Editorial

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Xiaoning Shi is a Technical Officer from the World Maritime University (WMU), in Malmö, Sweden, which is founded by the International Maritime Organization (IMO), a specialised agency of the United Nations. At WMU, she is working in the Maritime Risk and System Safety (MaRiSa) Research Group and conducting research on transport forecast by taking into account technological advancement. Prior to that, she conducted research in game theoretical aspects in modelling and analysing the liner shipping industry during her PhD studies. Before joining the WMU, she has been working in the general area of shipping and port economics and management at the Shanghai Jiao Tong University, China and University of Hamburg, Germany, respectively.

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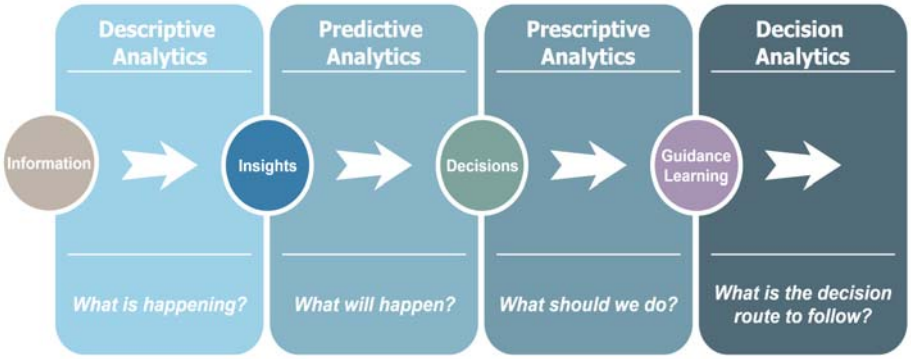
1 Introduction

Nowadays, the increasing volume of data and the complexity of problems surrounding maritime logistics make it imperative to jointly use optimisation and information technologies for devising data-driven approaches and obtaining tailored solutions that consider collected information and current situation features extracted from diverse information sources. In this context, decision analytics (DA) arises with the aim of supporting, guiding, and managing decision-making processes considering not only the application context but also the expected future and involved parties while handling and analysing large amounts of data. In this sense, as indicated by Voß (2014), DA provides a dynamic feedback loop aiding to transform data into insights for decision-making/guidance and effective planning. Thus, DA enables the transition to the guidance of decision-making and actions towards a state and not necessarily a solution alone. This way, it may be noted that prescriptive analytics (PA) aims at prescribing different possible actions to reach a solution. PA is commonly represented by the question, what should be done to make it (i.e., the desired solution) happen? DA, on the other hand, also considers current context information in order to permit decision automation while guiding to reach a given state (i.e., strategic objectives). It has to be noted that the states involve intelligently changing those desired/target solutions considered in the PA stage. Figure 1 extends the three aspects presented in Lustig et al. (2010) (i.e., descriptive, predictive, and PA) by including and contextualising DA. As can be seen in the figure, DA can thus be seen as the natural movement of distinguishing operations research in the whole analytics process as a driver for integrated and automated decision-making upon a goal.

Maritime shipping has become the most extended and essential transportation mode around the world. Handled freights can be either transported as bulk (i.e., petrol, grain, etc.) or within containers (i.e., cargo-carrying boxes of weathering-resistant steel, built following well-known international dimensions). For countries and regions, maritime transport has outstanding importance since it enables the integration and connection of different economies as well as established relations among them by means of global multimodal supply chains. In this context, the essential infrastructures for managing the flows of freights are maritime terminals. They are crucial node interfaces located at ports aimed at handling the transshipment of freights among water and land transport means. Moreover, these facilities have to cope with the increasing port traffic while meeting the requirements of different market players around them such as shipping companies,

forwarders, transport operators, delivery companies, etc. Keeping in mind the relevant role of these infrastructures as supply chain links between different transport modes, maritime terminals stand as key elements in modern economies and logistics systems. This important role played by them is accompanied by the strong demands of its environment forcing managers to efficiently perform timely operations related to the handling of freights. This context, as indicated in Steenken et al. (2004), needs integrated optimisation approaches involving the joint use of information systems, data science and operations research. In this sense, Heilig et al. (2017) analyse the current development of digital transformation in sea-ports and observe that tools to support (real-time) data science (e.g., big data, machine learning) and decision-making are enablers of such transformation, with data-driven decision-making being a source for value creation as well as facilitator for efficient port and terminal operations. Therefore, the use of DA as an enhanced competitiveness driver and support for the management of port-related logistics operations is necessary.

Figure 1 From descriptive analytics to DA (see online version for colours)



This special issue compiles four contributions that enhance the state-of-the-art of DA applications in maritime logistics by applying simulation, statistical models, information management, and game theory. The special issue is composed of four works addressing the different above-mentioned approaches with the goal of improving maritime logistics decision-making. In the sequel, we summarise the scope and contribution of the articles included in this special issue.

