed 40% thanks to policies supporting public transport. Also, in the Organisation for Economic Co-operation and Development (OECD) countries, there's been a decrease in car ownership among young population owing to, i.a., popular taxi services such as Uber and Lyft. These trends are expected to continue.

Autonomous vehicles will also aid in reducing carbon emissions by speeding up the overall vehicle fleet renewal time; according to research, automated vehicles are driven 50% more often which means the vehicle turnover rate is much higher. That way, the vehicles in use are newer and therefore "greener," cause fewer emissions, and emerging technologies are put to use much faster.

However, the Outlook's "main finding" in this area is that "the uptake of electric vehicles (EVs) – passenger EVs first, and

Fig. 1. World primary energy supply by source - exajoules/year in 1980-2050



Source for all figs.: DNV GL's Energy Transition Outlook 2019

later commercial EVs – will occur very rapidly." For private EVs, the 50% mark will be reached globally around 2033 (Fig. 5). In terms of commercial EVs, the utilisation will take longer. In less-developed regions, a 50/50 mixture of commercial EVs and internal combustion engine vehicles will still be present in 2050, while in Greater China and Europe, the 50% share in the commercial market will be realised by 2030. Obstacles to EV use include range deficiencies, comparatively high cost (set to come down after 2023), and slow 'refuelling' coupled

with scarce density of charging stations. Therefore, subsidies and other preferential treatment, such as the EU's emission-reduction plan, coming into force in 2020, which contains bonuses to carmakers, permission to drive in bus lanes, lower registration fees and taxes, etc., are crucial to EV uptake.

Other modes of transport, while not nearly as energy-demanding as road, also contribute to the energy transition. Maritime and air travel consume around 2% of the world's energy resources, each. Both industries, which are not in

any country's jurisdiction, were reluctant to make changes in terms of their emissions and other ecological footprints (read more in BTJ 3-4/18's Shipping, IMO, and the cosy bed they made. The complicated road to environmental shipping targets). First, in 2010, the aviation committed itself to 2% annual fuel efficiency improvements beginning in 2021. That declaration, however, was much too conservative bearing in mind that aviation is considered the "fastest-growing source of greenhouse gas emissions" among all modes of transport. The International Maritime Organization (IMO) followed, although not until 2018 and after much pressure, committing shipping to a CO₂ emissions reduction of 50% by 2050 compared to 2008 levels. Maritime is still the most energy-efficient mode of transport, but, at present, the most often used fuel in shipping is thick oil with sulphur (although, in 2020, new regulations limiting sulphur emissions come into force). Since in maritime transport, electricity is only used in short sea shipping, and that's not expected to change by 2050, most improvements in fuel will be moving from oil to a mixture of natural gas (mostly liquefied natural gas and wherever feasibly possible also liquefied biogas)

Fig. 2. World primary energy supply by source – exajoules/year in 2017-2050

2017	2020	2030	2040	2050	Share in 2050
4	5	17	37	61	11%
2	3	19	47	70	12%
2	2	3	4	4	1%
16	16	18	24	29	5%
55	57	58	62	65	11%
3	3	4	4	4	1%
29	31	33	28	22	4%
146	157	177	178	169	29%
172	175	162	128	96	17%
158	154	147	100	56	10%
586	603	638	611	577	100%
	4 2 2 16 55 3 29 146 172 158	4 5 2 3 2 2 16 16 55 57 3 3 29 31 146 157 172 175 158 154	4 5 17 2 3 19 2 2 3 16 16 18 55 57 58 3 3 4 29 31 33 146 157 177 172 175 162 158 154 147	4 5 17 37 2 3 19 47 2 2 3 4 16 16 18 24 55 57 58 62 3 3 4 4 29 31 33 28 146 157 177 178 172 175 162 128 158 154 147 100	4 5 17 37 61 2 3 19 47 70 2 2 3 4 4 16 16 18 24 29 55 57 58 62 65 3 3 4 4 4 29 31 33 28 22 146 157 177 178 169 172 175 162 128 96 158 154 147 100 56

Fig. 3. World final energy demand by carrier – exajoules/year in 1980-2050

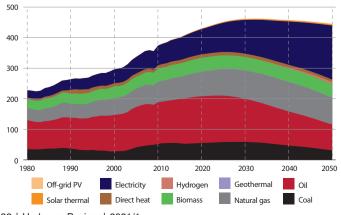


Fig. 4. World final energy demand by sector – exajoules/year in 1980-2050

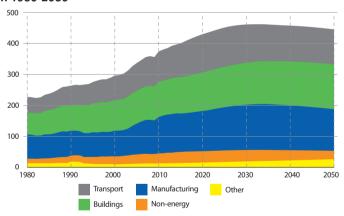


Fig. 5. World number of passenger vehicles by drivetrain – billion vehicles in 2015-2050

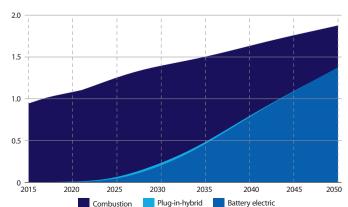
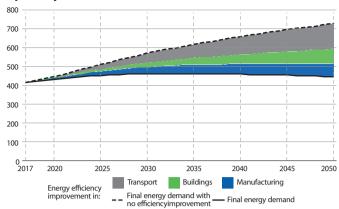


Fig. 6. The effect of the sectoral energy efficiency improvements on final energy demand - exajoules/year in 2017-2050



and hydrogen (read more in BTJ 6/18's The rub of the green. Zero-emission shipping by 2035). The switch will be driven by rising carbon costs and regulated decarbonisation efforts, while increases in efficiency will result from logistics improvements and various hull and engine efficiency measures. Therefore, the Outlook determines that the IMO-enforced 50% reduction in CO₂ emissions from 2008-2050 will be achieved.

Aviation, in both passenger and cargo transit, will grow by 170% in the next 30 vears, but only around 6% of all passenger-trips will be via electric planes. Therefore, the most significant change here will be driven by a switch to biofuels. Additionally, the fuel use is forecasted to increase just by 38% by 2050 due to improvements in efficiency in loading, engine, and aerodynamics technologies. The fuel itself will contain 42% of biofuels by 2050 with electric accounting for just 3%.

Finally, rail, which currently uses about 0.5% of global energy, is set to grow by 150% in the passenger sector in the next three decades. Particularly, China and India are predicted to increase their rail passenger traffic in part as a result of government support. This can be attributed to two major factors: in terms of decarbonisation, rail is a favourite mode of transport due to "ease of electrification," and in urban areas, rail is preferable on account of its space efficiency. Furthermore, innovation in speed-rail makes it competitive in both cargo and passenger transit, and globally, by 2050, freight rail demand will double.

Decarbonisation made digitally

According to the Outlook, in terms of power, by 2050 world electricity demand is set to escalate by 125%, with buildings (up by 92%) and manufacturing (up by 87%) eating up most of it. Therefore, in 2050, buildings will still have the highest electricity demand of 39%, manufacturing will be second with 32%, while transport sector will go from 1.3% of global demand in 2017 to 17% in 2050. Meanwhile, the use of direct heat, defined in the report as "the thermal energy produced by power stations for selling to a third party" is set to decline, and, as a result, the demand for direct heat will fall from 12 exajoules/yr in 2017 to 8 EJ/yr in 2050. Considering losses in distribution, global direct-heat generation will fall from 14 EJ/yr to 8.9 EJ/yr in the same period.

However, the Outlook also estimates that by 2050, the world will become much more energy-efficient, despite population and economic growth. As a matter of fact, "accelerated electrification will see primary energy supply peaking at 638 EJ in 2030." Furthermore, due to decarbonisation throughout the next 30 years, the use of fossils for energy will fall from 81% today to 56% in 2050, 4% of the energy mix will be nuclear, and 40% will come from renewables. By 2026, gas is set to surpass oil as the largest energy source and will amount to 29% of the energy mix by 2050 worldwide, while wind and solar use - enjoying solid growth 16- and 45-fold, respectively - will correspond to less than 25% of the global share, taken together, by 2050.

There are also alternative, albeit unproven, energy supply technologies described in the report, even though as mentioned at the beginning, the Outlook doesn't take those under consideration in its forecast. Some exciting potential could materialise in the form of 'ocean energy' - solutions that capture energy from waves, tides, ocean currents, ocean thermal energy, and reverse osmosis. Similarly, 'nuclear fusion' offers promise, with smaller fusion systems currently in the works. Unfortunately, the results are still limited and "no plant has yet produced more energy than that required to initiate and sustain a fusion reaction." The authors predict that a minimum of 20 years is needed before we see any breakthroughs (if any at all).

Digitalisation, or smart technologies, enables smoother and more efficient transmission, distribution, and management of energy. Here, cross-connectivity plays a crucial role, particularly when it comes to enabling of varying renewable sources which have a limited generation capacity. Automation is another key factor, particularly in the industrial and manufacturing production as well as the maritime sector. The very much needed emission-reducing and energy-saving trends in sea transport demand reliable, fast, and automated communication between ports, vessels, ship owners, cargo owners, and other actors

involved in shipping. Incidentally, the report calls blockchain a "coordinating tool" of the future – "a game-changer for how the power sector evolves."

Advancement in logistics in this sector could accelerate "slow steaming" for emissions reduction. It's been determined that slowing speed by 20% would save 30-35% fuel and slowing by 50% would save 60-67% (however, some express a healthy dose of scepticism towards the introduction of slow steaming regulations: read more in BTJ 6/17's The need for speed. Talking a global ship speed reduction scheme over). With time, the operational technology systems will come online (for updating and optimising), improving areas such as operating/energy efficiency and reducing maintenance downtime. The amplified digitalisation and connectivity will result in higher asset utilisation, decreasing energy use. The Outlook determines that by 2050 vessel utilisation, will increase by around 5%/20%/25% for deep sea bulk, short sea, and other deep sea trades, respectively.

Naturally, along with the advances in digitalisation and connectivity of data and processes comes the issue of energy systems' vulnerability to security threats such as cyber attacks. The Outlook warns that "governments will need to ensure that regulations are in place to be certain that operations and infrastructure can be trusted as being safe and secure."

Not even a shoestring budget

The good news is that energy intensity has been decreasing globally by about 1.6% annually for the last 20 years, and the report estimates that it will be 2.5% by 2050 (Fig. 6). Reasons for improvements include faster electrification of the energy system, thus smaller losses of electricity and better efficiency, along with a growing share of renewables in the power mix, which also translates to lower heat losses during power generation. However, the Outlook determined that target 7.3 of Sustainable Development Goal #7, which reads "By 2030, double the global rate of improvement in energy efficiency," will not be reached in time. The forecast sees an improvement of 2.4%/year from 2015 to 2030, which is less than double of the 1.5%/ year achieved in the 2000-2015 period.

Additionally, while the authors call the energy transition "rapid," they don't believe the goals of the Paris Agreement (to keep a global temperature increase below 2°C and to limit that increase to 1.5°C, in this century) will come anywhere close to being achieved. "The 'carbon budget' associated with a 1.5°C warming will be

exhausted in a decade, and the 2°C budget will be exhausted before 2050."

Another grim reality concerns energy access defined in the report as "having at least several lightbulbs, 'task lighting' such as a flashlight, phone charging, and a radio. Access to modern cooking and water heating means having access to natural gas, LPG [liquefied petroleum gas], electricity, coal and biogas, or improved biomass cook stoves." Sadly, the forecast determined that even with great innovation and progress of the next 30 years, about 800-900m people in the world, mainly in Sub-Saharan Africa, won't have access to modern fuels and will rely on traditional biomass for their cooking and water heating needs.

Is it all, after all, in the hands of everyman?

According to the Outlook, politically, socio-economically, and technologically the world is at crossroads, and the decisions made within the next few years will either accelerate or brake progress of the energy transition. A lot of the choices are actually in the hands of average people who have the power to alter their own behaviour, vote in elections for politicians who support investment in renewable energy sources, and to get involved in related activism or non-profits.

Already "islands, small towns, industrial and port sites, plus individual domestic energy users" are independently converting to distributed energy generation. In these systems, users – or 'prosumers' - produce, use, and sell energy. Due to decreasing costs and increasing flexibility of renewable generation and storage, this trend is expected to grow. In terms of societal drivers, the report predicts that the issue of air pollution and its health consequences are more likely to encourage energy transition than warnings of climate change. It's essential to recognise that energy transition has become a political issue, with a task of ensuring that energy is affordable, clean, reliable, and provided in ways that are satisfactory to the public. This is especially challenging in developing economies, many led by recently emerging populist movements, where political forces still put economic protectionism and domestic growth ahead of decarbonisation and sound energy transition practices. Additionally, false narratives or 'urban myths' in politics and the media about safety and eco-viability of energy sources such as hydrogen and nuclear as well as solar parks and wind farms could contribute to energy transition slowdown.

The job of silencing the echoes of misinformation certainly lies in the hands of a common man (or woman).



Three steps to sustainability

by Caroline Karlsson, Communication & PR, Lindholmen Science Park AB

Triple F, a research & innovation (R&I) programme of the Swedish Transport Administration, has been launched to aid Sweden's transport industry in its transition towards fossil-free operations. By enabling and facilitating comprehensive cooperation between the various stakeholders, it is expected to deliver actionable knowledge thanks to which in-country transport-related CO_2 pollution will go down in line with the nation's ambition of becoming, by 2045 at the latest, one of the world's first welfare countries with no net greenhouse gas (GHG) emissions. Changing the face of transportation is key in hitting that goal.

TRIPLEF

FOSSIL FREE FREIGHT

riple F is the Swedish Transport Administration's research and innovation initiative contributing to the transition to fossil free freight transport in Sweden. Triple F's headquartered in the Lindholmen Science Park in Gothenburg, with local offices also in Stockholm, Linköping, and Lund. The project's partners are always welcome to visit us and discuss ideas. We also welcome anybody who'd like to take advantage of our facilities to meet and work. For more info on the initiative, its partners, and projects please head to https://triplef.lindholmen.se/en

t'll be a balancing act – to bring about a relatively fast transformation that doesn't undercut Sweden's competitive position. It'll require putting in place an all-embracing transport system in which functionality takes centre stage. Challenges will be numerous and specific for different modes and regions. A common target, cross-sectoral collaboration, science-based grit work, and strong leadership will be what it takes to turn ambition into reality.

Two goals

The vision behind Triple F is to gather Sweden's top experts under one banner to work towards an agreed-upon goal. Their work, in turn, will serve as the basis for politicians to pass new legislation that facilitates the transition. Moreover, as the country is respected as a reliable partner, it can become a role model for others who also think conscientiously about the importance – and urgency – of reaching the global climate goals as agreed in Paris a few years ago. Exchanging experiences and sharing best practices will be instrumental in combating global warming.

As such, the programme has set two targets for itself. First, to foster, through research & development, innovative solutions – improving existing as well as helping to create entirely new ones – that will make it possible to establish a fossil-independent transport system. Second, to set up a platform for building and disseminating competence among stakeholders. To do so, Triple F will PhD-train future experts by engaging them in solving challenge-driven projects that will encourage cross-disciplinary know-how as well as personal mobility. The programme's works are divided into three focus areas: policy, technology, and logistics.

Policy

This area is tasked with producing knowledge and tools to be used to hammer out a roadmap to reach Sweden's climate target in a cost-effective way. The country sets out from its already agreed aim of decreasing domestic CO₂ emissions by at least 70% in the 2010-2030 period.

It'll be of paramount importance to provide both the private and public sector with incentives in order for them to implement, in succession, sustainable transport solutions, either by decreasing their dependence on fossil fuels or making a U-turn altogether. Measure types include administrative (regulations), economic (taxes, fees, subsidies), informative (info campaigns, support with procurement), R&I (research financing strategies), and social ones (infrastructure planning, public consultations). The tricky part will be to thoughtfully assess how these measures, taken alone as well as in combination. should be designed to help in reaching the climate goal without bringing about significant unwanted side effects, also Europeand global-wise.

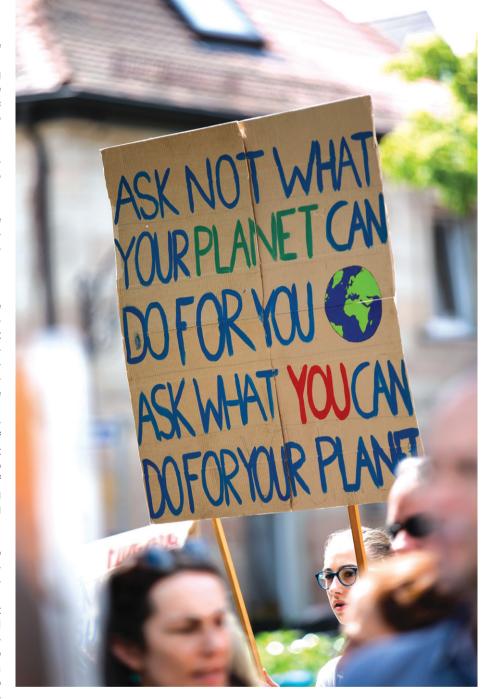
Technology

It will be impossible to make the transport system fossil-free without ecofriendly technology, including ways that will decrease transport work, make available new fuel sources, and increase energy efficiency. This focus area will examine the possibilities, solutions, and the societal impact of new types of vehicles, infrastructure, energy carriers, all coupled with the increasing digitalisation of the transport & logistics business. That said, Triple F experts will also look into opportunities how to make better use of what is already in place, e.g., increasing infrastructure capacity by better planning transport flows, i.a., through increasing vehicle utilisation rates. The overarching goal is to surface knowledge, thanks to which tech-solutions can be implemented faster, in a more cost-effective manner, and in a sustainable fashion.

What's important to fathom is that Triple F does not finance technological development - its task is rather to publicise the effects thereof and to put the spotlight on what technology can do in Sweden's pursuit of becoming a net-zero GHG country. In addition, the development and uptake of new technologies is heavily-reliant on what is statutory in the legal framework. As such, another task will be to ensure that well-researched solutions that deliver on their eco-promises can be legally implemented, so that private and public stakeholders won't have to make their way through a grey area - or not to advance at all out of fear of being suddenly cut short from the technology in which they invested.

Logistics

However, sometimes completely transparent to the general public, smoothly operating logistics is one of the backbones of a functioning welfare state. If Sweden wants to become a country independent of the use of fossil fuels, then new effective



and secure transport solutions, that meet the demands of both the industry and the society, need to be put in place.

Logistics is, in fact, the end result of the two aforementioned focus areas - policies that take into account the challenges and opportunities of the 21st century make it possible to develop technologies that address the former and make the most of the latter, i.e., enable the introduction of innovative logistic solutions, both on the IT and hardware operational front as well as how these two interconnect for added supply chain value. That said, the relation between the three resembles more of a spider's web instead of a strict linear line, as research into logistics can give valuable input on what is needed technology- and policy-wise. In

detail, this focus area will pay particular attention to the development of sustainable transport chains and, accordingly, to the rollout of new business and employment models.

Bringing it to the port

Triple F is a broadscale and multidisciplinary consortium that draws together expertise from all of Sweden, representing the society, industry, academia, and research institutes, all of which gives us a unique chance to tackle all the complex issues associated with making the country's transport system fossil-free. It won't be an easing task, but through cooperation, we'll – as the Swedish saying, used to describe an ultimately successful undertaking, goes – bring it to the port.



Charge!

by Gabrielė Vilemo Gotkovič

Rechargeable lithium-ion batteries could become the 'new gold' in the carbon-neutral future. In fact, the decarbonisation of cars, trucks, and power grids depends on this fast-improving technology. Batteries are expected to become one of the $21^{\rm st}$ century's key developments, and the market looks forward to being worth tens of billions of euros by the middle of the 2020s. One million plug-in cars are needed to be sold in 2020 to meet the EU's car CO_2 standards, and achieving the bloc's 2030 goals requires sales to go up by 40%. As a result, the European Commission has launched the EU Battery Alliance, championed by 16 gigafactories, to support the creation of a green battery value chain catering to Europe's demand.

he Unlike combustion engines that literally burn oil, batteries do not combust lithium or other minerals such as cobalt and nickel, which can be fully recovered and used again. As such, battery-powered vehicles are already, from a life-cycle perspective, better than traditional ones. However, they still have an environmental impact, which should (and can) be minimised in order to achieve the EU's climate and environmental objectives. Successful policy design has to consider sustainable battery production, reuse and recycling, as well as responsible sourcing of raw materials globally to maximise industrial, climate, and societal benefits.

