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EDITORIAL



# Special issue on "transitions and revolutions; preparing for future challenges of the maritime industry"

A transition to new business solutions and technologies is changing the maritime industry: bunkering options, digitization, big data analytics, and unmanned—and perhaps even autonomous—ships that will sail the oceans in the future are just a few examples of coming breakthroughs that will reshape the shipping and port industries. On top of that, a pandemic has disrupted supply chains and current practices pushing operators to introduce new approaches in the management of related logistics chains, making resilience key to the survival of companies in the future. For example, many new fuels, by a recent count of over 40 options, are considered to achieve the IMO $CO_2$ reduction targets for 2050. Ships ordered today will likely be required to adapt to the best-suited fuel in their lifetime. Yet, this choice is unclear at this point as both fuelling infrastructure and propulsion options are still under development or even in the research stage only. Similar situations consist of automation and COVID-19 has shown that worldwide disruptions are something to be ready for in the future as well.

This requires new approaches to design, operations, and decision-making for all actors in the maritime industry. Furthermore, our education strategies and training approaches of the future members of this industry should also be reconsidered in this light and the advancements and knowledge gained in science need to find their way into the classrooms. For this special issue, linked to IAME 2021 in Rotterdam, we have collected a set of papers that represent these advancements in dealing with these transitions and revolutions as well as introduce advancements in education that prepare the future marine workforce for this task.

For starters Fedi et al. (2022) looked at the past and current agreements between liner shipping companies. These agreements have received strong criticism in recent times as well as increased attention from the public and governing bodies. In their study of 60+ agreements registered with the U.S. Federal Maritime Commission over a period of almost 50 years, they discovered that over time key temporal impacts are reflected in these agreements over time. The focus of the cooperative working agreements changed from a commercial (e.g. rate agreement) to a more technical one (e.g. slot charter agreement) to deal with various criticisms and governance that followed. Paving the way for future discussions and agreements to keep liner shipping effective, without turning it into a disadvantage monopoly or semi monopoly. Such inputs seem to be of upmost relevance given the recent decisions of the EU commission on the block exemption as well as the reshuffling of alliances started in the second half of 2023.

Shifts in the field of liner shipping are also the focus of the next paper. In Guerrero et al. (2022), however, the focus shifts from contracts for cooperation to the connectivity of Africa. In their paper, a decade of container shipping is studied to identify shifts in this connectivity. First of all, a move from Europe and America towards Asia is seen, though less pronounced than in other studies. This is a breaking of past bonds, linked to colonization and the forming of new bonds, through extensive investments in the area, mainly by China under the One Belt, One Road initiative (OBOR). More importantly, the maximum vessel size accommodated seems to have a large impact on the connectivity score, something to take into further consideration for the future.

In the next research (Kovalenko, 2022), connectivity and links between cargo trade and several parameters impacting trade are studied. Here the limitations and qualities of the Northeast Passage (NEP), the route north of Russia that could link Europe and Asia via

a much shorter channel, and the impact on the potential of this route is investigated. A Structural Equations Model is applied to research various cargoes that are currently transported between Europe and Asia and their sensitivities for certain impacts on trade. These insights are then used to identify which cargo groups are most likely for the NEP and compare. All major cargo groups show strong links with logistical performance and economic growth, the latter is not expected to be impacted by the use of the NEP, but the first stands to improve given a 20% reduction in distance on average.

In the next set of papers, a shift from vessels to ports is made. Besides this shift, digitization has become important as well. The first two papers focus on governance (Gao, J. et al. 2022, BenHakoun et al. 2023). BenHakoun et al. (2023) investigate the impacts of vessels visiting ports in a clear bottom-up approach. For the emission measurements, a key gap in current research is the time vessels spent waiting or at anchorage. The so-called difference between net port time (time spent visiting terminals) and gross port time (time between arrival and departure from the larger port area). As a result, emissions are underestimated, and less incentive is given to the improvement of arrival planning.

Gao et al. (2022) discuss the management of IoT from a port management perspective. Based on an extensive literature study, they recognize that governance of data in smart ports needs to catch up with developments and procedures present in other industries. This was further confirmed in their case study. As a result, operational efficiency, sustainability and increasing levels of automation are insufficiently harvested and utilised, staying within company limits and as a result not achieving academic visions of smart ports.

The final paper (Yang et al., 2023) with a port focus, dives into the potential of such a smart port element, the automated container terminal (ACT). In this study, the benefits of a digital twin, linked to the ACT are discussed and supported. The digital twin is used for visualisation, operational analysis and abnormality detection. Although the study does not pay particular attention to this fact, there is a clear link with the improvement of operator awareness and understanding of the situation, compared to the situation without a digital twin. Which indicates new skills and opportunities for the future.

New skills and how to teach them are also the subject of the final two papers (Stein, M. 2022, Pruyn, J. 2022). In the first paper (Stein, M. 2022), the increasing complexity of port operations, also mentioned in the previous three papers, is the reason to look for more effective ways to provide safety and security training in port facilities. This paper puts the satisfaction and performance of the learner central. Where most studies focus on higher vocational and university students in an educational setting, here online tools are tailored to support on the job learning, allowing performance to rise above the best practice and minimal compliance level. Key factors for success are found in the learners own PC skills, their attitude towards learning and most of all the appropriateness of the content. This means that situations should be recognizable and not general, but also that before committing, PC skills should be checked and perhaps even improved to allow for easier and more effective learning.

In the last paper (Pruyn, J. 2022), the future of education and the use of games in education is the central proposition. Taking lessons from the literature on education, learning and especially gamification in education, this is the use of game elements (e.g. competition, badges, skill trees) in regular education, the successes in effective learning with games are evaluated. Several key requirements for games are taken from the literature and verified for two distinctive case studies. In essence, the paper demonstrates that games can be very effective in education, but not without proper care. Without that, it could very easily become a disaster, even demotivating students.

The set of papers combined in this special issue form a diverse and broad look at the future of the maritime sector. From liner shipping through ports and terminals to the importance of education and training for future skills and forms of education and training applied. It combined the most relevant papers in this respect from the IAME conference in Rotterdam and strives to bring forward this research to a broader audience. In a future

where the only constant is change, change in technology, change in legislation and change in trade and change in sustainability, we need these insights and others to deal with all this effectively.

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