2 DA contributions

One of the most important key performance indicators at ports is the vessels' turnaround time. Gracia et al. (2019) investigate the main factors involved in ship loading/unloading operations and analyse various strategies with the aim of deriving managerial insights permitting to improve such operations. A simulation model based on a real-world Mexican container terminal is proposed and four different scenarios addressing balanced and unbalanced workload (i.e., containers to be loaded/unloaded) as well as different yard organisation concepts are tackled. The results extracted from the simulations provide several managerial insights. For instance, the workload is the main factor affecting the

vessels' handling time which at the same time depends on the yard planning. In this regard, the number of trucks has an important influence as a shock absorber, especially when the yard is not well-organised (e.g., there is no upfront yard planning related to an arriving vessel). Moreover, the results also indicate that a proper use of quay cranes and using a discharging optimised grounding strategy is essential to achieve significant benefits with respect to minimising vessels' handling time. Finally, it is noted that a proper yard planning strategy is necessary to reduce the number of movements, and in that case, optimising the horizontal transport is a determining factor for reaching a better overall performance. From a DA perspective, the outcomes of this work support the knowledge for guiding decision-making based on the strategic objective of providing high-quality services to arriving vessels in terms of their turnaround time.

Utilising and taking advantage of data plays a relevant role for ports aiming to use DA, especially when considering and analysing the information associated with transshipment operations. Its efficient use allows a better allocation and preparation of resources towards container throughput. Grifoll (2019) examines the container flows in the multi-port gateway system of Barcelona, Tarragona, and Valencia (Spain) and proposes a probabilistic approach that conjugates a two-state Markov model chain and Monte Carlo simulations. The benefits of that method are the set of forecasting results provided in terms of statistical outcomes, e.g., histograms, cumulative probability functions, etc. which advances compared to a univariate method. In this context, the range of probability of traffic growth provided by the statistical method suggests inputs for decision-making of port planners and managers. Finally, the approach has shown a fair level of agreement with real data, making it suitable for short-term prediction. Finally, based on the numerical results, the volatility in the transshipment market leads to a source of possible disruptions in the container throughput predictions. In this way, the approaches provide a priori information to support strategic decision guidance related to port capacity and container flow management.

An important aspect of DA is the appropriate use and quality of data leading to efficient decision support. In this regard, Xu and Hu (2019) investigate the sufficiency of the existing maritime incident database at an international and national level, and this research shows that by applying a relational database approach, there are three defects, i.e., inefficient maintenance, inefficient query, and inefficient analysis. In order to improve the quality of data and associated analytical output, this research proposes a design of the relational maritime safety management database (MSMDB) with the entity-relationship (ER) model as a semantic model. The model is employed to depict the inter-related semantic information surrounding maritime incidents and to provide a concise visualisation of concerned entities and their relationships. Furthermore, data regarding maritime incidents can be organised in a logical way, and its associated tasks on maintaining data could be strengthened, accordingly. Finally, by means of a case-study, this paper represents its implementation of the MSMDB approach in the ferry sector; results show that the MSMDB approach allows one to keep a reasonable level of data redundancy and to implement information maintenance functions in a more accurate and efficient manner. Proper information management is the base facilitator for proper decision-making, especially when that information affects the functioning or decisions to be taken by either the shippers or terminal managers.

The selection of logistics service modes in e-commerce is considered by Ma et al. (2019). They address the perspective of facilitating data usage. It is demonstrated how an open platform can provide different logistics service modes by

facilitating data sharing to a certain authorised content, which accordingly leads to profit sharing mechanisms among this open platform and online stores. Furthermore, in case that above-mentioned services provided by the open platform are replaced either by a service provided by third party logistics (3PL) providers or by platform integrated self-operation, the timing of sharing data plays an important role for the equilibrium analyses. Based on that, this research analyses under these three modes the service levels, service costs, transaction costs, and performances of the related platform, respectively. In addition, the paper addresses that applications of this research on business to customers (B2C) markets could be potentially extended to business to business (B2B), customers to customers (C2C), online to offline (O2O) and wholesale vs. retail markets within a similar analytical framework. Last but not least, six implications are groomed to provide direct recommendations to decision makers, especially practitioners in the logistics sector. The contributions of this work show the importance that cross-disciplinary research (in this case, by using game-theory) has on logistics (and decision guidance) for drawing a given context and what-if cases that support the roadmap determined within DA towards a given strategic goal, in this case the selection of an e-commerce logistics mode.

3 Conclusions

DA is interfusing any area, including maritime shipping. Stakeholders, managers, consultants and business leaders need to understand the real merit of optimisation. It is not just a different jargon buster for improvement (or even change). It needs a full fledged understanding of analytical methods from different realms, including operations research, machine learning, artificial intelligence and data science. Paired with an appropriate use of data, this can gear maritime shipping on its development track and even master the challenges of digital transformation.

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