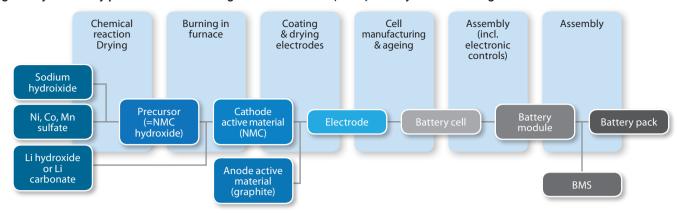
A market-driven by regulations towards sustainability

Just as for conventional cars, upstream emissions in electric vehicles (EVs) are associated with their production phase, notably of lithium-ion batteries (LIB). Unfortunately, little robust, primary up-to-date data is available on the 20 odd materials, as well as complex and fast-evolving

processes used in LIB cell, module, and pack manufacturing. The recent report by Circular Energy Storage, commissioned by the Brussels-based NGO Transport & Environment (T&E), highlights the current climate impact range of LIB batteries to be between 39 kg ${\rm CO}_{\rm 2equivalent}$ /kWh and 196 kg ${\rm CO}_{\rm 2e}$ /kWh, roughly the same as driving a diesel car 11,800-to-89,400 km.

The T&E's policy brief on battery regulations in Europe outlines the following reasons for this wide spectrum. First, there is a significant absence of current primary data, with much modelling based on studies dating back as far as 1999. While the earlier pilots have a higher per kWh energy input, the new gigafactories demonstrate a significantly lower energy use due to economies of scale and process efficiency gains. Secondly, the lack of a consistent calculation methodology often completely ignores the reuse and recycling potential. At the moment, industrial LIB recycling is mainly limited to portable batteries, excluding the volumes of batteries from end-of-life EV vehicles.

Fig. 1. Key chemistry phases in Nickel-Manganese-Cobalt 111 (NMC) battery manufacturing



Source for figs. 1-2: T&E's GREEN POWERHOUSE. T&E blueprint for battery regulation in Europe (2019)

Consequently, this makes it significantly more challenging to accurately account for the real-life impact of different recycling processes.

On this account, the urgent first step for the EU battery regulations needs to be put in place to maintain a robust and upto-date database of emission factors for different battery materials and processes which are at the cell level and are factory-, process-, and location-specific.

The production of battery cells is the most energy and carbon-intensive part of making LIB, responsible for as much as 75% of energy consumption. Figure 2 shows an exemplary breakdown of different steps for Nickel-Manganese-Cobalt 111 cell chemistry (currently on the market but getting fast outdated). The detailed data on the latest chemistries, such as NMC811 (eight parts nickel, one-part manganese, and one-part cobalt), is not readily available, yet these are expected to have lower carbon footprints. Nonetheless, the figure pinpoints the general battery emissions 'hot spots' that should be taken into account when legislating future EU battery regulation.

To reduce carbon and environmental footprint of battery production, the EU sustainable performance requirements should incentivize, support, and foster deploying waste heat recovery processes, along with technologies to green the preparation of precursors. Huge improvements can come from better cathode coating techniques that would make the cathode powder mixing and coating processes more efficient. The design of the future EU regulations should also seek to incentivize the set-up of vertically-integrated local supply chains in order to drastically reduce transport emissions as well as stimulate the future battery production facilities to be located near lowcarbon energy sources.

It is important to speed up this process so as to lower the overall carbon footprint of batteries. This much-needed acceleration can gain momentum via a comprehensive regulatory strategy. Mandatory requirements on all battery manufacturers whose products are found on the EU market are necessary to measure and report each battery's carbon and energy footprint. Next, once accurate data have been collected and data verification process established, a mandatory CO₂ threshold should be considered in order to ensure that all future batteries follow manufacturing best practise. Finally, EU research & innovation funding should focus on improving battery manufacturing processes, e.g., better coating techniques, industrial waste heat recovery processes, and environmentally-friendly and efficient recycling.

It is as equally important to ensure a sustainable battery design strategy. For instance, the use of hazardous materials in manufacturing should be phased-out and tightly controlled to spur innovation into better methods, materials, and toxic-free battery value chains. Batteries should also be durable and have a long lifecycle, where the design of battery cells and packs incorporates circularity from the outset to facilitate disassembly, repair, and recycling.

Ultimately, innovative technologies should be incorporated into battery management systems to provide standardised access to key battery parameters and usage data. A 'battery passport' would enable innovative and smart services by providing comprehensive and extensive information on the product. Both static (i.a. battery production date & location, carbon footprint) and dynamic data (remaining capacity & fade and voltage drop, charging history, etc.) could be used to make the most of batteries, especially if we consider their multifunctionality, when, e.g., EVs could serve as energy storage points for the power grid.

The circular battery

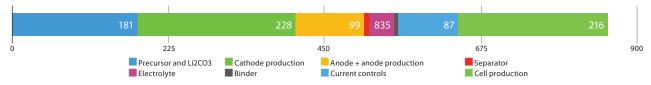
When battery performance is no longer good enough for a car or a truck (less range, worse acceleration, etc.), it should be reused in less demanding applications like in forklifts or as a stationary energy storage/buffer in high power charging stations (to reduce peaks). Such second-life batteries will provide extra storage flexibility on the grid, allowing for higher penetration of renewables across Europe. It is therefore important to incentivize longer lifetime and remove any barriers for reuse applications.

The ultimate goal is, however, to fully recover all the valuable materials (lithium, nickel, cobalt) found in batteries at the end of their lives. While few people today question the benefits of recycling, as it helps to secure critical materials in Europe, currently the market for LIB recycling is in China where EU batteries are usually sent. An important finding from one of the studies conducted by Element Energy indicates that Europe has inadequate recycling capacity, estimated today at 33kt/ year, deemed insufficient should currently in use EVs reach the end of their lifecycles in 2030 onwards. Similarly, there is almost no commercial-scale LIB recycling in Europe as things stand today, the majority of "recycling" companies providing lowvalue collection or shredding only. Europe should perceive battery recycling as an asset, not a burden, and an opportunity to create local industries and jobs.

Batteries made responsibly

The growing battery demand for mobile and grid applications has put into spotlight the key metals used in lithium-ion technology, namely cobalt, lithium, and nickel. The attention has especially turned to the implications of the EV boom has had on cobalt, particularly the working conditions in the mines of the Democratic Republic of Congo (DRC), where around two-thirds of the global cobalt production are situated at present.

Fig. 2. Energy used in MJ per kWh of Nickel-Manganese-Cobalt 111 (NMC) battery cell (excl. casting)



The transition to a zero-emission economy in Europe should not come at the expense of others. On the contrary, if done responsibly, increased demand for minerals mined in countries such as the DRC could help support much-needed development. Nonetheless, this necessitates socially- and environmentally-responsible ways of sourcing materials. It is important to acknowledge that mining challenges in places like the DRC are much deeper and older, which makes them no better than widely criticised practises in oil and gas industries. Instead of bashing electric cars, the European community should use their increasing market share as a leverage to put pressure on downstream companies to clean up their supply chains as well as on governments, to put solid governance structures in place to solve problems in both large-scale and artisanal mining in a comprehensive and pan-industry manner.

Various certification schemes have sought to improve sourcing of materials (copper, tin, gold, and cobalt), e.g., the voluntary OECD Due Diligence Guidance for responsible supply chains, supported by the Responsible Business Conduct guidelines,

acknowledged by many as the best practice example in the field. T&E's comparative analysis of the six largest global supply chain certification schemes applicable to the industrial cobalt production in the DRC shows that while most schemes are comprehensive in their design and sustainability criteria, they nonetheless lack rigorous and independent enforcement. Crucially, traceability on where cobalt is extracted and access to transparent information on mining conditions remain most schemes' Achilles heel.

The focus, therefore, should be on better enforcing of what is already in place. Fortunately, the previous OECD guidelines on responsible supply chains have already been integrated into national or supranational legislation on conflict minerals (tin, tantalum, tungsten, gold), such as the US Dodd-Frank Act or the EU Conflicts Minerals Regulation – but do not currently apply to cobalt, nickel, or lithium.

A single, reliable, and enforceable mechanism on which to base supply chain due diligence, and the choice of suppliers across all the materials, will also benefit the EU battery industry, which often gets lost in the myriad voluntary schemes applicable

to individual metals. Companies should not be pulling out of, e.g., the DRC completely or blankly refusing to buy from small-scale miners; instead, downstream companies should work with and require their suppliers to improve mining conditions and refining practices. In other words, the EU trade and development policy should help European companies source materials sustainably via smart investment to improve safety, health, and working conditions in developing economies.

'round the corner

Batteries – whether in vehicles or, at the end of their life, as second life storage applications – offer a readily-available distributed energy resource and can store electricity cheaply, facilitating far greater integration of renewables into Europe's energy market. The EU has the chance to ensure responsible corporate behaviour across the supply chain by making green objectives mandatory instead of voluntary.

The e-mobility revolution is just 'round the corner, and Europe is rightly prioritising battery value chain development in its industrial strategy.





Data-driven sustainability

by Dario Zingariello, Marketing and PR, myclimate

A new tool provides the commercial vehicle sector with new means to fight climate change. Companies can track the amount of greenhouse gases (GHG) emitted by their vehicle fleet and then offset these emissions through the Swiss foundation myclimate.



yclimate, a science-based and business-orientated foundation, is a partner for effective climate protection - both locally and globally. The Swiss non-profit organisation wants to shape the future together with its partners through consultation, education, and climate protection projects. Click www.myclimate.org for more info.

limate change concerns all players, economy- and society-wise, not least the transport sector. The CO₂ emissions of a transport vehicle over its entire service life depend on fuel consumption, mileage, and a plethora of other factors. In the transport industry, it is still unusual for companies to offset their fleets' CO, emissions. In addition, until now there has been a lack of solutions for simply and reliably recording and calculating the GHG emissions of a transport vehicle worldwide.

Transparent 'carbon life cycle' telematics

With the support of the Swiss foundation myclimate, the internationally active also Swiss telematics service provider LOSTnFOUND AG has developed an innovative addition to its fleet. tech solution. Now, the dashboard not only gives fleet managers an overview of the efficiency and safety of the vehicles in their fleet but also shows the CO. emissions of each vehicle, measured in tonnes. The methodology for calculating the ecological performance of a vehicle registered with fleet.tech is based on the 'life cycle' approach. This means that in calculating the vehicle's CO2 footprint,

the processes and their environmental impact are taken into account proportionately from the beginning (manufacture) to the end (disposal) of its life.

Customers register their fleets in a database containing over 30k vehicle types, entering details such as year of construction, manufacturer, model, exhaust emission standard, etc. The system then records all journeys using GPS and other consumption data and automatically calculates the emissions and the necessary CO₂ offsetting amount in Swiss francs or euros. Customers can then voluntarily offset the amount of CO, per vehicle produced within 6, 12, or 24 months - and do it with a single mouse click. The system automatically produces an invoice and an individual myclimate offsetting certificate.

Daniel Thommen, Founder and Managing director of the LOSTnFOUND Group, underlined, "We pass on 100% of the money received from customers for CO, offsetting to the myclimate foundation. The CO, balance sheets and evaluations that we prepare are free of charge for our customers. By providing an uncomplicated CO, offsetting mechanism, we would like to make our more than 2,000 customers aware of the CO, emissions of their vehicle fleets and offer



them a simple tool for charging extra for climate-neutral transport."

Stephen Neff, CEO, myclimate, added to this, "The transport and logistics industry is essential for our daily lives and our economy. The associated CO₂ footprint can now be offset, and the industry can make a contribution to achieving global climate targets. We are, therefore, pleased that the design of the fleet.tech solution also took the issue of CO₂ emissions into account. The CO₂ data and the possibility of offsetting through our foundation help fleet operators to act in a more climatefriendly way, immediately and without any complications." As such, it is up to the carrier to decide whether to pass on the offsetting costs to its customers or not.

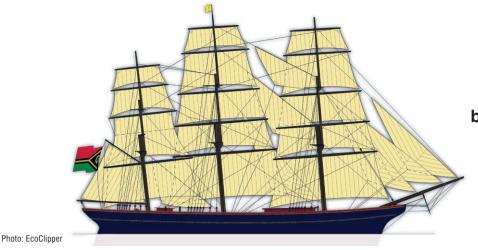
Shape of the future

Championingvoluntaryqualityoffsetting measures, myclimate promotes quantifiable

climate protection and long-lasting development worldwide. The foundation engages itself in various emission reduction projects, such as when encouraging to replace fossil fuel with renewable energy sources as well as by implementing energy-efficient technologies. Additionally, through interactive and action-oriented educational programmes, myclimate encourages everyone to make a contribution towards a climate-friendly future. With this goal over 20k pupils and more than 8k apprentices have been reached in Switzerland, and a worldwide network of 1.6k students and young professionals has been established.

Moreover, the foundation offers consultancy on integrated climate protection with tangible added value not only in Switzerland but also abroad, thanks to partner organisations. myclimate provides this through analyses, IT solutions, labels, and resource management; services range from simple carbon footprints for businesses over sophisticated product life cycle assessments to performance management. Its clients include small-to-medium-to-large businesses, public administrations, non-profit organisations, event organisers, and even private individuals. All in all, it's about actively shaping our future - a sustainable one that is.





Modern sailing ships as the enabling link between ethical production, travel, and transportation

Return of sail

by Capt. Jorne Langelaan, CEO and Founder, EcoClipper

For thousands of years, sailing ships were the only available long-distance mode of transport and travel. About 200 years ago, steam and motor ships, and later aviation, started to take over. More recently, the realisation that climate change is a direct result of burning fossil fuels has led a small yet spirited group of organisations and companies to work toward the return of wind-powered vessels.

recently published report (available at EcoClipper's website), probably the first of its kind in the world, documents this transition by analysing a growing market and what might be the most significant change in the world of freight shipping and travel in this century. The report is a result of a range of interviews with leading companies in the sustainable shipping and travel industries and a detailed study carried out by two sail cargo researchers, Hannah Hurford and Charlie Barker. The publication is meant not only to be an information paper but a key instrument for public and private entities - be they investors, financial institutions, shipping companies, or travel agencies - enabling them to make strategic decisions. Equally important, it represents a collaborative effort; an opportunity to establish new and strengthen the existing ties with sail cargo players in Europe.

Value-driven

During the previous years, the sail cargo and sustainable travel market have been characterised by a number of significant trends and developments,

including the establishment of two industry associations, the International Windship Association and Sail Cargo Alliance; climate crisis strikes by masses of school kids, teenagers, and other like-minded activists; the launch of the Poseidon Principles by large financial institutions; the International Maritime Organization's sulphur and greenhouse gas emission regulations and targets; and, of course, whatever will come to pass during and in the aftermath of the coronavirus pandemic.

Since the rise of coal- and oil-fired ships, the use of sailing vessels for commercial purposes has largely been restricted to training and leisure cruising. But with the rising public awareness of the climate crisis and the need for more ethical and sustainable transport and products, exciting new possibilities for a modern commercial sail industry have begun to appear. Sail cargo is an emerging, profitable market that has been under development for the last decade. It shouldn't come as a surprise, as a growing number of suppliers and consumers see it as a desirable alternative to conventional means of shipping. There are several aspects of

a modern sail cargo industry that offer a unique advantage to the many people who now wish to trade and buy goods in a profitable but more climate-friendly way.

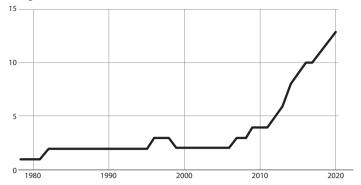
In order to better examine one of the primary comparative advantages of the sector – its environmental impact, the report looks at sail cargo and travel in relation to the UN Sustainable Development Goals (SDGs). These aspects include community engagement, fair trade practices, and non-corporate, non-hierarchical business structures. But above all, it points out the simple fact that sail propulsion has huge potential given its environmental sustainability because, unlike motorised transport, it uses a free and renewable source of energy, and its emissions and pollutants are close to zero.

In essence, sail cargo brings together two aspects of ethical consumerism, namely green transports of products that were sourced and produced in a fair and eco-friendly way. It's a highly value-driven initiative, extending beyond a decrease in emissions and fossil fuel consumption, to promoting ethical and fair trade products, small-scale producers, collaborative and innovative logistics, as well as flatter, flexible and more inclusive organisational structures. Initial ventures are paying off, and the expansion of projects indicates future potential in a new and currently under-developed market.

True sustainability

In response to this expanding market, there is a rise in the number of sail cargo vessels being built or adapted. The more dedicated sail freight vessels

Fig. 1. Sail cargo fleet size in 1978-2020



Source: EcoClipper

there are, the more ports and other authorities will understand how to work with them, and the more companies will use sailing ships to transport products.

Future success is to be found in creating a market at the cross-section of ethical production and transportation, maybe even coupled with passenger transport, rather than throwing the gauntlet to the conventional sea shipping industry. Doing this will require, on the one hand, creating an apt eco-ethical narrative, and, on the other hand, investing in technology – modern, purposebuilt vessels which will allow for better economies of speed and scale.

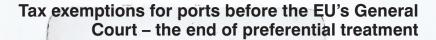
As sail transport is usually more expensive and time-consuming, concerted awareness-raising and marketing will be required to alter consumer and passenger behaviour and expectations away from conventional, cheaper, and quicker alternatives. Social media will be crucial in spreading awareness of both sail cargo and travel.

The challenges are known, some of them top tier demanding, but it's also a fact that the popularity of the sail cargo market has grown exponentially during the past ten years. While previously there was not much interest in true sustainability, now companies and customers are increasingly looking for green solutions. At the same time, however, it is clear that to open up the market to a wider audience, a certain growth in scale and number of ships are needed.

Because of this, the EcoClipper team sees it as their task, now more than ever, to finalize design of a line of sail cargo ships. These will be larger than the current ones, sustainable, and designed for reaching all the SDGs, more so than other modes of transport and travel. Yet, these ships will be small enough to be financed with reasonable investment and produced swiftly. The striving is to serve the growing market for sustainable shipping and travel, to enable exponential growth in emission-free alternatives.









STATE AID

Photo: Rawpixel

Non-taxation without justification

by Dr. Kai-Dieter Classen,

LL.M. (Berkeley), Deputy Director of the External Affairs Division of the Hamburg Port Authority¹

Member States (MS) of the European Union (EU) enjoy broad fiscal sovereignty regarding their tax systems. This freedom, however, is fenced in by the EU state aid law. The General Court recently confirmed several of the European Commission's (COM) decisions regarding the illegality of exemptions from corporate tax for ports. Moreover, these verdicts confirm the application practice of state aid law to ports in general.



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ntil today, the COM has decided more than 70 cases concerning state aid to ports. Consequently, it amended the General Block Exemption Regulation (GBER) in 2017, exempting certain public support measures for ports from the strict notification requirement. However, not a single port case could be found in the judicature of the EU courts, forcing the COM and legal practitioners to borrow legal reasoning, in particular, from the airport cases, most notably the Leipzig-Halle judgement. This has now changed after the General Court decided a series of cases dealing with corporate tax exemptions for ports in the Netherlands, Belgium, and France.

State aid law and taxation – the three-step-test

Given the broad fiscal sovereignty of the MS and the absence of an EU harmonization of direct taxation, the COM developed a three-steps-test to establish whether a tax measure confers a selective advantage to an undertaking.

First, the tax system of reference in the MS is identified, which, in these cases, was the respective system for corporate taxation. Then, the COM investigates whether the

taxation of the undertakings at issue departs from the established system of reference. Finally, the COM evaluates whether the measure which constitutes an exception to the application of the general tax system may be justified because it results directly from the basic or guiding principles of the tax system.

Therefore, the selectivity of the advantage must be assessed on the basis of an internal comparison within one MS, between undertakings that are factually and legally in a similar situation in the light of the objectives of the tax law concerned.

Self-defence for ports?

The Dutch case constitutes the precedent in the port sector. It resulted from an own-initiative investigation launched by the COM already in 2004 and which was concluded with the contested decision in 2016 (SA.25338). In the Netherlands, corporate entities are subject to corporate income tax. There were, however, certain exemptions for several Dutch public seaports and for bodies whose activities consisted mainly of the management, development, or operation of a port.

The Dutch authorities had, i.a., argued that the preferential treatment of their ports was an act of "self-defence." Because ports

in the Hamburg-Le Havre range would receive different types of public support, they tried to prove, the tax exemption did not lead to preferential treatment of Dutch seaports. but, at most, to a slightly less disadvantaged position compared to other EU ports.

The COM did not buy this argument. It arrived at the conclusion that Dutch authorities had not provided any arguments that would justify the exemption by reference to the rationale of the Dutch corporate tax system - which is to tax profits. Treating public undertakings, including public seaports, that are involved in economic activities more favourably than private undertakings does not fit into this rationale.

In its appeal to the General Court (T-160/16, judgement of 31/05/2018), Groningen Seaports refrained from challenging the COM's fundamental (and in many other cases contentious) economic and legal assumptions that ports were undertakings and that the tax exemption was incompatible with the internal market! Instead, the focus lay on a procedural objection: at the time of the decision, the COM was still conducting parallel investigations in Belgium, Germany, and France. The appellant argued that the COM should have decided all proceedings at the same time or at least should have granted the Netherlands a transitional period. By not doing this, it allegedly created an unlevel playing field at the expense of the Dutch ports.

The Court rejected this view. A violation of state aid rules cannot be justified by the fact that other MS also fail to comply with these provisions. The effect of several distortions of competition cannot neutralize each other. Even if other MS granted state aid to their ports, it is no less the duty of the COM to declare aid granted to the Dutch ports incompatible with the internal market, irrespective of the outcome of other investigations.

An all-out attack on the COM's premises

While the Groningen Seaports judgement was rather barren regarding the application of state aid law to ports on the merits, the subsequent Belgian and French cases targeted exactly these fundamentals. In France, ministerial decisions exempted from corporate tax the autonomous ports, maritime chambers of commerce as well as chambers of commerce and industry managing port installations. Under the Belgian law, ports were not subject to corporate tax but to a more favourable tax system.

Both France (SA.38398) and Belgium (SA.38393) had brought up a significant number of arguments why their ports should not be submitted to the rules of state aid law and why, in the alternative, the tax exemption was compatible with the law. The COM rejected them all, asserting that, i.a., the case-law on airports must be applied to ports, because they are simply another type of infrastructure. The concept of "economic activity," the trigger for state aid law, derives from matters of fact, in particular, the existence of a market for the services concerned, and does not depend on national choices or assessments. Certain port activities, such as making available land to port service providers against remuneration, have to be considered as economic, while others, such as maritime traffic control and safety or anti-pollution surveillance, are non-economic in nature.

The COM stressed that the classification as critical infrastructure does not mean that port activities involving those infrastructures are essential functions of the state. Economic activities in the energy, telecommunications, and transport sectors may also be critical for the life of the nation without this depriving them of their economic nature. And even though it may be considered that ports hold a legal monopoly to offer port services within the premises they operate, the transport services they offer are, at least to a certain extent, in competition with those offered by or in other EU ports. All in all, the COM viewed corporate tax exemptions as an unjustified operating aid which was not targeted at specific investments.

Both decisions were appealed (French cases T-747/17 and T-754/17, judgements of 30/04/2019 and Belgian cases T-673 & 674/17 and T-696/17, judgements of 20/09/2019). The General Court, however, confirmed the COM's reasoning and dismissed all actions completely. As none of the judgements was further appealed to the European Court of Justice, they have become final and binding.

Small chance of success

As the immediate result of these cases, the Netherlands, France, and Belgium had to remove the corporate tax exemption for ports. Having been qualified as "existing aid," i.e., a measure that was in place before the European Treaties came into force. the MS in question did not have to recover the aid from the beneficiary for the past.

In the overall context, however, the General Court formally and broadly confirmed the COM's application of state aid law to ports. The fact that this judicature was not further appealed to the European Court of Justice indicates that concerned MS saw a small chance of success. Consequently, Spain recently accepted the COM's findings in a parallel investigation and agreed to amend its corporate tax legislation accordingly. Italy, however, is up on its toes and refused to accept the COM's preliminary assessment of its tax provisions for ports as state aid.

Nevertheless, it seems that the applicability of state aid law to ports as well as the major guard rails are now settled.

¹ This article represents the author's personal view



Subsidizing maritime transport – also on land?

by Dr Kai-Dieter Classen,

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Shipping policy has embraced the tonnage tax as the main instrument to support national shipping lines. In some states, it even covers cargo handling activities. Such broad scope raises questions relating to state aid policy and the avoidance of collateral damage to competition, not to mention the clarity of legal methodology.

he EU and its Member States (MS) grant numerous forms of relief to the maritime sector, be they exemptions from cartel law (check BTJ 3-4/19's Independent we sail - allied with the competitor? The future of the Block Exemption for Consortia in liner shipping to learn more) or fiscal benefits (on this subject in general see the 2019 International Transport Forum's study Maritime Subsidies: Do They Provide Value for Money?). Among other things, MS often use tax exemptions to support domestic shipping lines. One of the most prominent schemes is the so-called tonnage tax, a means of taxing the income of vessels that is generally more favourable than regular corporate tax. Against the background of many 'cheap' flags of convenience, the goal of this support measure is to strengthen the national shipping industry and to keep central activities of the shipping business from offshoring.

Tonnage tax schemes have grown into complex regulatory microcosms which differ significantly between the MS. Surprisingly, several tonnage tax schemes also cover cargo handling activities of the shipping lines. All schemes constitute state aid, according to Art. 107 Treaty on the Functioning of the European Union (TFEU) because they grant fiscal advantages to shipping companies. Thus, they must be notified to the European Commission (COM) which assess their lawfulness.

More predictable and less burdening

Tonnage tax schemes are widespread. They can be found not only in the tax laws of almost every coastal state in the EU, but for example also in Japan, the US, South Korea, or India. Generally, instead of applying the regular corporate income tax to real profits, the taxable income is determined by calculating



a fictional profit based on the tonnage operated by a shipping company. Hence, the tonnage tax is not a tax but rather a method for determining taxable income.

By way of example, according to the Danish tonnage tax scheme of 2018. the taxable income is a lump sum calculated by reference to the net tonnage, per 100 net tonnes and per 24-hour period started, irrespective of whether the vessel is operational or not. For a vessel with up to 1,000 net tonnes, the flatrate revenue is set at 1.21 per 100 net tonnes, which decreases corresponding to the increase in vessel size, with a cap at 0.34 for ships with more than 25,000 net tonnes. This fictional profit is taxed with the ordinary corporate tax rate regardless of the real profit made by the shipping company (see SA.45300 -Amendment to the Danish Tonnage Tax Scheme, 11.10.2018, para 28).

Some countries even apply differentiated or lower tax rates in addition to the benefit of a tonnage-based profit calculation. Most tonnage tax schemes contain additional conditions, such as various requirements to fly the national flag or obligations to train seafarers and are often coupled with further measures to reduce the cost for shipping lines (like wage-cost deductions to make up for the cheaper wage costs of foreign seafarers). Most are opt-in schemes, with the shipping company being bound by its decision for a certain time period.

All in all, the tonnage tax is more predictable than the regular corporate tax, and the tax burden is much lower. Unlike direct subsidies, it does not stabilize loss-making businesses. Naturally, only those companies are eligible to benefit from the respective national tonnage tax which are subject to taxation in that country.

A patchy, contradictory picture

All tonnage tax schemes contain ringfencing measures to prevent abuse and to contribute to transparent accounting. Given the raison d'être of the tonnage tax, the provision of maritime transport services is the central activity to benefit under all schemes. However, many MS expanded the scope of their schemes to cover, e.g., cruise ships, commercial yachts, cable-, pipe-laying, and crane vessels, research units, as well as a growing number of so-called ancillary activities (in a pure sense, these are closely, if not inseparably, associated with the privileged main service, which is why they are allowed to participate in the tax privilege; a definite list of such ancillary services, however, does not exist).

With respect to cargo handling operations as eligible ancillary services. a patchy, even contradictory picture emerges. Some states, like Portugal and the UK, explicitly exclude the loading and unloading of vessels from the tax privilege. Others, like Cyprus, Denmark, Finland, Lithuania, Sweden or the Netherlands, include it (in varying form and range) - and occasionally also the associated temporary storage of goods. In some cases, restrictions apply, e.g., that the revenues from ancillary services may not account for more than a certain threshold of the total tonnage taxed revenues. Under the German tonnage tax scheme, for instance, the term ancillary service is interpreted in a strict sense: freight handling qualifies only if it is done with the vessel's own cargo gear.

The COM is aware that ancillary services which enjoy the tonnage tax benefits potentially threaten to distort competition with land-based providers, who are taxed according to the general rules of taxation. Nonetheless, it applied a very generous permission policy with respect to cargo handling. Being state aid, the tonnage tax schemes must be compatible with Art. 107 TFEU. For a tailormade application of this general provision to the shipping industry, the COM adopted the Community guidelines on State aid to maritime transport in 2004, which, slightly updated, still apply today. This document determines the conditions

under which MS can set up certain state aid schemes to support their maritime transport industry. The guidelines are applicable to "maritime transport" activities, i.e., the "transport of goods and persons by sea." As this definition does not cover ancillary services, the COM decided that such services, by analogy with maritime transport, may be subject to the provisions of the Maritime Guidelines (see supra SA.45300, para 59 pp.).

A legal distortion of competition - for a common interest?

It is an established principle of the rule of law that any intervention by the public authorities in the sphere of private activities of any natural or legal person must have a legal basis and be justified on the grounds laid down by law. Allowing cargo handling services to benefit from tonnage tax privileges, and thus giving them a competitive edge over their land-based competitors, is based on an analogous application of a COM guidance document that does not gualify as law. Its purpose is to substantiate Art. 107 TFEU with respect to maritime transport services and produce a uniform application to this sector.

Is taking recourse to an analogous application of a guidance document really an adequate legal basis regarding the requirements of the rule of law in order to justify a potential or real distortion of competition in the cargo handling sector?

When applying state aid law, the COM looks at each case individually and decides it independently of the outcome of other cases. This practice is reasonable, especially when dealing with tax measures, an area where MS enjoy broad fiscal sovereignty. However, the common denominator for all parallel tonnage tax cases is the 'common interest' of the EU. Is it really all that beneficial to have more than 20 different tonnage tax schemes which treat cargo handling so staggeringly different, hence making a state aid affected playing field even less level?

These are just two questions which emerge from the current patchy European tonnage tax landscape and the COM's underlying permission practice. For the future, it might be wise to refocus on the principal reason for the existence of the tonnage tax that is to strengthen the national shipping industry - and not to interfere in competition among cargo handling operators. Hence, the list of eligible ancillary services should be re-evaluated accordingly.

¹ This article represents the author's personal view



Disruption-to-resilience

by Peregrine Storrs-Fox, Risk Management Director, TT Club

Extraordinary circumstances often require innovative and exceptional practices. While governments — both state and national — are desperately seeking to restore the consumer economy by tentatively easing social restrictions, the supply chain environment, however, remains significantly disrupted. The transport & logistics world continues to face many challenges, with numerous players striving to maintain their critical operations effectively. We at TT Club have sought to support sound, safe practices, protecting as far as possible against unexpected risks and liabilities.



T Club specialises in the insurance of intermodal operators, non vessel owning common carriers, freight forwarders, logistics operators, marine terminals, stevedores, port authorities and ship operators. The company also deals with claims, underwriting, risk management as well as actively works on increasing safety through the transport & logistics field. For more info please visit www.ttclub.com.

or those involved in import and export alike, the diverse governmental responses to the pandemic around the globe have created a variable demand for goods, complex regulatory structures, and significantly changed trade patterns. While the current circumstances facing global supply chains and the operators that serve them are truly challenging, there is a strong need for carefully considered and pragmatic advice on real issues. As such, our team has compiled recommendations for mitigating measures that operators might find useful in combatting current challenges. Contained within TT Club's frequently asked questions (head to www.ttclub.com/news-events/coronavirus-guidance to learn more), an advisory service that we have maintained throughout the pandemic and housed on its dedicated coronavirus pandemic (COVID-19) webpage, it is wide-ranging and detailed guidance for freight forwarders, logistics and transport operators, carriers and cargo handlers on matters of safety, security and liability unusual to the current situation.

Uncollected/abandoned cargo

Among the issues, that of cargo abandonment could be particularly salient to many. There is likely to be an increase of low-value cargoes in containers being abandoned, either delayed in transit or for which a market is no longer available. Once cargo is abandoned, there is a range of operational, legal and potentially regulatory challenges for all stakeholders in the supply chain, but freight forwarders and logistics operators are especially exposed. Where cargo is already generally accumulating at terminals, depots and warehouses, space may well be at a premium. Whilst contractually there is a mechanism to recover costs incurred or chargeable in relation to cargo that becomes abandoned, often the shipper and consignee are difficult to track and may have sparse assets, making recovery costly, time-consuming, complex and uncertain.

Freight forwarders should, in 'normal' circumstances, employ a sound record-keeping regime. At this time more than ever, good management controls should

be in place to monitor the arrival, clearance and collection of cargo at destination. Issues can then be identified at the earliest opportunity. The general guidance is to act as soon as the situation manifests itself.

TT Club's experience has shown that the freight forwarder's first notice of an issue is typically an approach by the shipping line to claim their losses, either because it is mentioned as the shipper or consignee on the ocean bills of lading or because it arranged the booking. The freight forwarder may be the only entity that is traceable - and likely to have liability insurance, increasing the prospects of recovering the costs. While it is always wise to check the definition of

"merchant" on the ocean bill of lading, typically this is broad and consequently entitles the shipping line legally to demand payment from the forwarder.

It is prudent to implement sufficient management controls so that proactive steps can be taken to prevent the problem in the first place. It is worth collating data in relation to risky, uncollected cargo hotspots; unreliable customers; as well as commodities most likely to be abandoned. Once the problematic trade routes or areas with frequent uncollected cargo incidents are identified, the relevant departments (commercial and operations) need to be made aware, such that informed decisions may be taken regarding any bookings that present heightened risk. Certain socio-political circumstances (such as sanctions) might also influence the level of risk in certain jurisdictions.

Contractual terms

The advisability of altering the terms of Standard Terms and Conditions (STCs) and bills of lading in order to protect against specific pandemic liabilities is also an issue commonly raised. The terms of most bills of lading have substantial commonality and are linked to generally well-established statutory or case law principles. While it is always good practice to review the bill of lading wording periodically, this may not now be an immediate priority.

In many instances, a bill of lading terms will have been drawn from an industry association model (such as the International Federation of Freight Forwarders Associations, FIATA, or the Baltic and International Maritime Council, BIMCO), in which case you should liaise with the appropriate body in relation to a review process. Further, you should seek independent legal advice. At the same time, it should be remembered that bills of lading will incorporate national and international law that will often be paramount, particularly in relation to events that may exempt the carrier from liability,

including force majeure provisions.

For a force majeure defence in STCs to succeed, the party seeking to rely upon it has the burden of proof to demonstrate that the event is beyond or outside the control of a contracting party and prevents that party from performing its obligations under the contract. If the law does not define the concept of force majeure (as in England), a specific clause therefore must be included in the terms of the contract, which is itself sufficiently incorporated for the service or transactions in question. In some jurisdictions the concept of force majeure is expressly recognised, in which case there will generally be clearly defined requirements for force majeure to apply. Under English law, it would depend on the contract wording, thereafter verifying that the circumstances have given rise to a force majeure event within the scope of the contractual wording. The applicability of the defence will be fact specific in each case. The party seeking to use a force majeure defence must also be able to demonstrate that they have explored or taken all reasonable steps to avoid or mitigate the associated loss.

Whether quarantines or restrictions related to COVID-19 constitute force majeure will depend on the wording used in the contract. For instance, if a contract defines force majeure as an "act of God" and the proximate cause of the presented claim is a voluntary work from home or quarantine directive, then the circumstances may not fall within the force majeure definition. However, if the force majeure clause specifically includes reference to, for example, "pandemic," there would be a stronger argument for a force majeure defence.

Stakeholders should not simply assume that there is a blanket defence to claims under force majeure. It is recommended to seek legal advice in the applicable jurisdiction for individual cases where a declaration of force majeure is being considered.

Workforce safety

This is another critical issue at a time when many transport operations continue to be an essential service under government guidance. The required actions will vary from operation to operation. Governmental mandates will inevitably differ, and stakeholders will need to remain in close contact with the local authorities to ensure they meet such requirements.

The availability and provision of personal protective equipment (PPE) should be considered. If stakeholders elect to adopt policies of wearing PPE, note that training may be necessary to ensure that it is fitted correctly and adherence to policies

is monitored. Stakeholders may consider facilitating access to medical/quarantine facilities for any person showing symptoms, whether on-site or otherwise. In the absence of a government mandate, it would be prudent for stakeholders to review their STCs along with individual contracts to understand how implementing such practices might affect their ability to satisfy their contractual obligations.

Ports in particular have demonstrated their resilience by continuing to facilitate trade throughout the lockdown period. Crucial supplies (incl. food imports, along with medicines, energy and fuel) have continued to flow. Those port workers responsible for making it happen have been identified as 'key workers' by many governments and continue to need support as the lockdown is gradually lifted.

As part of key supply chains, ports have had to consider a wide range of factors as part of their risk assessments and management plans during the COVID-19 outbreak. These range from social distancing, cleaning facilities, personal protective equipment, shift patterns and communications to remote working and health and well-being. It is vital that port and terminal operators maintain such discipline and support their staff, ensuring all risks are managed as best they can be.

Many ports are concerned about seafarer welfare at their facilities, recognising the responsibility for properly protecting all involved in the safe transfer of ships' crews, many of whom have had protracted periods at sea. Governmental mandates will inevitably differ in this regard and those managing ship husbandry will need to remain in close contact with the local authorities to ensure they meet relevant requirements. Subject to specific requirements, operators may consider implementing health screening and restricting access to crew or others arriving at the port facility. Communication with customers, especially with those carriers that ordinarily undertake crew changeovers at the location, is essential to evaluate the available options.

The future need for supply chain transparency

In the wake of the COVID-19 outbreak, many manufacturers will strategically review their end-to-end supply chains, a key focus being future resilience. Remarkably, logisticians have managed to navigate through the plethora of unprecedented challenges faced in the first quarter of 2020. This does not, however, detract from the fact that inefficiencies have been identified. From reliance on original documentation to a lack of final-mile delivery capacity. On review, stakeholders are recognising



that emerging (but not yet widely implemented) technology can serve to overcome a number of the challenges faced through the COVID-19 outbreak.

One recurring theme will be transparency, with pivotal questions to be thoroughly addressed such as how can I have full visibility and therefore confidence in my end-to-end supply chain?; how can I identify weak links and potential blockages in times of crisis?; or how can contingencies be built in to bypass such blockages? In order to build effective models, there is a fundamental need to understand one's entire end-to-end supply chain. This includes document flows as well as capacity constraints and alternatives employed at all junctures along the chain.

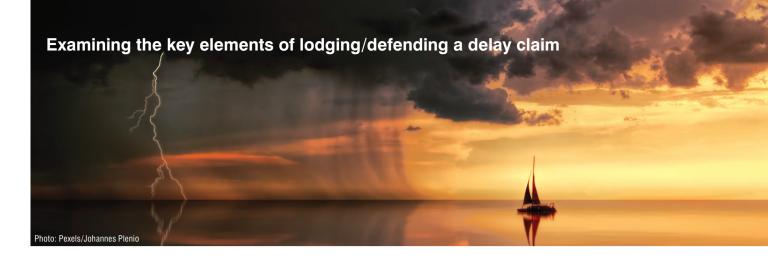
In the last weeks, there have been incidents where original bills of lading could not be delivered to the destination port ahead of cargo arrival and also where the final-mile delivery driver has been unable to secure a physical signature on the proof of delivery (POD). Capacity issues at the port of loading or destination have caused delays to shipments and there have been general final-mile capacity challenges, too. Recognising that a

shipper or freight forwarder has little visibility once the goods are in transit - or understanding, for example, how many times a movement is subcontracted for transport along the way - could provide a valuable indicator as to the availability of quality resources in a particular location. This depth of understanding will serve to develop not only resilience, but also safety and security through the supply chain, especially where dangerous goods are concerned. Adoption of emerging technologies such as electronic bills of lading and electronic PODs/documents could alleviate challenges concerning documentation flows. Embracing a wider use of the Internet of Things-enabling sensors and distributed ledger blockchain technologies could assist in providing increased transparency through the supply chain. The early identification of leading indicators could empower stakeholders to take action to manage associated risks.

Transparency would bring numerous benefits to legitimate stakeholders, whilst also creating a more robust, self-policed environment for those who use the supply chain for illegitimate purposes. Identification of purposely misdeclared goods could

become more effective if stakeholders have knowledge of the shipper, consignee, route taken and the descriptor of the cargo, coupled with the ability to interrogate earlier shipments to identify trends. Where misdeclaration is less intentional because of a genuine lack of knowledge, expertise or ignorance, transparency could serve to highlight and rectify issues before a serious incident occurs. As a freight forwarder, a carrier or a haulier, having instant electronic access to documents and full visibility of the goods being shipped to the point one takes them into their care, custody and control, would be invaluable. It would certainly influence how the goods are placed further into the supply chain.

There will be an importance placed on transparency in the drive to improve supply chain resilience. As initial restrictions are eased, immediate wholesale changes, especially where established supply chains exist, are unlikely. Supportive technology platforms, however, are already emerging, albeit not yet widely adopted. Could the unprecedented challenges faced because of the COVID-19 outbreak be the catalyst for an accelerated integration of emerging technologies?



COVID-19 and force majeure

by Nurlan Agayev, Owner and Recovery Specialist, Alterlaw, and Gabrielė Vilemo Gotkovič

Vessels in quarantine, both empty and laden containers with restrictions on movement stuck in terminals. no boxes available on the market, country border lockdowns. The coronavirus (COVID-19) pandemic has already had a huge impact on the maritime industry worldwide, leading in many cases to delays or no deliveries at all, hence losses in production and an overall hit to the economy. As such, carriers will, in all probability, face a rising wave of claims against them. Invoking force majeure will probably be their primary line of defence. However, it's not a silver bullet that can be shot absent-mindedly.





he Hague-Visby Rules, H(V)R, the applicable convention to many transport contracts/bills of lading, reads, "Neither the carrier nor the ship shall be responsible for loss or damage arising or resulting from: (g) Any other cause arising without the actual fault or privity of the carrier, or without the fault or neglect of the agents or servants of the carrier, but the burden of proof shall be on the person claiming the benefit of this exception to show that neither the actual fault or privity of the carrier nor the fault or neglect of the agents or servants of the carrier contributed to the loss or damage."

Carriers will also refer to the delayclause in the bill of lading issued by them, stating that the carrier is not liable for direct and indirect damages caused by the delay. Finally, yet importantly, the carrier will state that the advised departure and arrival times are an estimation rather than the actual time of departure/arrival.

Delay:

primary or secondary cause of loss

A common mistake is to classify every loss – that is the result of a prolonged voyage - as a delay claim. Not all delays are created equal, though. Delay is the primary cause of loss when the master of the vessel sails at a slower speed. Delay is the secondary cause of loss following unseaworthiness of a vessel or a deviation of the schedule by the master.

The burden of responsibility in the former case differs radically from that of the unseaworthiness of a vessel or the duty to carry and deliver the cargo safely. From the carriers' perspective, it's in their interest to focus on the delay itself rather than on the vessel's unseaworthiness, as they can escape liability should they be successful in proving they have exercised sufficient due diligence in the conduct of the voyage.

Carriers are, in principle, liable for unjustified delay if the delay has caused a loss. They can, however, fall under the protection of the H(V)R if the act that caused the delay is beyond their power (port congestion and extreme weather are the most used exonerations, but COVID-19 is and will be used massively in the foreseeable future). But even in that case, the liability of the carrier can be involved, entirely or partially. Foreseeability, due diligence, and reasonability should be, therefore,



examined in order to find out whether the carrier was (partially) negligent for the delay or not delivering at all.

Foreseeability

If the carrier wishes to exclude liability for the loss which resulted from a delay coming from a lockdown or restrictions on movement, they should prove these circumstances were indeed unforeseen. Importantly, the delay should be in balance with the actual cause of the delay. If the restrictions/lockdown lasted, say, two days, whereas the vessel arrived a week later than scheduled at the port of call, the carrier cannot just "hide" behind lockdown/restrictions and reject liability (a similar logic applies to bad weather forecasting; interestingly enough, however, because COV-ID-19 has brought air traffic, a major source of real-time weather data, to a standstill, this may as well have its implications when it comes to foreseeability legal-wise).

Due diligence

Carriers should also exercise due diligence in performing the voyage. Otherwise, it means that the carrier is negligent (irrespective whether we're in the middle of "corona times" or not). If negligence leads to delay, the carrier is liable for the consequences of that negligence. When delay beyond the control of the carrier is about to take place, in which the liability of the carrier is in principle excluded according to the H(V)R, the carrier should: inform the merchant about the delay (in

consultation with the merchant, the carrier can deliver the cargo to a nearby port/terminal); take care of the cargo during the delay – as the voyage prolongs, so does the duty of care of the carrier; overcome the delay – the carrier should take reasonable measures to overcome obstructions and deliver the cargo on time; finally, the carrier should resume and continue the voyage as soon as possible.

Reasonability

The carrier is only expected to do what reasonably can be done to overcome the delay given the circumstances. The onus of proof is, nonetheless, on the carrier to prove that the lockdown wasn't foreseeable, that they exercised due diligence to avoid delay (and consequentially – loss), and that they did what reasonably could be expected from them.

Circumstances

There is no general rule to decide whether a carrier is liable for the damage caused by prolonged voyage (or no voyage at all). Every case should be examined factually, doing justice to the circumstances in which this-and-that case took place. The importance of going through a comprehensive, fact-finding analysis cannot be, therefore, underestimated. This holds true for both clashing in an actual court case as well as when trying to resolve the issue during the amicable phase; in fact, a great deal of claims is solved amicably/out-of-court, therefore, a decent

formulation of the cause of loss starts in the amicable phase. The opposite is valid, too, as a poorly prepared legal action can break the court case; especially the claiming party should be surgically specific on the cause of damage.

Different jurisdictions

It is important to note there are country differences when it comes to the interpretation of the H(V)R. In many civil law jurisdictions, such as the Netherlands or Germany, the concept is codified. Under the Dutch Civil Code, for instance, a party relying on force majeure must demonstrate that its inability to perform cannot be attributed to it - by showing that failure isn't their fault, legal- or standard-wise. In practice, however, it often proves difficult to establish because the burden of proof is significant. In Germany, the concept is codified in a number of different pieces of legislation, hence the precise application depends on the particular case.

In contrast, common law jurisdiction, such as the English one, is not in the habit of codifying legal doctrines. That said, a peculiar feature of the common law contract law, unless provided otherwise, gives the parties the discretion to set out their own rules governing their contractual relationship. This gives the contractual parties flexibility and freedom to decide on the applicable terms and conditions as well as the certainty that these established terms will not be altered by legal principles existing outside the contract. As such, it is always a safer choice to include a force majeure clause in the contract under English law.

Even so, the H(V)R are often mandatory, and related general principles are often enforced in a similar manner in different countries.

Claim-critical

In the case of loss claims caused by delay, the involved parties should find out what was the primary cause of damage. Once that is done - and let us assume that the delay was actually the root problem - the responsibility regime of the delay should be examined, independent of the liability-excluding clauses of the terms and conditions of the bill of lading. If the delay cannot be justified, the carrier is liable for the consequences of the negligence. If the carrier is, however, of the opinion that the act that caused the delay was beyond their responsibility, they should prove that this act couldn't be foreseen, even after exercising proper due diligence. As such, it seems that the reasonability part is of critical importance when it comes to examining foreseeability, due diligence, and what can be expected from a carrier.



The scale of investment needed to decarbonize international shipping

by **Randall Krantz**, Senior Project Advisor, Global Maritime Forum, **Kasper Søgaard**, Head of Research, Global Maritime Forum, and **Dr Tristan Smith**, Reader in Energy and Shipping, University College London

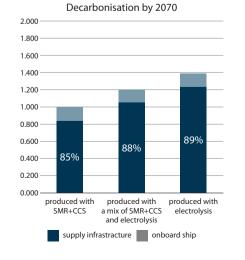
To make the decarbonization of the maritime shipping sector successful, the coming three decades will need to see a fundamental shift towards zero carbon energy sources. This implies a need for significant investments into new fuel production, supply chains, and a new or retrofitted fleet. The aim of this insight brief is to gauge the capital investment needed to achieve decarbonization outcomes in line with the IMO Initial Strategy. This Insight Brief is based on new analytical work conducted by University Maritime Advisory Services (UMAS) and Energy Transitions Commission (ETC).²

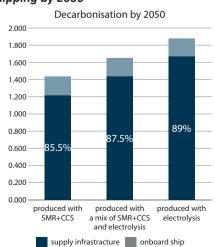
AT LEAST \$1 TRILLION IN INVESTMENTS NEEDED TO DECARBONIZE SHIPPING

The scale of cumulative investment needed between 2030 and 2050 to achieve the IMO target of reducing carbon emissions from shipping by at least 50% by 2050, is approximately \$1-1.4tn, or on average between \$50-70b annually for 20 years. This estimate should be seen in the context of annual global investments in energy, which in 2018 amounted to \$1.85tn.³

If shipping was to fully decarbonize by 2050, this would require extra investments of approximately \$400b over 20 years, making the total investments needed between \$1.4-1.9tn. The estimate of investments required is based on ammonia (NH3) being the primary zero carbon fuel choice adopted by the shipping industry as it moves towards zero

Fig. 1. Total investments needed to achieve IMO decarbonization targets and investments needed to fully decarbonize shipping by 2050





carbon fuels.⁴ Under different assumptions, hydrogen, synthetic methanol, or other fuels may displace ammonia's projected dominance, but the magnitude of investments needed will not significantly change for these other fuels.

To avoid shifting emissions upstream, it is important that efforts to decarbonize shipping also include the decarbonization of fuel production. The analysis is therefore based on the use of low/zero carbon hydrogen as input to the production of ammonia.

Figure 1 shows the modelled capital investment needed for two different overall rates of decarbonization – a 50% GHG reduction by 2050 on the way to 100% by 2070, as per the IMO mandate, and a 100% GHG reduction by 2050, as per a 1.5°C scenario.

The investments needed depend on the production method for the hydrogen used to produce ammonia. Figure 1 shows the total investment in infrastructure needed for three different methods of hydrogen production: pure electrolysis production, production based on pure steam methane reformation (SMR) with carbon capture and sequestration (CCS), and a mix between the two. The investment to produce hydrogen from natural gas with CCS is estimated to be lower than the production of hydrogen from electrolysis. However, it cannot from this be concluded that hydrogen from SMR+CCS will be cheaper than hydrogen from renewable electricity, as this will also depend on the price of the energy feedstock.

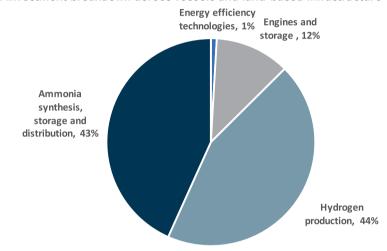
THE MAJOR NEED FOR INVESTMENT IS UPSTREAM IN ENERGY AND FUEL PRODUCTION

Investment needs can be broken down into two main areas: ship related investments (which include engines, onboard storage, and ship-based energy efficiency technologies) and land-based investments (which include investments in hydrogen production, ammonia synthesis, and the land-based storage and bunkering infrastructure).

The biggest share of investments is needed in the land-based infrastructure and production facilities for low carbon fuels, which make up around 87% of the total investment.⁵ Hydrogen production makes up around half of the total land-based investments needed, while ammonia synthesis and storage and bunkering infrastructure make up the other half.

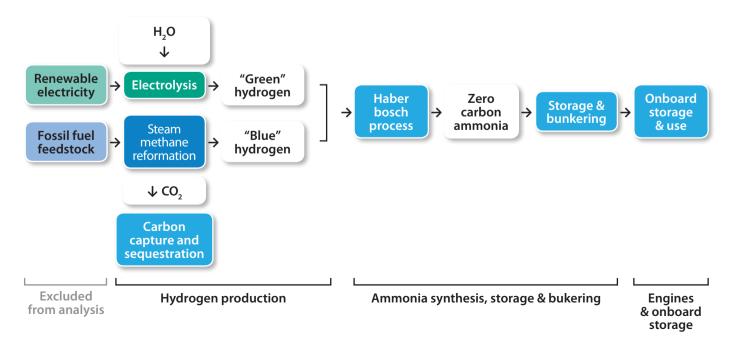
Only 13% of the investments needed are related to the ships themselves. These investments include the machinery and on-board storage required for

Fig. 2. Investment breakdown across vessels and land-based infrastructure



a ship to run on ammonia both in newbuild ships and, in some cases, for retrofits. Ship-related investments also include investments in improving energy efficiency, which are estimated to be higher due to the higher fuel costs of ammonia compared to traditional marine fuels.

GREEN AND BLUE HYDROGEN POTENTIAL FEEDSTOCKS FOR ZERO CARBON AMMONIA



his Insight Brief is based on analysis by UMAS and the Energy Transitions Commission for the Getting to Zero Coalition, a partnership between the Global Maritime Forum, the Friends of Ocean Action, and the World Economic Forum. The views expressed in this Insight Brief are those of the authors alone and not the Getting to Zero Coalition or the Global Maritime Forum, Friends of Ocean Action or the World Economic Forum.

Getting to Zero Coalition

he Getting to Zero Coalition is an the Getting to Zeilo Countie... tion that brings together leading stakeholders from across the maritime and fuels value chains with the financial sector and other committed to making commercially viable zero emission vessels a scalable reality by 2030. Go to www.globalmaritimeforum.org/gettingto-zero-coalition for more details.



GLOBAL MARITIME FORUM

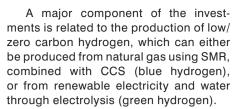
he Global Maritime Forum is an in-Lternational not-for-profit organization committed to shaping the future of global seaborne trade to increase sustainable long-term economic development and human well-being. For more info, please go to www.globalmaritimeforum.org.



he Friends of Ocean Action is a coa-Lition of over 50 ocean leaders who are fast-tracking solutions to the most pressing challenges facing the ocean. Its members - the Friends - come from business, civil society, international organizations, science, and technology. To learn more, head to www.weforum. ora/friends-of-ocean-action.

WØRLD ECONOMIC FORUM

he 1971-established World Economhe 1971-established would ic Forum, a not-for-profit foundation, engages the foremost political, business, cultural and other leaders of society to shape global, regional, and industry agendas. The Forum strives in all its efforts to demonstrate entrepreneurship in the global public interest while upholding the highest standards of governance. Check www.weforum.org to find out more.



The relative competitiveness of the two options is a function of the investment costs and the prices of electricity and natural gas, and will be significantly influenced by technology development and policy choice. In the medium-tolong-term, the rapidly falling price of

renewable electricity6 and a reduction in electrolyser costs are expected by some to make electrolysers the lower cost production solution in many geographies7 - even if electrolysers are a more expensive option in capital cost terms.

Meanwhile, costs of CCS are also expected to decrease as technologies move beyond pilots and demonstrations. Acceleration of cost reductions for CCS would allow for a competitive marketplace between green and blue hydrogen, likely influenced by contextual geography and policy.

SYNTHESIS AND CONCLUSIONS

Whilst research and development is valuable across all technology areas pertinent to shipping's decarbonization, the opportunity to reduce the overall costs of decarbonization is greatest in the upstream production of fuels. This emphasizes the need to involve stakeholders across the full fuel value chain to make the transition possible in the most economically efficient manner.

Hydrogen and ammonia have multiple applications in today's economy and likely increasing roles in the global economy across energy storage, low carbon heat, transport fuels, and, in the case of ammonia, as a key input in the production of fertilizers. This means that investments in hydrogen and ammonia production can serve other purposes than supplying fuels for shipping, which can create synergies and reduce the investment risk, especially in the early phase of the transition.

Finally, it is important to note that the significant investments needed to decarbonize shipping can only be expected to happen if there is a long-term commercially viable business case. Technological developments alone - although very important – are not expected to be enough to create such a business case as the costs of zero emission fuels are expected to be significantly higher than traditional fossil fuels used in shipping in the coming decades.

The term zero carbon energy sources should be understood as including zero carbon and net zero carbon energy sources. See the definition of zero carbon energy sources: https://www.globalmaritimeforum.org/content/2019/09/Getting-to-Zero-Coalition Zero-carbon-energy-sources.pdf
http://www.globalmaritimeforum.org/content/2020/01/Aggregate-investment-forthe-decarbonisation-of-the-shipping-industry.pdf The analysis uses the GloTraM model to estimate the profit maximising solutions (combination of decarbonisation choices), given a number of different fuel and machinery options. Some cost reductions over time are incorporated into the projections, but all estimates are uncertain and should be used as a guide to the scale only, due to the rapidly evolving nature of underlying technologies.

Into the projections, but all estimates are uncertain and should be used as a guide to the scale only, due to the rapidly evolving nature of underlying technologies.

International Energy Agency: World Energy Investment 2019

Ammonia (NH₃) is primarily produced through a chemical process where hydrogen reacts with nitrogen taken from the air to form ammonia. The competitiveness of ammonia in the model stems from the fact that ammonia is cheaper and easier to store (both onshore and on-board) than hydrogen and cheaper to produce than synthetic hydrocarbons such as methanol

This breakdown is based on the scenario where shipping achieves a 50% reduction in GHG emissions by 2050 using a combination of SMR+CCS and electrolysis to produce zero carbon hydrogen. The other scenarios show a similar but not identical distribution of costs https://www.bloomberg.com/news/articles/2019-08-21/cost-of-hydrogen-fromrenewables-to-plummet-next-decade-

brier https://www.yara.com/news-and-media/news/archive/2019/yara-and-engie-to-testgreen-hydrogen-technology-in-fer-tilizer-production/



Redrawing the map of global trade

by **Ben Aylor**, Managing Director & Senior Partner, Washington, DC;

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Marc Gilbert, Managing Director & Senior Partner, Montreal;

Claudio Knizek, Managing Director & Partner, Washington, DC;

Nikolaus Lang, Managing Director & Senior Partner, and Global Leader, Global Advantage practice;

lacob Koch-Weser, Knowledge Expert, Boston:

and Michael McAdoo, Partner & Director, Montreal; the Boston Consulting Group (BCG)

The COVID-19 pandemic has delivered perhaps the greatest shocks to international trade since the Great Depression. Global trade in 2020 is projected to decline by 20% according to our baseline scenario for economic recovery, and it is not projected to regain its 2019 absolute level of \$18 trillion until 2023. Only the most optimistic economic scenarios see trade returning to its previous level in 2021.

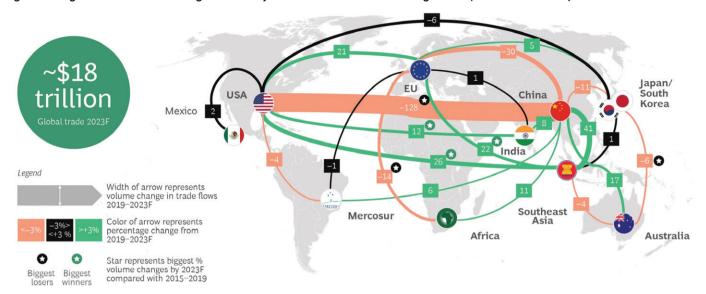
egardless of when the top-line numbers fully recover, however, the global trade landscape will still look dramatically different as companies shift their focus from fighting the pandemic to winning the post-COVID-19 future. As it destabilizes economies, intensifies geopolitical frictions, and exposes the risks of current global manufacturing and supply networks, the pandemic is also likely to redraw the map of world trade.

To visualize these shifts, we have prepared two maps depicting major trade corridors. One shows the actual change in trade volumes from 2015 through 2019; the other projects changes from 2019 through 2023 under our baseline economic scenario (Figs. 1-2). Among the sharpest shifts: two-way trade between the US and China in 2023 will have shrunk by around 15%, or about \$128 billion, from 2019 levels. Trade between the US and the EU will continue to grow, but at a sharply lower rate than the

\$135 billion surge from 2015 through 2019. EU trade with China will have declined by about \$30 billion from 2019 through 2023, after growing by \$124 billion in the previous four-year period. EU trade with India and South America will flatten. Southeast Asia will continue to be one of the strongest gainers, increasing two-way trade by around \$22 billion with the EU, \$26 billion with the US, and \$41 billion with China by the end of 2023, but still at a slower pace than the earlier four-year period.

Companies will be compelled to revise their mix of products and the design of their global supply chains – and governments their trade and economic policies – to adapt to these and other shifts. This will be particularly true in segments such as medical equipment, biopharmaceutical products, semiconductors, and consumer electronics, which are particularly exposed to geopolitical and macroeconomic pressures.

Fig. 1. Change in volume of traded goods in major corridors from 2015 through 2019 (billion US dollars)¹



[†] Corridors represent ~30% of global trade. Not included are: intra-EU = ~20%; intra-NAFTA = ~8%; China (incl. Hong Kong) = ~4%; intra-Southeast Asia = ~3%; rest of the world = ~35% Source: UN Contrade; OECD; World Economic Forum; IHS; TradeAlert; BCG analysis

Other ways COVID-19 is transforming trade

The future of trade is also being redefined in other ways. For example, as part of its European Green Deal strategy to slash greenhouse gas emissions, the European Commission is considering pressing ahead with a proposal to impose a carbon tax on imports. This tax could redefine global competitiveness in a range of industries.

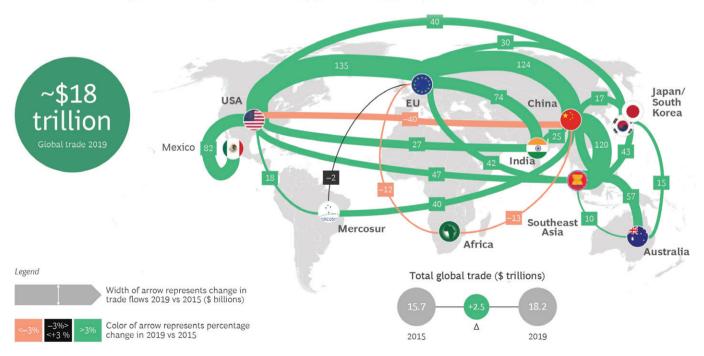
The pandemic is adding greater urgency to efforts to restructure global supply

chains as companies seek to make their manufacturing and procurement networks more resilient to shock. It is exacerbating the deteriorating US-China trade relationship, putting more than \$500 billion in annual two-way trade at risk, especially in industries in both economies that will have a hard time replacing lost revenue and sources of critical components and materials. A potential decoupling of the US and Chinese technology sectors – which could make devices and IT systems in

both markets no longer interoperable – might have even greater repercussions (these topics will be explored more deeply in upcoming Boston Consulting Group publications).

Companies should start acting now to adapt to the emerging new reality of the post-COVID-19 era, such as by reassessing their global manufacturing and supplier footprints and their approach to inventory, as many of the changes are structural and are likely to be long-lasting.

Fig. 2. Change in volume of goods traded in major corridors from 2019 through 2023 under baseline scenario (billion US dollars)¹



Baseline scenario assumes a U-shaped global economic recovery by 2023. Corridors in the map represent ~32% of global trade.

Not included are: intra-EU = ~20%; intra-NAFTA = ~8%; China (incl. Hong Kong) = ~4%; intra-Southeast Asia = ~3%; rest of the world = ~32%



Forces that are redefining the future of trade

The realignment of the world trade order was already underway before COVID-19 hit in early 2020. For much of the post-World War II era, global trade had been a driver of global economic growth, expanding three times faster than global GDP from 1950 through 2008 in an era that saw fairly steady reductions in tariffs and new multilateral free-trade pacts. In the 2010s, however, trade growth flattened relative to global GDP growth as new and deeper multilateral trade deals stalled, the UK voted to leave the EU, and the US renegotiated existing trade treaties and relationships.

Tariff wars involving the US and major trade partners, particularly China, contributed to a significant shift in US import sources. US imports from China declined in nearly all major industry categories in 2019 - most dramatically in energy products, semiconductors, machinery, and packaged foods - but rose in most sectors in trade with the EU, Japan/South Korea, India, Southeast Asia, and Turkey. The full effect of the US tariff hikes, moreover, was only partially felt in 2019. The COVID-19 crisis has been a further blow to trade. In addition to suffering from falling demand as nations sank into recession, trade was constrained by actions taken to control the virus, such as lockdowns of factories and controls on incoming shipments at ports, as well as by export bans on certain medical and agri-food products imposed by several governments and customs unions.

Going forward, global trade dynamics and the choices companies make regarding their supply chains will be significantly shaped in the following ways by the

macroeconomic environment and geopolitical frictions, which will in turn influence supply chain tradeoffs.

The macroeconomic environment

The lower trade flows through 2023 predicted in our models can be attributed largely to decreased demand for traded goods as a result of deep recessions and structural economic damage. Low demand will, in turn, affect prices, particularly for commodities.

Trade volumes will be heavily influenced by whether economic recovery is shaped like a V, U, or L. Our projection that global trade will return to the 2019 level of \$18 trillion in 2023 assumes that the global recovery path will resemble a U – after a steep decline, economic activity will remain low through at least 2020 and then rebound, presumably when some combination of mass testing, viable treatments, and an effective vaccine is available.

If recovery is rapid, resembling more of a V, trade could return to its 2018 level sooner than 2023. Under a slow, L-shaped recovery, international trade growth will remain relatively flat for several years. The shape and speed of recovery in specific countries will vary, depending largely on their progress in containing the pandemic.

Geopolitical friction

The COVID-19 crisis has already accelerated the trend toward nationalist policies and managed trade. In addition to worsening the US-China relationship, the pandemic is prompting some governments and customs unions to place further controls on trade in medical and agricultural goods. By mid-April 2020, more than 80 countries had imposed export bans on medical devices

and personal protective equipment needed to fight the spread of COVID-19. The Eurasian Economic Union, which includes Russia, banned certain agricultural staples, as did nations such as Vietnam and Cambodia. Governments are also likely to put greater emphasis on domestic production to reduce the risk of future supply shocks, particularly of medical supplies and equipment. Germany has expressed interest in localizing more supply chains, for example, and South Korea is exploring measures to encourage reshoring of manufacturing.

Supply chain tradeoffs

For many companies, severe supply disruptions for everything from auto parts and consumer electronics to protective equipment during the pandemic have underscored the risks of concentrating too much production and sourcing in a handful of distant low-cost locations and overreliance on just-in-time inventory management. Rising tariffs, restrictions on market access, and other manifestations of geopolitical frictions will also require companies to alter their supply chains.

In our conversations with manufacturers across a range of sectors, executives are reporting a greater focus on supply-chain resilience. They are adopting more regional, "multilocal" sourcing and manufacturing footprints and are willing to maintain higher "safety stocks" in inventory – even if these moves entail somewhat higher costs. Companies are also more willing to put production in locations that are closer to customers – and are finding they can offset higher labour costs by adopting advanced Industry 4.0 manufacturing systems.

Companies should be thinking proactively about redesigning their supply chains to make them more resilient to future shocks. The types of change will vary by industrial sector and each company's needs and strategic objectives (a topic the BCG will explore in more depth in an upcoming publication).

Impossible to predict, but...

The paths of the COVID-19 pandemic and the recovery of the global economy remain impossible to predict. But it is becoming increasingly clear that, by intensifying geopolitical and economic forces already at work, the pandemic's disruptive impact on international trade will leave a lasting mark. Rather than waiting for a return to the status quo, companies should act now to make their manufacturing networks and supply chains more resilient. Companies should take

a fresh, holistic view of the markets and trade relationships that are likely to drive growth and secure competitive advantage in the post-COVID-19 world.



New tension to global socio-economic structures

by **Ewa Kochańska**

In May 2020, the World Business Council for Sustainable Development (WBCSD) released an update to its Vision 2050 report, titled The consequences of COVID-19 for the decade ahead. The coronavirus pandemic caused a major disruption in global markets, economies, and human life, significantly changing WBCSD's outlook. The brief summarises what vulnerabilities have been exposed by the pathogen, and how it might shape the economic, political, and cultural future. Further, the authors suggest the crisis can be leveraged for the benefit of communities which have an opportunity to become more resilient and ecologically sustainable as a result of a thoughtful and responsible recovery.

he "This shouldn't have been a surprise," said Dr Seth Berkley, CEO of Gavi. the Vaccine Alliance, in a TED Connects series at the end of March 2020. "This is the third coronavirus that has jumped into humans. We had SARS in early 2002. We had MERS a number of years later, and now we have this virus," he listed. What's more, ever since the pandemic has started, some expert warnings from years ago resurfaced leaving the public wondering why we were so unprepared. For example, back in 2015, Ron Klain, a political consultant in the Obama White House and then Ebola Czar, seemed to have been reading from a crystal ball, "Ebola is very difficult to transmit. Everyone who is contagious has a visible symptom," said Klain before adding, "With a pandemic (flu), the disease would be much more contagious than Ebola. The people who are contagious may not have visible symptoms. It

could break out in a highly populous country that sends thousands of travellers a day to the US. It could be a country with megacities with tens of millions of people." Furthermore, co-chairs of the World Health Organization's (WHO) Global Preparedness Monitoring Board, Dr Gro Harlem Brundtland and Elhadj As Sy, said in their 2019 annual report that politicians around the world have largely ignored warnings related to epidemic preparedness. The report, which analysed whether the world is capable of preventing and containing a global health threat, found the governments ill-prepared. "Many of the recommendations reviewed were poorly implemented, or not implemented at all, and serious gaps persist," they said. "For too long, we have allowed a cycle of panic and neglect when it comes to pandemics: we ramp up efforts when there is a serious threat, then quickly forget about them

when the threat subsides," the duo blew the whistle, but nobody cared to listen.

These sorts of warnings were shown

on many news channels after COVID-19 hit, yet before the pandemic, it was rarely a breaking story. This is in spite of, as

the WBCSD brief points out, the WHO recognising 1,483 epidemic events in 172 countries between 2011 and 2018.

Impact of the COVID-19 pandemic on global trade

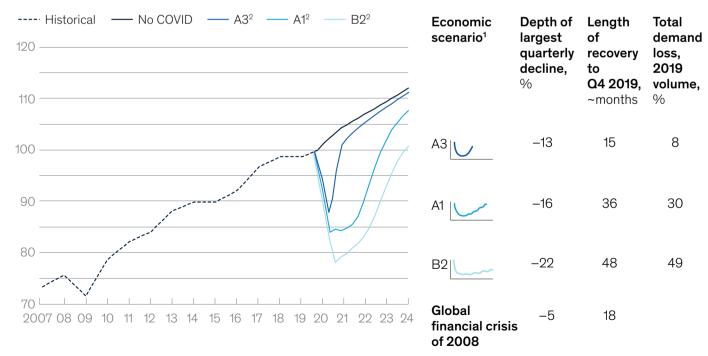
The economic downturn set off by the COVID-19 pandemic is expected to affect global trade and logistics more than any other recent crisis, according to the Global freight flows after Covid-19: What's next? analysis from McKinsey & Company. The report finds that global unconstrained trade demand could decrease by 13-22% in the second and third quarter of 2020. For comparison, the largest decline during the 2007-08 crisis in trade volumes was about 5%. McKinsey's supply and demand modelling also stipulates that the crisis will impact global trade more than the GDP that is set to decline by 3-8% in 2020. Additionally, the decrease in trade will last significantly longer, with trade volumes taking 15-48 months to recover to Q4 2019 levels while value lost will equal to 8-49% of total 2019 trade volume. The COVID-19 ramifications will affect specific commodities to a different degree; to illustrate, trade volumes of automobiles are expected to decline by more than 50%, while trade volumes of cereals will only decline by about 5%. Therefore, the extent to which each transport mode will be affected depends on its commodity mix. The severity of the crisis regarding individual trade lanes will also vary depending on country-specific pandemic developments and which commodities are carried on that trade lane. For example, in McKinsey's A1 economic scenario, the demand for containerized ocean trade will fall by 6% on exports from South America to Europe (which are mostly agricultural products) and 20% on exports from Asia (largely machinery and equipment). In their A3 scenario, with more effective control of the virus, those numbers change to 2 and 11%. Then again, in the B2 scenario, with lacklustre economic intervention, the numbers change to 8 and 27%. "Across scenarios, the impact on Asian exports is likely to be larger than on Asian imports, and the impact on east-west trade lanes is likely to exceed that on north-south lanes," said McKinsey.

The WBCSD brief names five major factors that have intensified the negative consequences of the pandemic: over-dependence on economic growth; high levels of economic and social inequality; lacklustre coordination and collaboration of institutions; under-investment in health-care systems and scientific research and

preparedness; and too much emphasis put on efficiency and short-term value by businesses.

Governments across the globe have been struggling to figure out the balance between lockdown initiatives and sustaining some level of economic activity to help maintain wages, particularly in poorer nations. Excessive 'spreadsheet focus' has made the world particularly vulnerable to a pandemic such as COV-ID-19, which has required complete lock-downs in most areas. As expected, populations in lower socio-economic groups, across both underdeveloped and mature economies, have seen their livelihoods

Global unconstrained trade demand by macroeconomic scenario, tons, index (100 = Q4 2019)



Note: Preliminary results, as of June 1, 2020.

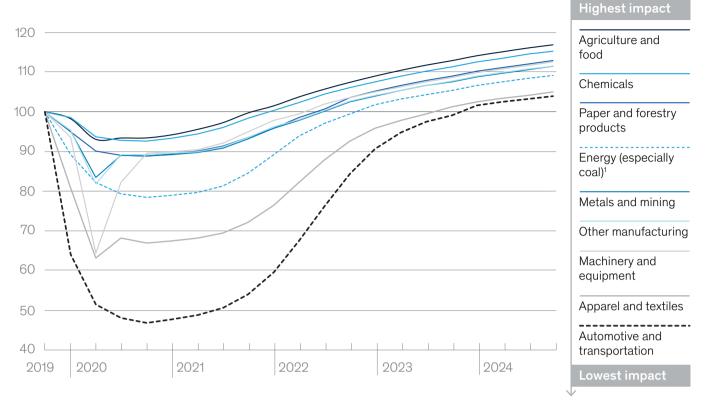
Include trade between countries, excluding intra-European (Central Asia, Eastern Europe, European Union, United Kingdom) trade.

²A3: public health responses with rapid and effective control of the virus and partially effective economic interventions; A1: partially effective public health interventions and partially effective economic interventions; B2: partially effective public health interventions and ineffective economic interventions.

Source: IHS World Trade Service data; McKinsey COVID-19 Trade Flow Recovery Model; McKinsey analysis, in partnership with Oxford Economics

Global unconstrained trade demand by commodity groups.

tons, index (100 = Q4 2019), Scenario A1



Share of sectors across modes, 2019

	Contain- erized sea, TEU, ² %	Dry bulk, tons, %	Air cargo, tons, %		Contain- erized sea, TEU, ² %	Dry bulk, tons, %	Air cargo, tons, %
Agriculture and food	22	14	32	Other manufacturing	7	2	16
Chemicals	18	4	9	Machinery and equipment	13	0	25
Paper and forestry products	16	2	2	Apparel and textiles	s 8	0	6
Energy (especially coal) ¹	1	32	0	Automotive and transportation	5	0	3
Metals and mining	12	47	7				

Note: Analysis based on granular commodity breakdown; aggregation to groups of commodities illustrative; Preliminary results, as of June 1, 2020.

threatened if not entirely obliterated. Lockdown measures have removed income sources from many working adults, especially freelancers, contractors, and gig economy workers. That's an area of the labour market that has exploded in recent years; meanwhile, some governments have not been able or willing to provide a legitimate financial safety net for these workers.

Additionally, problems with cooperation during this crisis have emerged within countries as well as between them. Several nations, especially at the beginning of 2020, have banned exports of medical equipment and supplies even as their neighbours were in a desperate need (that was the fate of, e.g., Italy). The public watched in shock how healthcare systems, even in the wealthiest of nations,

crumbled under the ruthlessly escalating numbers of coronavirus patients and deaths. The initial indifference of some powerful economies and the jarring inaction from the European Union should have left its Member States questioning what the community really stands for. Similarly, some US newspapers reported that states have competed amongst themselves for medical supplies. This breakdown in

¹Oil and gas products not considered in sectors by their degree of disruption.

²Twenty-foot equivalent units.

Source: IHS World Trade Service data; McKinsey COVID-19 Trade Flow Recovery Model; McKinsey analysis, in partnership with Oxford Economics

Unconstrained trade demand change for ocean container, 2020 TEU, % of 2019 (Scenario A1)



Note: Preliminary results, as of June 1, 2020.

For Asia-related trades,

than backhaul.

headhaul is impacted more

cooperation has led to failed attempts to diminish COVID-19 in most parts of the world and, consequently, to the continued spread of the virus as lockdown measures have eased over the summer.

The virus indeed underscored the value of healthcare quality and access. The austerity programmes adopted post the 2007-08 financial crisis have played a major role in healthcare systems underperforming during the pandemic. The authors of the brief state that "there are an estimated 30,000 coronaviruses in animals: we don't currently know how many of these could spread to humans, because research hasn't been done." Certainly, now is the time to rethink and reshape the healthcare industry from a local as well as global standpoint. From a corporate point of view, the emphasis on immediate efficiency and short-term financial value maximization, along with overutilization of low-interest business

loans, has left companies without the liquidity needed to deal with a sudden economic downturn. As recently as October 2019, the International Monetary Fund cautioned that a crisis even half as bad as the one in 2007-08 could leave almost 40% of corporate debt in top global economies owed by companies that don't earn enough to cover their interest payments. The WBCSD brief warns that the crisis driven by COVID-19 will most likely be "significantly worse" than the one 13 years ago.

Asia exports to Europe

and North America are

hardest hit.

Current and future reality

As mentioned above, COVID-19 has not affected everyone the same way. In terms of income and wealth inequality, WBCSD sees the pandemic as perhaps reducing this inequality temporarily; long-term, however, the coronavirus is likely to escalate it depending on how governments handle the response. When

it comes to gender inequality, while the illness itself affects men more than women, the side-effects of lockdowns have disproportionately impacted women and girls. Girls have been more likely to withdraw from school due to money constraints, women working remotely have taken on more responsibilities for homeschooling and carrying for children, and domestic violence against women and girls has increased.

North-south trade lanes

are less impacted than

east-west ones.

When it comes to intergenerational factors, here again, while the immediate effects of COVID-19 have touched upon the older generations at a much higher rate, the long-term economic consequences affect the younger groups in terms of severe income losses and weak job prospects. This could impact the younger generations' mindset when it comes to economic and political structures. After all, if the country refused to help them in terms of income assistance

when the government forbid them to work, all the while the healthcare industry failed to save their parents' or grandparents' life or health, why would they support these institutions?

In terms of politics, in many countries, the pandemic also underscored the recently ignited nationalistic trends. Border closings and at least the initial refusal to share medical supplies along with bans on the export of those supplies to countries that suddenly found themselves in grave need, pose some eyeopening examples of isolationist tendencies. Even within the EU and, to some extent, within the US, help to individual states came shockingly slow. On the other hand, while the pandemic intensified political and economic divisions, it has also unified some local and even global communities. The spirit of solidarity and interdependence has resurfaced, and if kept alive, it may reinforce the social contract with emphasis on community and interhuman relationships.

Furthermore, the pandemic crisis accelerated certain trends, some positive, such as reshoring, digitalisation, and some more problematic, like surveillance and autocratisation. Companies have already been either considering it or already moving manufacturing closer to the end consumer due to changing technologies and geopolitics. Similarly, with the necessity of remote work, school, and health services as well as the rise in e-commerce, digital and technological innovation have made some leaps, especially in telemedicine and virtual learning. On a flip side, cybercrime is thriving just as much, with BBC News reporting in April that Google stops around 18 million coronavirus-related e-mail scams daily. What's more, national surveillance, or rather "bio-surveillance," has found a new footing with governments implementing measures such as contact tracing and considering health or immunity passports as lockdowns and travel restrictions are lifted. The concern with increased surveillance is data ethics and possible privacy violations, not only in new democracies and countries with authoritative governments but any state or institution that lacks cyber competencies.

With regard to the next decade, several new trends are likely to emerge as a result of the pandemic. One of them is a decrease in urbanization as people leave highly congested cities that are more prone to a rapid spread of pandemics (and because the rapid uptake of remote work has made it possible for people to stay where they live instead of fleeing to bigger cities in search of

better paying jobs). Secondly, some industries (travel and tourism) may never return to their pre-COVID levels due to shifts in consumer behaviour such as a reduction in spending and maintaining lockdown mindset due to some positive side-effects, e.g., less aeroplane, maritime (cruise), and road pollution. Thirdly, recognition of the importance of scientific expertise, which might make the allure of populist narratives fade away. Fourthly, a newfound gratitude for low-income key workers, leading to a political shift towards egalitarianism. And fifthly, cleaner air noted during lockdowns in usually highly polluted areas might inspire citizens to put pressure on local governments to move more aggressively on clean air initiatives.

All-inclusive recovery

The WBCSD brief emphasises that the right type and a high level of government involvement in recovery cannot be overstated. It's clear that after the current crisis dies down, private households will have to recover financially; many used up all of their savings, some took on additional debt. Similar fiscal reality has hit many businesses and financial institutions, which, due to budgetary restraints. may not be able to invest and take risks. Therefore, the aggregate demand is expected to remain low for quite a while. In light of these realities, the type and implementation techniques of recovery policies enacted by governments will be of crucial importance.

The recovery could become an agent of positive change by creating a more sustainable and balanced global economy. But if mismanaged, it may also become the final straw, becoming a facilitator for elevated economic and social uncertainty, perhaps even leading to violence. Shortly before the pandemic, 70% of respondents across 27 different nations told Ipsos polling that they believe the economy is rigged to the benefit of the wealthy and powerful. In order to avoid conflict, governments need to structure recovery packages prioritising the most vulnerable groups. The WBCSD brief defines that as "choosing public investment, coupled with tax reform, rather than austerity, as the recipe for recovery ideally using investment to kickstart the decarbonization of economies, creating jobs in the process. If we get this right, COVID-19 could massively accelerate progress towards Vision 2050." To accomplish it now is the time to shift to stakeholder-oriented capitalism. By making a recovery all-inclusive, another backlash against capitalism can be avoided.

To help businesses build sustainability, the brief introduces the three Rs: responsibility (particularly important in the crisis-response stage), and resilience and regeneration (crucial in the postcrisis phase). In order to fulfil the three Rs obligations, some companies will need an entirely new business model. Financial responsibility and resilience are especially important pertaining to government bailouts. For one, government support packages often come with strings attached, e.g., requiring corporations to accumulate more cash reserves. Additionally, companies that are registered in the so-called tax havens may not receive government aid at all. Conversely, since cabinets are always pressured to step in and save failing businesses in times of crisis, some companies might forgo of financial responsibility altogether, continuing to focus on short-term goals instead. Such corporate schemes will be closely scrutinized, especially in the wake of COVID-19, by the media and the public alike. Systemic resilience is also needed to deal with the consequences of the crisis - and that means cooperation of business, finance, and government sectors to ensure, among other things, that the recovery and its stimulus packages are consistent with the United Nations' Sustainable Development Goals, the Paris Agreement, and WBCSD's Vision 2050.

Before the next crisis hits

The COVID-19 crisis exposed vulnerabilities in the capitalist system, including the absence of resilience due to an incessant appetite for short-term profits, under-investment in crisis-preparedness measures, and government regulation that drives companies to offer unstable or temporary employment in place of proper work contracts. The authors of the WBCSD brief conclude that there's a need for a new social contract between workers, corporations, and governments to "strengthen social safety nets and ensure that the risks and costs associated with systemic crises are more equitably distributed before the next crisis hits."

This new stakeholder capitalism will require changes in ownership and governance, law and regulation, and pay and incentives. For economies to recover, capital and demand are needed. Since that may not come from consumers who are likely to curb their spending, the investments, directly linked to decarbonization efforts, could create the demand necessary to encourage a new wave of economic growth, hopefully a sustainable one this time around.

The post-corona government and business world



Photo: Elle Hughes/Pexels

How to win with COVID-19

by **Ewa Kochańska**

The Boston Consulting Group (BCG) recently released a series of articles on how governments and businesses, particularly their leaders, can assist populations in coping with the coronavirus pandemic (COVID-19), and how to best prepare for the new reality after the crisis is over. From describing scenarios that can help organisations "win the COVID-19 battle," through the outline of what is the now evolving definition of leadership and "people priorities" within organisations, to the economic restart and new expectations of governments and businesses "in the wake of COVID-19," the features intend to map out a foolproof strategy.

OVID-19 has already caused a more significant economic downturn globally than the 2008 financial crisis. With no blueprint for dealing with a pandemic of this level in recent times, countries across the world seem to be walking on quicksand. Increasingly, finding a middle ground between the disastrous and possibly deadly consequences of shutting down the economy, particularly in the second and third-world countries, and coronavirus' unrelenting claim on life, has proven to be an especially difficult task. But it is the responsibility of leaders - in healthcare, politics, business, and societal organisations to manoeuvre through the crisis and come out better and stronger on the other side.

Guesstimating

According to the article How Scenarios Can Help Companies Win the COVID-19 Battle, when establishing a framework for dealing with the virus, the approach should be realistic and

flexible, free of "unnecessary details" and "false precision." The factors that must be considered include the public health situation, the direct impact of government measures, macroeconomic environment (learning the intensity of the economic consequences of the crisis based on factors such as bankruptcy rates and investment levels), and business-specific demand (determining industries' increased or lowered demand due to the pandemic). BCG advises that companies should establish 'cockpits,' or dynamic indicator dashboards, which would gather information (key performance indicators), backward and forward-looking, to feed into the scenarios on an on-going basis.

Keeping in mind that the response to coronavirus has varied among countries, global regions, and even districts within individual countries, leaders must establish a 'reference scenario' for each area in which they operate with its own unique forecast. For example, closure of restaurants translates into increased demand

Fig. 1. The evolution of people priorities for the New Now

During the crisis 1 Accelerate smart work 2 Enhance corporate health and hygiene 3 Mitigate people and skills risk 4 Manage workforce flexibility 5 Communicate openly with empathy 6 Stand together 7 Speed up digital readiness

... To the New Now

Beyond the crisis

- 1 Smart work
- 2 Physical and mental health
- 3 New paradigm for skills and talent
- 4 Flexible workforce
 - NOW
- 5 Leadership with head, heart, and hands
- 6 Purpose-driven culture
- 7 Bionic organization

in retail stores and online sales so businesses in areas with a lot of entertainment might want to introduce or expand services for online shopping (grocery food delivery options, hiring delivery drivers, etc.). Due to the continually evolving nature of this crisis, leaders must be ready for rapid changes in strategy.

Additionally, while at the moment companies are focusing on short-term losses and retaining their employees, the crisis will likely have long-term consequences. Companies that emerge stronger after the crisis will be headed by leaders who were rational but also bold in their strategic response. BCG proposes that organisations plan for three-time horizons during this pandemic: flatten, fight, and future. Flatten takes the first two to three months because that's how long the initial lockdowns to control the outbreak last. During this time, company leaders need to focus on workplace and employee safety, immediate finances, business continuity, etc. Fight lasts the subsequent 12 to 18 months when business activity comes back but can still be stagnant due to remaining restrictions until the vaccine is available. This is when companies need to cultivate resilience and be on a lookout for unique opportunities, including those related to the pandemic. Future starts somewhere around the end of the first half of 2021. That's when companies start looking forward and dealing with a likely global recession and recovery.

When it comes to taking action, BCG recommends borrowing a decision-making approach from the military called the OODA loop, to help continuously and proactively consider and readjust new action plans. OODA stands for: observe

(the situation and adjust scenarios based on current information); orient (to identify strategic options); decide (on the most effective plan); and act (quickly and decidedly).

The authors also recommend setting up two temporary crisis offices - one, the intelligence and anticipation office (IAO), "single source of truth for adapting scenarios across the organisation," in charge of developing an action plan for the fight phase of the crisis, informing the CEO and executive committee. The second one is the COVID response office (CRO), in charge of the flatten and fight phases of the crisis. CRO takes care of workforce management, operational continuity, and stakeholder engagement. The CRO is also responsible for the fulfilment of the action plans developed by the IAO, reserving the right to change them depending on new developments during the crisis.

It is important to remember, however, that while making informed decisions is a must during this pandemic, some information, such as when the vaccine becomes available or when the worldwide lockdowns will be lifted, is simply not available. As a result, often leaders will need to rely on their instincts rather than data.

"Head, heart, and hands"

According to the article *Leadership* in the New Now, leaders' empathy will be as important for organisation's survival during the crisis as their competencies. The article lists seven "critical people priorities of the crisis response" that will guide companies to survival and towards success during COVID-19. They include acceleration of smart work (working

remotely, virtual meetings), enhancing employees' physical and mental health, mitigating people and skills risk, managing a flexible workforce, cultivating purpose-driven culture, speeding up digital readiness, and the last, which the article discusses at length, leading from "head, heart, and hands."

In terms of the 'head,' a visionary leader with great communication abilities can reassure and inspire the workforce, something that's particularly important in times of crisis. When it comes to the 'heart,' the larger purpose of the organisation should be prioritised. It's especially crucial to review what role the company plays in its environment, the community, and the country, regarding its customers, employees, and stakeholders. The pandemic highlighted these ideas even more, "shining a bright light on corporate culture. It is revealing whether businesses support their workforce, for example, through the promise of avoiding layoffs and doing what they can to minimize financial hardship, or whether employees feel that protecting the bottom line is priority number one." And lastly, leading from the 'hands' emphasizes communication among leaders at all levels and their subordinates. "Managers don't just need to frame issues; they must also solicit feedback and suggestions, and regularly interact with teams as 'thought partners'." Free exchange of ideas is the theme here, with all employees contributing to the conversation.

The People Priorities for the New Now article discusses the seven people priorities mentioned above in more depth. Smart work, according to the authors, will soon become the new standard in all organisations. The pandemic has

Fig. 2. Seven people priorities for the New Now



1 Smart work

Accommodate virtual collaboration and remote work at scale Try a new approach that balances remote and onsite work Set up smart workspaces Realize the cost upsides

2 Physical and mental health

Cultivate physical health capabilities Make mental health and mindfulness matter Promote well-being and resilience

3 New paradigm for skills and talent

Create an adaptive learning ecosystem
Upskill and reskill by building digital capabilities at scale
Refocus and enable talent programs and platforms

4 Flexible workforce

Make your workforce, costs, and skill planning dynamic Tailor working models for employees Institute new performance, reward, and compensation systems

5 Leadership with head, heart, and hands

Lead with empathy and direction Enable and empower frontline leaders Develop a continuous, two-way communication platform

6 Purpose-driven culture

Foster a culture of resilience Align purpose, vision, and values Commit to sustainability and social impact at a higher level

Source figs. 1-2: Boston Consulting Group

accelerated the process that would typically take years, the epidemic acting as a "digital catapult." Therefore, companies need to adopt practices that make working remotely and collaborating virtually as convenient and efficient as possible. "Remote work will not replace onsite work entirely (...) but instead complement it;" therefore, finding a practical balance between remote and on-the-spot work will be vital, including not only offices but also factories, where smart technologies can aid workers in a lot of manual tasks, keeping the spread of infections at bay. Smart work also provides obvious cost benefits by saving money in high-expense areas in travel and real estate.

The physical and mental health of the workforce must become "organisational cornerstones." Employees' overall wellness, mental as well as physical, have to become a priority. This is particularly important now that the second wave of COVID-19 and threats of future viruses are a possibility. To help maintain a healthy workplace, companies should invest in technologies such as big data and digital tools with (cyber-secured) phone applications for social distancing and infection tracking. It's also clear that mental health and mindfulness shouldn't be ignored. Considering that the spread of the virus on its own caused a lot of stress, the employees, whose companies in many cases laid off a big part of the workforce, additionally feel pressure to make up for what was lost during the lockdown and are now in a position to handle more work than before. This new reality adds enormous pressure that may contribute to chronic stress, anxiety, cognitive overload, and

burnout. "Techniques that proactively enable better work-life balance – making work and private time more predictable through feedback, nudging, and the use of technology, for example – are key to maintaining a productive workforce."

Additionally, the pandemic created

"a new paradigm for skills and talent." In order to fulfil their potential, companies will have to adjust to the new realities swiftly and on a large scale. First, the authors propose to create an adaptive learning ecosystem within the organisation. "Leaders and teams need to make the pursuit of new experiences, skills, and knowledge part of their daily routines." Secondly, businesses must continually train and retrain the workforce. Even before the crisis, studies showed that about 60% of the global workforce needed to "upskill and reskill." Thirdly, they should refocus and enable talent programmes and platforms in order to recruit and keep valuable talent. Practices such as "acquihiring (acquiring struggling start-ups with valuable workforce)," and embracing the Build-Operate-Transfer (BOT) model, where digital experts and new recruits work together for on-the-job coaching, enabling the organisation to limit outsourcing of digital services, can be extremely beneficial.

A flexible workforce is another one of those concepts that organisations have been dipping their toes into but, during the pandemic, were forced to fully embrace. The workforce, costs, and skill planning post-COVID-19 will have to become even more dynamic. The changing business model means that staff needs will also fluctuate with organisations

7 Bionic organization

Harness data and digital platforms Use AI and algorithms to complement humans Adopt agile at scale Simplify your operating model

reaching out to the contractor and freelance market more frequently, introducing more flexible hours, and increasing upskill and reskill training. The pandemic has also pushed workforce shifts from over-capacity markets to deficient ones such as from retail outlets to distribution. which broadened skill sets of the migrating labour pool. This increased flexibility will also need to apply to space, how much work is done remotely and onsite. time, and forms of affiliation - contract, contingency, freelance, etc. "Companies should also rethink their workforce strategies based on important questions. Which value-driving skills should be incubated internally? What positions should be open for part-time employment? How much flexibility should be granted to remote and offsite workers?" Consequently, along with the new workforce models come new performance, reward, and compensation systems, which will have to be equally flexible to accommodate the changing employment environment.

The pandemic also exposed the need for a purpose-driven culture. Successful post-COVID-19 organisations will have evaluated their company culture to ensure that they're resilient, have their purpose, vision, and values aligned, and are committed to sustainable and responsible social impact. Anything from sharing experiences and solutions across industries, to engaging with the workforce, customers, and society as a whole can help create a much more productive and successful business.

And finally, the pandemic has certainly pushed the business world closer to the concept of the bionic organisation. Today, companies have no choice but to

invest in the newest technologies if they want to compete. "Crises are like forest fires – amid the tragedy emerge the seeds of renewal and growth." The authors believe that a successful organisation of (very near) tomorrow will harness data and digital platforms, use Artificial Intelligence (AI) and algorithms to complement humans, simplify their operating model, and adopt agile at scale (since, in this new organisational structure, leaders will deal with constantly evolving roles and tasks for themselves and their employees).

"Huge structural moves"

In the article How Governments Can Galvanize Their Nations for the Rebound. the authors underscore that "with so many norms shattered, so many industries idled, and so much of society on pause" now is the perfect opportunity for fundamental structural changes that can bring positive benefits to citizens as well as businesses. "We mean bold, far-reaching, and visionary initiatives that amount to nation-building. We mean huge structural moves that will reshape society and the economy for the better." A crisis of this magnitude can propel a nation to pinpoint and fix its vulnerabilities to "ensure competitive, innovative, resilient, and sustainable national platforms far into the future."

The authors named three priorities they believe can help establish fundamentals imperative to future competitiveness and enable countries to come back stronger after the crisis. First, double down on existing and new paths to growth. This includes applying digitisation, innovation, and entrepreneurship to speed up national competitiveness. Related to that is engaging "grassroots open-source technologists" to optimise national brainpower. Next, investments in digital economy elements such as AI, machine learning, the Internet of Things, digital infrastructure, and research & development are necessary. But investments also have to be carefully distributed, keeping in mind economic shifts caused by the epidemic. The authors warn that the new habits of businesses and consumers that are beginning to take shape might stay with us for good (such as getting away from reliance on China being 'the world's factory'). Likewise, relying on "mega-factories" might be on its way out. "Insurers, investors, and others closely attuned to risk will pay much closer attention in future to supply chain risks." Regulatory flexibility is also important so that regulations don't curb technological and scientific progress. At the same time, protecting the privacy of citizens cannot be overlooked, even in times of pandemic. Therefore, technologies such as contacttracing smartphone applications have to be carefully designed to respect users' privacy. And finally, directing stimulus programmes to sustainable and eco-friendly businesses and initiatives ensures that the future is more climate-friendly.

Second, build and strengthen capabilities for the future at three levels: individual citizens, via investments in such programmes like higher education and employee training and upskilling; organisations, including businesses, e.g., by providing remote-work tools free of charge; and governments, by constantly reviewing how they perform.

Third, develop economic and social resilience. "Governments must be proactive in planning to localize, regionalize, or otherwise secure" supply chains pertaining to food, medical supplies, and healthcare equipment. This might mean re-evaluating the country's trade agreements. Additionally, governments should especially support and guard the essential sectors of their economy while protecting the workforce that might be endangered by new technologies such as automation or green solutions (e.g., Government mineworkers). policies should also further address economic inequality, an issue that leads to global protests every few years, with little results to show for it. This is particularly felt in developing economies, especially by informal workers, who even in the top world economies, such as the USA, had difficulties collecting COVID-19 government aid. "There is much more to be done to reinforce the social contract and, in many places, to repair it."

Post-COVID relaunch is a delicate dance

Article Beyond the Curve: How to Restart in the Wake of COVID-19 points out something that has already been observed in South Korea - that the recovery won't be smooth but rather volatile, demanding flexibility of policy and adjustments as the situation changes and new information surfaces. BCG recommends that governments have a strategy with three core components. First is determining, based on factors such as healthcare and public readiness, when to lift the lockdown; the second is determining how to reopen "on the basis of a consistent national framework with effective local implementation." The third is creating transparency to ensure public trust and ease public concerns related to reopening.

The article also names three models of reopening the economy post-COVID-19. First is a full reboot without restrictions

(New Zealand), second is the same but with protections and stringent restrictions regarding vulnerable populations. and third is a "graduated approach" that most western countries and China are undertaking. Under the full reboot approach, the country waits for zero new COVID-19 cases and then restarts all economic and social activities with almost no restrictions except international travel ban. This approach requires aggressive testing and contact tracing, an economy that can withstand a lengthy shutdown, and a disciplined population. The second approach, under which vulnerable populations still stay isolated, may be necessary for poorer nations that can't afford a long economic shutdown, don't have enough test kits, and have a weak healthcare system. The third and, so far, the most popular model has governments gradually lifting restrictions, mindful of the capabilities of the healthcare system and extent of the pandemic. In this approach, businesses and organisations posing low transmission risk open up first, and gradually, other areas of economic and social activity join in. Whichever approach is chosen, based on the progress of the first country affected by the virus, China, an economic recovery might take a while after COVID-19 is eradicated, especially in sectors such as travel and hospitality.

"Now, more than ever"

At the time of writing, the world still awaits a COVID-19 vaccine, in a shadow of the very real threat of renewed surges of the pandemic in nations that are already exhausted, emotionally and financially, having seen thousands of lives lost and their economies on life-support.

Still, it's important to celebrate the good news. One of the leading global economies, the USA, is already in a recovery phase after hitting recession in February 2020. American unemployment experts, who were threatening that the jobless rate could reach 20%, got a surprise of a lifetime after the rate actually dropped in May over one percentage point to 13.3% from 14.7% in April. That's certainly good news for all since global economies are now so closely intertwined.

Naturally, businesses are always in the best shape when they're cautiously optimistic – to paraphrase Benjamin Disraeli – expecting the best but prepared for the worst. And no matter how quickly or slowly the top economies recover, the BCG authors reiterate that the "society now, more than ever, needs to collaborate to protect people's lives and health, manage mid-term implications, and search for lasting solutions."

Second fiddle?

by Przemysław Myszka

"Analysts have long talked about the end of an American-led system and the arrival of an Asian century. This is now happening in front of our eyes," Josep Borrell, European Union Minister for Foreign Affairs, said. He furthered, "We need a more robust strategy for China, which also requires better relations with the rest of democratic Asia." Margrethe Vestager, Executive Vice President of the European Commission and Competition Commissioner, added, "In the part of west Denmark in which I grew up, we were taught that if you invite a guest to dinner and they do not invite you back, you stop inviting them." In her view, Europe needs "to be more assertive and confident about who we are." At the same time China's President Xi Jinping champions "openness" in Davos, which according to Kai Strittmatter, author of expert books on China, should be read as the country's openness to scale-up overseas, while maintaining a tight grip on domestic affairs, including controlled access to the Chinese market. Are we, therefore, witnessing the end of EU's passive stance towards China's rising global presence? Are the Chinese ready to revise their Belt and Road Initiative (BRI) to onboard more foreign partners as well as to make it "lean, clean and green" after having been burned by loss-making projects?

he uropean Union Chamber of Commerce in China (Chamber) has recently published a survey-report (132 respondents), under a telling title *The Road Less Travelled. European Involvement in China's Belt and Road Initiative*, to investigate the role of Europe's businesses in the BRI, check if and how the scheme has changed since its inception, and see in what ways the EU can complement the BRI while at the same time developing its own credible alternative.

Filling-the-gaps

Naturally, such a grand project like the BRI – \$6.0 trillion in trade between China and the Belt and Road countries in 2013-2018, \$1.21 trillion alone in I-XI 2019 (29.3%

of China's total trade) – couldn't go below European businesses' radar. Over the years, what was meant to essentially better rail-connect China and Europe grew into a global web of parties willing to tap into the BRI, including not only Central Asian but also Western African and even South American economies. As of July 2019, 136 states and 30 international organisations have signed BRI cooperation agreements with China, out of these 12 EU Member States, mostly new entrants from Central Europe, but also Italy, one of the block's founding fathers, an event that stirred quite an uproar back then.

Politics in or out, a chunky looking cake was to be cut. That said, the Chamber underlines, European businesses have come

Tab. 1. Where are the BRI-related projects that European companies are involved in?

Region	Country
East/South East Asia	China, Malaysia, Indonesia, Thailand, Vietnam, Myanmar, Singapore
South Asia	India, Pakistan, Bangladesh
Central Asia	Kazakhstan, Russia, Uzbekistan
The Middle East	United Arab Emirates, Jordan, Saudi Arabia
Africa	Tanzania, Morocco, Ivory Coast, Algeria, Congo (not specified if DRC or ROC), Somalia, Sudan, Ethiopia
Europe	Belgium, Italy, Romania, Belarus, 'Central and Eastern European countries'
The Americas	Argentina, Brazil

Source for tabs. 1 and 3-4, and Fig. 1: The European Union Chamber of Commerce in China's The Road Less Travelled. European Involvement in China's Belt and Road Initiative

up against various entry barriers. "Insufficient information available" and "nontransparent public procurement systems" have been cited by more than half and nearly 40% of the respondents, respectively, as the main challenges. "The lack of transparency is made all the more apparent by the fact that a mere 10 per cent of bidding companies say they got notice of a BRI-related project from public tender/ publicly available information," the Chamber added. As a result, those who have participated in a BRI project have been brought on-board by the Chinese, either by companies (mostly protected state-owned enterprises, SOEs) or directly the government, "[...] meaning that they were essentially hand-picked to participate. Therefore, the competitiveness of these bids is essentially irrelevant in the absence of actual competition." Only 20 of those questioned had made a bid, out of which a dozen or so got through. Six companies formed joint ventures with SOEs to win the tenders; out of these, four held between 1% and 25% of the shares, and only one had a controlling stake. Though a few companies have participated in over 50 projects, they played niche roles, whether because the Chinese themselves couldn't provide the goods/ services (54% of respondents), due to their long-term presence in the targeted market (62%), or their close ties with the involved Chinese company (69%). Only a single interviewed party said they'd won thanks to having the most competitive bid. "This 'filling-the-gaps' role is very similar to European companies' participation in China's market in general, particularly with respect to public procurement," The Road Less Travelled reads.

This want for transparency is magnified in how the BRI projects are financed, with nearly all backing coming from China's policy and/or commercial banks or even Chinese companies themselves. While it might not come as a surprise that the World Bank, led by Western economies and Japan, is being blocked from access to the BRI, hardly any financing comes from the Asian Infrastructure Investment Bank (AIIB), the set-up of which was proposed by China itself already back in 2013 and whose HQ started operating in Beijing the following year. The multilateral nature of the AIIB, something that necessitates greater transparency and feasibility standards as well as distributes control, is, it seems, what makes the Chinese steer clear from it (out of the \$12b invested by the AIIB across 63 projects by end-2019, only a modest portion fell under the BRI). Moreover, European financial service providers avoid 'typical' BRI infrastructural projects, like setting up ports or railways, dominated by the SOEs and heavily politicised. Instead, they prefer 'soft' initiatives, especially carried out by Chinese privatelyowned enterprises. "One interviewed representative states that while this has still led to meaningful increases in sales, European opportunities were 'crumbs from the table, albeit pretty big crumbs'," the Chamber reports. Interestingly, European companies can turn the table for the game rules to play to their advantage, namely convincing the Chinese side to stamp a given project with the BRI label, hence fast-track something they otherwise would pull resources for from elsewhere, albeit tangibly slower.

Because the initial bonanza has begun to fade away, and the Chinese Communist

Party (CCP) started having afterthoughts about burning funds through the BRI, the financial vehicles set up by China have applied greater scrutiny – only for the projects to undervalue the initial costs to secure financing, after which the entire thing goes back to square one as the contracted (and party-supported) SOEs take over. Non-Chinese financial institutions are invited to partake only in selected cases: cross-border transactions and foreign exchange, or when there's lack of confidence between the Chinese and local companies, "This lack of mutual trust can be alleviated by involving European financial players that have experience in the recipient country, as they can identify reliable actors on the local side while also engaging with Chinese companies to ensure standards are upheld and that projects are feasible," the Chamber says. It also notes that European banks are nowadays more frequently asked to manage finances - before, during, and after project execution - to make the whole venture more bankable, "a sign of progress for BRI-related projects that have often struggled to become profitable in the past."

Alike in foreign affairs, China prefers to address its BRI counterparts bilaterally, with SOEs enjoying the full backing of the CCP and its diplomacy. Similar to what's happening in global container shipping, the Chinese use 'vertical integration' in their offerings, providing a suite of solutions (project management, financing, materials, construction, and post-completion services) wrapped in a single package. This, in turn, is a potent allure for developing countries who want to kick-start their economies in a rapid fashion, pushing away concerns about 'debt-trap diplomacy.' But, again in a similar style to the container business, this vertical integration is meant to benefit the offerer. This has been, in fact, one of the sobering moments for a number of developing (Cambodia, Sri Lanka) and more mature (Indonesia, Malaysia) countries, revisiting the terms of their cooperation with the Chinese as well as looking around for ways to involve non-Chinese businesses, notably European business organisations, to take part in their BRI undertakings. These discrepancies are reflected in the numbers of the Reconnecting Asia database: out of all contractors involved in China-funded projects 89%

Tab. 2. Financing of BRI-related projects

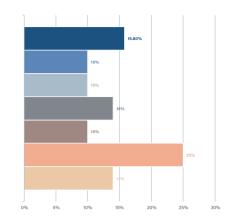
China Development Bank	\$183b in outstanding loans by the end of 2017
Export-Import Bank of China	\$118b in outstanding loans (end-March 2018)

Industrial and Commercial Bank of China, Bank of China, China Construction Bank \$225b in outstanding BRI credits for 800 BRI projects

are Chinese, 7.6% are local, and 3.4% are foreign companies vs 29%, 40.8%, and 30.2% if the financing comes from a multilateral development bank. Some 21% of the organisations surveyed by the Chamber said they had seen an increase in participation of non-Chinese companies, whereas 17% stated the opposite, which "could indicate that the BRI may be crowding out not only other foreign competition looking to participate in projects in third countries but also local companies based in these countries."

If somebody can be portrayed as a successful European BRI story, the Chamber argues, it's the quality and safety services (QSS)/testing, inspection and certification (TIC) sector. "As industry leaders in the provision of these services, European companies often have deep, long-held relationships with the project-recipient countries insisting on these conditions. So rather than just plugging certain capacity/ technology gaps, some European service providers in the QSS/TIC industry have been able to secure full participation in the handful of projects they are involved with, from inception to completion," authors of The Road Less Travelled explain. Certain cross-border projects also make onboarding non-Chinese partners welcome, if not entirely necessary, particularly when it comes to rail transports across the New Silk Road. Owing to various factors, i.a., the state-owned nature of the rail industry as well as break of gauge, different electrotechnical and other barriers to entry, it's best to split the haul between different local players. The same goes for organising

Fig. 1. China's tariff rates on some EU Geographical Indications included in the 2019 agreement (tariff category in parenthesis)



such shipments, with the expertise of multinationals like DP DHL beyond the reach of Chinese logisticians.

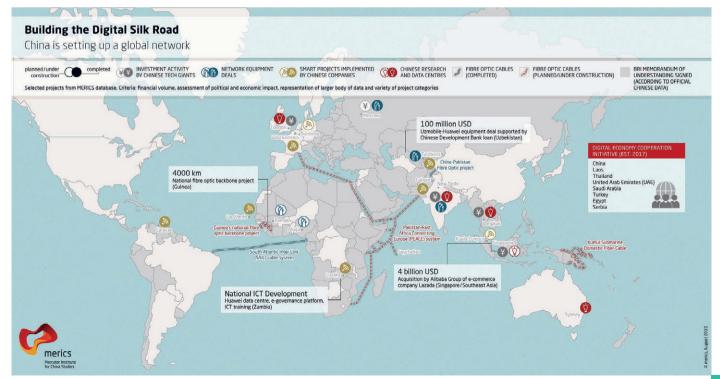
As smooth as silk?

Arguably, the BRI isn't solely about projects where return-on-investment is the focal point, with accusations going as far as saying that China is creating vassal states and securing trade lanes for vital imports (like oil and gas). Then again, no other country in the world has come up with a doable plan of connecting remote economies to the global market, this way opening doors to doing business in, e.g. Central Asia by European companies, too. Lack of robust infrastructure is what has been making accessing certain countries a logistics nightmare, a game not worth the candle, import- and export-wise. "The BRI's railway story has been one of the most hyped, and

- English Blue Stilton Cheese (Blue-veined cheese and other cheese containing veins produced by penicillium roqueforti)
- Greek Sitia Lasithiou Kritis (Virgin Olive oil, not chemically modified)
- Scottish Farmed Salmon (Atlantic salmon, fresh or chilled, excluding livers and roes)
- French Bordeaux wine (Other wine of fresh grapes, in containers holding 2L or less)
- Polish Vodka (Vodka)
- Italian Prosciutto de Parma (Hams and shoulders of pigs with bone in, salted, in brine, dried or smoked)
- Spanish Cava (sparkling wine)

not without reason: the image of consumer goods being unloaded from containers that just crossed the Eurasian continent by train is a powerful way to positively influence public opinion, and represents an undeniable achievement," the Chamber paints the picture.

There has been a lot of sweet-talk how rail and maritime transports do not compete but complement each other. The Chamber's analysis goes against the grain, saying there's a number of goods that are particularly suited to be shipped by train. Rather than take the (often questionably reliable) sea leg and freeze their working capital for at least a month, the Chinese car companies prefer to have their shipments with automotive components directly delivered to, e.g., Chengdu or Chongqing in two weeks' time "and at a cost that, while still more expensive than maritime shipping.



Thailand (1996–2008): turn-key contract between the Bangkok Metro Public Company Limited, Siemens and Lincas for the Bangkok Subway Line 2, financed through an ODA loan provided by the Japan International Cooperation Agency (JICA).

Egypt (2017): wind farm project in Ras Ghareb in a consortium that included ENGIE and Toyota, co-financed by the Japanese Bank for International Cooperation (JBIC), Société Générale and Nippon Export and Investment Insurance (NEXI).

Singapore (2018): joint venture for the reclamation, wharf construction and dredging of the Tuas Terminal Finger 3 between Penta-Ocean Construction (Japan), Hyundai Engineering and Construction (South Korea) and Boskalis International (Netherlands).

Japan and Southeast Asia (2019): cooperation between Septentrio (Belgian company focusing on Global Navigation Satellite System, GNSS, technology) and CORE (Japanese system integrator) to develop a receiver which can utilise the Centimetre Level Augmentation Service (CLAS) of Japan's Quasi-Zenith Satellite System (QZSS).

remains relatively low per unit of high-value items." The same goes for other high value-to-weight ratio goods, such as electronics or clothing, "which makes the actual increase in cost for shipping a container by rail negligible when spread out per item in the container." As regards the fashion industry, certain specifics come into play. "The mode of transport must take into account the delicacy of the clothes and needs an ad hoc transport service. Great attention must be paid to the cleanliness of the containers and special precautions are required for the preparation of containers for the transport of hanging garments. The level of service required in this segment is very high and it requires competence, precision and accountability," the Italian intermodal operator Furlog describes.

The picture has been, however, distorted for many years by hefty rail subsidies given away by the Chinese more than generously. One surveyed party, representing the logistics business, said that it roughly takes \$7,000 to ship one container from most places in China to most places in Europe. On average, subsidies have covered \$3,000-4,000. While the Chinese central government has imposed a cap on the subsidies at \$0.8 per kilometre, local authorities have compensated for it, some of them vehemently. The Chamber reports, "Xi'an, where subsidies are so high that final freight costs are comparable to maritime shipping. This creates an absurd distortion where it is cheaper to ship goods produced in Xinjiang west by first going 1,000+ km east to Xi'an, where they then enjoy local subsidies to go back west." Trade flows across the New Silk Road aren't balanced, with significantly more laden containers heading west than back to Asia (for every euro worth of goods going east, two euros head west). "In a bid to prevent trains from returning without any cargo, even heavier subsidies are being provided. Interviewed business leaders indicate that after-subsidy prices had reached as low as USD 400 per container," The Road Less Travelled adduces.

What's more, for Chinese companies putting the New Silk Road into effect, hence the BRI as well, is also about

drawing political capital, irrespective of the price spread between the rail and maritime legs (though, services linking Harbin with Moscow and Hamburg were scrapped when subsidies went down). While the Chinese Ministry of Finance talks about eventually abolishing subsidies altogether (by 2022), in the meantime fighting against empty eastbound container runs, there are "[...] doubts that these subsidies will be effectively wound down until they have been replaced by comparable support through other means [...] as long as the success of the BRI carries such a high political value, and that demonstrating successful BRI-related work remains highly advantageous for advancing government careers, other ways would be sought by officials to maintain high usage of the railways, with their cities still functioning as major hubs." The Chamber also cites one executive saying, "for the bulk of goods, the feasibility of transcontinental rail shipment will rise and fall less because of market forces like supply and demand, but more due to the political will to raise or lower subsidies and incentives."

To balance trade, a number of steps can be taken, the Chamber advises. For instance, China could lower tariffs on goods that are suitable for transporting by rail, particularly agriculture, food, and beverages. Second, more dangerous goods could be rail-shipped. This would, however, require aligning customs and safety regulations across the multiple jurisdictions that sit along the New Silk Road as well as the set-up of proper handling stations, not to mention their oversight as nobody wants another Tianjin explosion-like event to happen. Other improvement venues include creating standardised forms for necessary administrative tasks and digitalising customs procedures, something which "[...] could save considerable time – up to two full days according to one interviewed executive."

Play kingmaker

Having mentioned digitalisation, back in my first China-focused article (BTJ 6/16's All roads lead to Beijing. Setting the world's agenda with the New Silk Road),

the Digital Silk Road (DSR) was just briefly touched upon as more of a concept than a tangible suite of projects nor a top-down well-ironed out strategy. "But the geopolitical world has changed tectonically since 2015, and the DSR is becoming an increasingly important part of the BRI and could emerge as a vehicle through which Beijing pushes for an alternative to what it sees as a U.S.-dominated technology world. Once overstated concerns that Beijing will try to use the DSR to forge a new paradigm for sovereign cyberspace could become prophecy as the pandemic shocks geopolitics, the US-China tech cold war drives further decoupling, and Beijing increasingly views the DSR as perhaps the core element of Xi's BRI vision," reads the Will China Control the Global Internet Via its Digital Silk Road? analysis by Robert Greene and Paul Triolo.

The DSR will be another means of scaling up Chinese SOEs overseas. Enjoying the privilege of its own protected market and open access to US and European ones, at least till the former's crackdown on Huawei and the likes, China's tech-giants target adding the digital backbone to BRI's infrastructural projects and, as such, influence the wording of future global IT standards (especially 5G, blockchain, cloud computing, and Artificial Intelligence) through faits accomplis. "[...] industry insiders have reported that larger Chinese firms are establishing entire ecosystems of their software that operate within more closed-source systems, meaning that they control access to the source code necessary to develop compatible/interoperable services. This allows them to either play kingmaker to companies that want to license out their services under the larger set of standards within that specific ecosystem, or to simply occupy the entire space themselves," authors of The Road Less Travelled note. They further caution, "They will be entering under-developed markets in a dominant position while also benefiting from heavy government support, thus putting any other international competition at a large disadvantage. Just as worrying is the potential for abuse of recipient countries by these digital champions. Smaller,

Tab. 4. Comparison of the keynote speeches delivered at the 2017 and 2019 Belt and Road Forum for International Cooperation

	2017	2019
Overall purpose	To portray the BRI as an initiative that serves the interests of all people in recipient countries by highlighting achievements in the past four years.	To emphasise high-quality development along the BRI with clear priorities — "it's time to turn the grand blueprint into an exquisite picture (从大写意到工笔画)."
Infrastructure focus	The BRI is taking shape as an infrastructure network underpinned by six major economic pillars, featuring land-sea-air transportation routes and information expressways.	The network is centred on the same economic pillars, but projects need to be high-quality, sustainable, resilient, affordable, inclusive and accessible.
China's promises (for the next stage)	 Launch signed connectivity projects soon and deliver early benefits Scale up financing support and institutional and technological cooperation Provide assistance to developing countries and international organisations 	Expanding market access in China Enhancing international cooperation in intellectual property (IP) protection Increasing the scale of goods and services imports More effectively engaging in international macroeconomic policy coordination Better implementation of related policies

less developed countries that do not have the capacity for setting their own standards will certainly be put under considerable pressure to simply adopt Chinese standards." Another 'motivation' will be playing with the appeal of entering China's market – companies 'just' need to be sure not to make the mistake of investing in solutions that do not work where one-fifth of the world's population resides.

Truth be told, Europe has been caught between a rock and a hard place. On the one hand, there's the US and its omnipotent and nothing but profit-driven tech-behemoths as well as national agencies 'permanently recording' both their citizens and allies, irrespective of whether a Republican or Democratic administration is at the helm. as evidenced by Edward Snowden. On the other hand, China, which under Xi Jinping has weaponized the Internet, as described in great detail by the already-mentioned Kai Strittmatter in his We Have Been Harmonized: Life in China's Surveillance State. and made quantum leaps in technologies believed to kick-start the global economy onto the next level.

Global Europe?

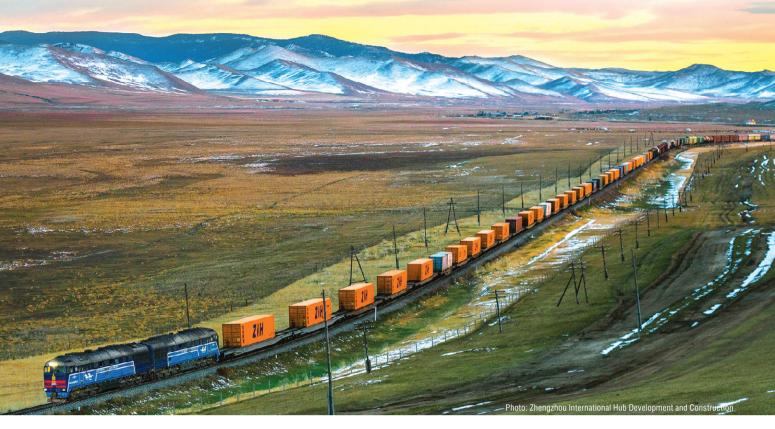
The Chamber tables a few recommendations should Europe decide to level the playing field with the CCP, two of which stand out: the use of the International Procurement Instrument (IPI) and the roll-out of the EU-Asia Connectivity Strategy (EU-ACS), an initiative backed up by Japan to counter the BRI. The former would be "a pragmatic mechanism to match China's degree of market closedness in certain areas - in essence it would compel Chinese firms accessing the EU market to operate under the same restrictions that European companies face in China with the intention of incentivising positive reciprocity. This kind of approach would be effective in areas like shipping, and digital goods and services." As such, the European Commission proposed this June measures that will extend European legislation on state aid

to companies from third countries operating on the European market. "The aim is to prevent unfair competition from Chinese companies in European public procurement markets and in their plans to build transport and communication infrastructure as part of the New Silk Road policy," reports the Robert Schuman Foundation (RSF). The European Commission has imposed customs duties on "Egyptian" fibreglass fabrics that are in fact manufactured by subsidised Chinese companies and only transit through the Suez Trade and Economic Cooperation Zone onto the European market, "This kind of replicable decision for other products is a good sign of the more comprehensive overhaul of European trade policy that is now underway," the RSF notes.

The EUACS is of a more strategic nature, as its primary goals are the creation of transport links, energy and digital networks, not least fostering human relations; offering connectivity partnerships to countries and organisations in Asia; and promoting sustainable finance. Jyrki Katainen, Vice President for Jobs, Growth, Investment and Competitiveness in the Juncker Commission, described it by saying, "We want to work with our Asian partners to improve connections between Europe and Asia, while bringing our values and approach in doing so. Infrastructure networks that will be built should be coherent, interoperable, as well as financially and environmentally sustainable. Calls for tender should be open and transparent to promote good governance and a level playing field." The EU's BRI in short. However, the Chamber notes, 60% of its survey respondents did not hear about the EUACS. It stands to reason that the PR machinery behind the BRI has done a marvellous job of publicizing the scheme, whereas the EU-ACS has been lost amidst other affairs, not to mention that it's the TEN-T that garners the most attention EU-wide.

Nevertheless, there appears to be a growing understanding that an alternative

must be provided. Parag Khanna, author of The Future is Asian and speaker at the 2019 Europa Connectivity Forum, warned, "It is very dangerous to view Asia only through the prism of China, because that not only betrays history, it also sets up a very dangerous self-fulfilling prophecy. Cooperation between Europe and Japan [...] is a step towards making sure that that doesn't happen." Though troubled with a number of minor and major problems, the EU's attempt cannot be discarded as a defeat even before the clash started. It has throughout the years managed to mould once hostile countries into a functioning block, second to none when it comes to, e.g., sporting the green agenda. The development of the TEN-T is ongoing, with prospects of extending it to neighbouring countries (there's a set of 13b road & rail projects, 4,800 km in length, to be carried out across Eastern Europe and the Black Sea by 2030). Next, the EU and the Association of Southeast Asian Nations (ASE-AN) are, the Chamber reports, nearing the completion of the EU-ASEAN Comprehensive Air Transport Agreement (CATA), which "[...] will liberalise the scope of the 'freedoms of the air' of cargo and passenger routes between the two regions. The EU has estimated that this will bring approximately EUR 7.9 billion worth of economic benefits over the first seven years after the agreement comes into force." The EU has established ties with Asian economies that might - because of their jagged historical relations, mode of governance, and economic rivalry - hold cold feelings towards China's BRI: Singapore, South Korea, and Japan. "This is why Chinese initiatives in countries like the Philippines are encountering steady competition from Japanese and Korean projects, which are generally seen as more reliable in terms of delivery, and as upholding higher quality standards," The Road Less Travelled reads. Additionally, "These are also some of the key reasons why European businesses decide to settle in countries like Singapore



or Japan. They also enjoy a more advantageous trade regime under recently signed agreements with the EU, which increases these countries' attractiveness as Asian hubs, and they can also partner more easily with local companies to carry out projects in third country markets."

According to the Chamber, echoing Commissioner Vestager's words of being "more assertive and confident about who we are," the EU should apply reciprocity across the board. If a Chinese company would like to enter an EUACS procurement, European businesses and their Asian partners should be able to do the same as regards BRI bids – and on terms exercised by EUACS projects, such as transparency, sustainability, and feasibility. That might be a real collision of cultures, overt vs covert.

Empty promises?

But perhaps the BRI is changing itself. During the first (2017) Belt and Road Forum for International Cooperation (BRF) the focus was put "[...] on the size, the scale, the sums of capital at play and the number of countries that had signed up," The Road Less Travelled reads. SOEs answered the 'political call' and rushed abroad and in a manner atypical to what was the norm introduced by Deng Xiaoping's Reform and Opening-up. Rather than thread carefully, they overestimated the value of cash in project execution, while "Many European business leaders interviewed [...] note that the relative success or failure of Chinese companies involved in the BRI (both private and state-owned)

has been largely based on their level of experience in other markets." Some went even further, the Chamber quotes, "[...] The big rush of outbound investment and construction projects in the early days of the BRI and the associated 'Go Out' policy led many companies into difficult positions, with one SOE executive saying to his European business partner that the thencalled 'One Belt, One Road' had ensnared inexperienced companies in the 'One Belt, One Trap'."

The 2019 BRF, in turn, brought a change of atmosphere. Talks of opening the Chinese market as well as bringing on-board quality and sustainability standards have yet to prove it isn't a bouncing cheque; however, "several European companies have [...] noted that Chinese companies are decreasingly reliant upon importing Chinese workers to complete projects, choosing to invest more in local human resources instead." Although a positive change, this cannot be taken as proof that the entire BRI scheme is opening and that China will remove fundamental barriers, e.g., the negative list for foreign investments. Strittmatter in We Have Been Harmonized explains at length the intricacies of CCP's language - the Europeans and Chinese may use the same words but understand them in a completely different way.

That and the fear of 'promise fatigue;' in November 2019, the Chamber surveyed its members ahead of an import fair in China. According to Reuters, "Some European companies felt cheated at last year's

inaugural expo. [...] Many of the deals made last year were not later realized [...] with one respondent describing theirs as a symbolic agreement. [...] One respondent said last year's expo fully lived up to their expectations – but only by being 'awful' in both organization and results." The Chamber's Vice President, Carlo D'Andrea, commented on the occasion, "We expect this year's event to be supplemented by concrete measures to facilitate further market opening and increase foreign investment, not by empty promises."

When values collide

According to data provided by the European Commission, China is the EU's main import and third export partner, while the EU sits atop China's imports and exports (World Trade Organization's statistics). Beyond doubt, commerce is what has been if not uniting then at least connecting the two blocks for many years. Europe's reserve, in contrast to the Trump administration, forbids unleashing a full-blown trade war. But there are limits to everything - and this goes both ways: Europe demanding reciprocity and reaching to its Asian partners to counterbalance the BRI, whereas China asserting a combative attitude (vividly nicknamed "wolf warrior diplomacy").

The clash between opposing sets of values has entered into a new phase, trade having increased difficulties with glueing them together. The two are dropping the sweet-talk, facing each other, as we say in Poland in a somewhat medieval & militaristic fashion, "with the visor open wide."



Time and again

by Ralf Fiedler,

Group Manager Ports and Transport Markets, Fraunhofer Center for Maritime Logistics and Services

According to a 2016 study by the European Sea Ports Organisation, most ports in Europe are publicly owned (some 87% by a municipality or city). Public ports — even if they operate as 'private' under commercial law such as GmbH, Ltd, or AB — compete with a number of other obligations that public authorities have to meet in terms of the necessary expenditure from their budgets. Additionally, further funding constraints due to the recent economic downturn will certainly play a role, too.



the Fraunhofer Center for Maritime Logistics and Services (CML) develops and optimizes processes and systems along the maritime supply chain. Within practically oriented research projects, CML supports public and private sector clients who are involved in port operations, logistics, and shipping. Visit www.cml.fraunhofer.de/en.html for more details.

s such, arguments are repeatedly put forward that ports allegedly do not make up for their costs and that steep budgetary resources cannot be made available to cover all the maintenance and investment costs. "Port pays port" is one of these policy principles, which, however, often fails to recognise the true economic importance of ports. Time and again, ports must prove that their worth stretches beyond their gates and guays.

The long arm of the port

It, therefore, remains vitally important to showcase, in a scientific manner, the employment effects and value-added generated by the port industry, all in order to leverage that knowledge once it comes to cutting the budgetary cake anew. Interestingly enough, the positive economic effects of ports do not usually fall into the same cost or benefit categories, so that's maybe why they might be omitted in the first place.

To make this effect visible, and to develop a uniform and applicable method,

the Institute for Shipping and Logistics (ISL), the Economic Trends Research (ETR), Holocher and Partners, and our own Center for Maritime Logistics and Services have jointly developed a method to measure the employment impact and value-added generated by ports in a study for the German Federal Ministry of Transport.

The developed solution, which can be applied at different locations, is based on two pillars. First, a survey of the actors with regard to their direct employment and turnover as well as their investments. Second, an analysis of the economic input-output tables in order to capture the interaction between different economic sectors.

From a macroeconomic perspective, we're talking about a series of effects – from initial and first-round (often referred to as the so-called direct effects), via value-added, to induced. The first trigger macroeconomic effects in other sectors of the economy via the value chain. The expansion of employment at all stages of the value chain increases incomes and

Tab. 1. Wider economic impact of German ports

Effect stage	Turnover (billion euros)	Added value (billion euros)	Employment
Initial First-round Value-added chain	27.8 13.0 10.3	10.2 5.8 4.8	183,338 128,041 101,165
Total	52.0	20.8	412,544
Induced	10.0	4.8	108,763
GRAND TOTAL	62.0	25.6	521,307

purchasing power, which has a positive impact on consumer demand because of the additionally generated income. This again unlocks a further chain of effects described as the induced effect. The increases in production caused by consumption are estimated in the inputoutput analysis.

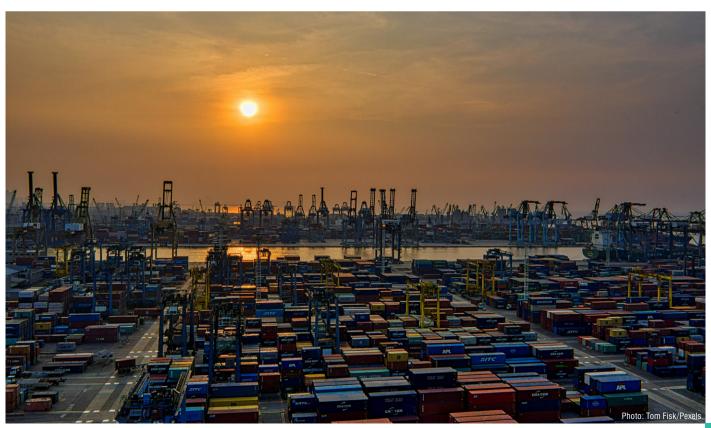
The total regional economic effects in port regions are often smaller than the overall economic impact of ports. A case study for the ports in Lower Saxony in the above-mentioned study concludes that, depending on the extent of the employment effects considered, only between a third and a quarter of the indirect and induced employment effects are in the same federal state. It's very likely that the situation outside Germany will be more or less the same should port-related industrial jobs be located other than directly in port regions.

Direct port-dependent employment is thus concentrated only to a small extent on the coast and along inland waterways; it is rather spread over the whole

country (e.g., when heavy-duty industrial components for the offshore industry are manufactured in southern Germany but destined for shipping through North or Baltic seaports). Consequently, a properly functioning port-hinterland transport infrastructure system is of high importance to the port employment effect, hence the sector's overall economic significance.

A clear cut

The proposed method captures the economic 'web-like' impact of ports, particularly along the port-dependent transport & industry chain, including employment and value-added. This, in turn, clarifies the cost-benefit investment ratio, even if the municipality or city owning the port is not the direct beneficiary; the country is, in any case, and that again withholds the question who actually should be in charge of investing in port maintenance and infrastructure. The importance of ports clear-cuts regional, national, and European boundaries.





In search of transparency and fair play

by **Nicolette van der Jagt**, Director General, European Association for Forwarding, Transport, Logistics and Customs Services (CLECAT)

The coronavirus pandemic (COVID-19) has quickly emerged as the number one global risk in 2020, affecting virtually all spheres humans are involved in. There is an overall recognition that this crisis will be longer, deeper, and more transformational than expected. Lockdowns have drastically reduced the level of economic activity, and there is great uncertainty about the rate and nature of recovery. Projections for global forwarding remain extremely challenging for the year ahead. Container lines at the end of June announced further significant service cancellations to take effect from the third quarter, trying to maintain the freight rates they have achieved in recent months despite the drop in demand. Freight forwarders are expecting further disruptions in their supply chains in view of this. Due to blank sailings, maritime logistics supply chains are becoming more and more unreliable, reducing supply chain efficiency and parameters such as capacity, sailing frequency, transit times, ports of call, and associated service quality.



Counded in 1958, the Brussels-based European Association for Forwarding, Transport, Logistics and Customs Services represents the interests of more than 19k companies (multinational, medium and small freight forwarders, and customs agents) employing in excess of 1m staff. Its primary goal is to contribute to creating a uniform and seamless international trading environment, where cargo can move freely, securely, and sustainably. Visit www.clecat.org to learn more.

rade volumes are expected to remain volatile and, at best, moderate this year and beyond, and the question if trade patterns will also change hangs in the air. Much will depend on the future importance of China in global trade and whether COVID-19 will have a wider impact on globalization. Apart from this gloomy near-term picture remains a hope that the crisis will impact the freight forwarding industry also in a more positive way, improving such indicators like resilience, visibility, and sustainability.

A generous exemption

The pandemic has also taken its toll on all container lines, and surely nobody wants to see another bankruptcy in this business that will send shock waves throughout the supply chain. Maersk and MSC have recently expressed their fury about South Korean state aid. The irony of this is that European carriers are equally privileged and receive subsidies, tax breaks, and other forms of financial support from governments. A report produced by the International Transport Forum (ITF) has revealed the wide-spread support of the maritime shipping industry through subsidies; though systemic data gaps obscure the full extent of this (mal)practice (read more in BTJ 3-4/19's Container Wars. The impact of container shipping alliances on the supply chain).

Following a recent decision of the European Commission (EC), clearing



the Italian maritime industry state aid, CLECAT and the Federation of European Private Port Companies and Terminals (FEPORT) have called on the EC to avoid market distortions in the EU and to unbundle the activities eligible for favourable tax treatment under tonnage tax schemes, largely in line with the recommendations made by the ITF. The special tax regime in Italy will not only be applied to a company's core revenues from shipping activities, such as cargo and passenger transport but equally to certain ancillary revenues that are closely connected to shipping activities. The private terminal operators have noted that the privilege granted to shipping companies, allowing them to benefit from preferential tax treatment for their cargo handling activities, distorts competition between integrated terminals and independent ones.

There are now clear cases demonstrating how vertically integrated carriers can benefit from tax schemes, which provide incentives for carrier haulage (doorto-door transport arranged by the carrier) rather than merchant haulage (where door-to-door transport is arranged by the shipper or freight forwarder), a situation obviously not acceptable to freight forwarders. Carriers do not limit their services to port-to-port services; they exchange data on services that relate to the port and land sides, made easier with developments in the area of big data, business intelligence, and analytics. All of this was not available to the liner shipping industry at the time of the previous reviews of the Consortia Block Exemption Regulation (CBER). Carriers are benefiting from a generous exemption under EU competition rules, whilst in competition ashore

with forwarders for whom a similar exception hasn't been made, nor they see any benefits from the liner services.

The unsurfable wave

Whereas the EC has noted that it "ensures that there is no spill-over of the favourable tax treatment of shipping companies into other sectors unrelated to maritime transport," we have serious doubts regarding the EC's methodology when assessing the risks. Freight forwarders who compete against shipping lines for container haulage transport are exposed to shipping lines abusing their market power to discriminate in favour of carrier haulage, giving preferential treatment to their own subsidiaries involved in the door-to-door movement of containers. In this context, carrier haulage charges are cross-subsidized by ocean freight-related charges and surcharges given the benefits of the CBER that freight forwarders do not enjoy. CLECAT has therefore advocated that for any extended CBER the market changes must be taken into consideration to ensure that the CBER and data exchanged between shipping lines remain related to port-to-port data as competitors related to haulage services do not have the benefit of the CBER.

The question remains whether today's problems of the maritime container supply chains could have been avoided and what has caused the disruption. There is no denial that volumes have decreased. However, the higher economies of scale associated with mega-ships mean that fewer vessels can operate in a market of a given size. As argued by shippers, forwarders, and terminal operators during the review of the block exemption for consortia, mega-ships and the associated commercial practices of strategic alliances have driven consolidation in the container shipping sector. The introduction of ultra-large vessels is particularly disruptive to supply chains in today's crisis circumstances. The shipping lines "kicked off a wave which they can't surf now," as one commentator noted. It could be argued that it comes as no surprise that carriers are disproportionately hit by the economic and trade repercussions of COVID-19.

Post-corona and in anticipation of the next review of the CBER, which will already start in 2021, more transparency will be welcomed, which may need a review of the EU state aid guidelines. In this respect, fair play and sharing of the burden between different actors in the supply chain should remain the guiding principle during crisis times.

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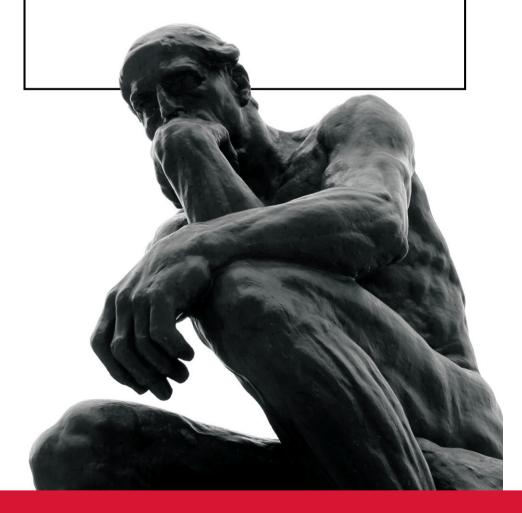
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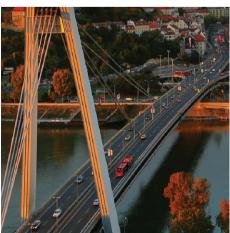














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