Edited by
DONG-WOOK SONG
PHOTIS M PANAYIDES

MARITIME LOGISTICS

3RD EDITION

A GUIDE TO CONTEMPORARY SHIPPING AND PORT MANAGEMENT

Kogan Page

PRAISE FOR *MARITIME LOGISTICS 3RD EDITION*

'This book represents an outstanding contribution by two of the world's leading experts to the literature on maritime studies and logistics. It is essential reading for all postgraduate students, researchers and practitioners and should be on all course reading lists.'
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'Maritime logistics management remains the backbone of international business. Managers who don't understand maritime strategies, operations and tactics are often incapable of responding to the unique disruptions experienced in ocean transportation. This third edition of *Maritime Logistics* provides the most comprehensive and up-to-date information available on the topic. Considering the supply chain complications, bottlenecks, regulations and disruptions we continue to experience in the 2020s, this book should really be on every innovative business professional's shelf.'
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'This is an excellent publication that brings together in one volume everything that all those interested in ports and shipping need to know about maritime logistics. Covering the ground and the specifics of shipping and port logistics in thorough and comprehensive ways, this third edition of *Maritime Logistics* allows the reader to fully understand the rapid evolution and latest developments of global maritime supply chains. An essential knowledge basis for students and professionals in the field.'
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Jan Hoffmann, Head, Trade Logistics Branch, UNCTAD

'In a time when the disruptions of maritime supply chains have never been so impactful for industries and consumers, this book is a perfect guide for professionals and students looking for a better understanding of maritime logistics.'

Pierre Cariou, Professor of Shipping and Port Management, KEDGE Business School

'A real tour de force in its comprehensive coverage of the shipping and port industries.'

Kevin Cullinane, Professor of International Logistics and Transport Economics, University of Gothenburg

Maritime Logistics

A guide to contemporary shipping and port management

THIRD EDITION

Edited by
Dong-Wook Song
and Photis M Panayides

KoganPage

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Dong-Wook Song dedicates this book to his lovely family members Sung-Hee, Jee-Young and Jee-Hoon

Photis M Panayides dedicates this book to his wife Marina and his sons Michalis, Ioannis and Aristotelis

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ABOUT THE EDITORS

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Photis M Panayides is a Professor in Shipping and Maritime Economics in the Department of Commerce, Finance and Shipping, and Dean of the School of Management and Economics at the Cyprus University of Technology. He has published widely in the area of shipping, transportation and logistics in highly ranked journals. Professor Panayides has authored four books: *Principles of Chartering* (3rd edition, 2018), *Recent Developments in International Shipping Finance* (Informa, 2002), *Professional Ship Management: Marketing and strategy* (Ashgate, 2001) and *International Ship Management: Market analysis and strategic opportunities* (IIR Publications, 1999). He edited the *Routledge Handbook of*

Maritime Management (2019) and co-edited the books *Shipping Operations Management* (Springer, 2017), *Maritime Logistics: Contemporary issues* (Emerald, 2012) and *Maritime Logistics: A complete guide to effective shipping and port management* (Kogan Page, 2012, 2nd edition 2015). He is contracted to author the book *Shipping Performance Management* (Series: Lloyd's List Practical Guides, 2020). His research interests are in the areas of shipping performance management, maritime logistics and its association to supply chain performance and chartering. He served on the council of the International Association of Maritime Economists (IAME), and currently serves on the editorial board of *Transportation Research E, Maritime Policy and Management, Maritime Economics and Logistics, International Journal of Physical Distribution and Logistics Management,* and the *Journal of Business Logistics*. He also served as the Vice-President of the Board of Directors of the Cyprus Ports Authority.

PREFACE TO THE 3RD EDITION

Following the overwhelming adoption of the second edition of the book *Maritime Logistics* and the enthusiastic and positive feedback from academics, researchers and practitioners, and bearing in mind the recent developments that have occurred in the field since the last edition, it seems that this updated edition is a natural consequence. The second edition represented a significant update to the previous edition, while the current third edition has been updated to take into account recent developments.

Echoing the aim in the preface to the first edition, the present volume aims to contribute significantly to the training of the next generation of maritime logistics specialists and to promulgate further the progression of this fascinating sub-discipline of logistics and supply chain management over the years to come. The book is particularly useful to students and researchers at the early stages of their learning and research journey in the discipline of 'maritime logistics'. The chapters presented in this volume aim to provide them with an up-to-date insight into the area and to inspire them with new learning opportunities and research ideas by reflecting this emerging field of the maritime industry. The book will also find an appreciative audience in the realm of lecturers and academics who are always eager to include new material and enrich their lecture notes with updated concepts and practical cases.

Having adopted a similar approach to the editing of the second edition, we have requested the contributors to provide us with updates, new research findings, and recent and emerging trends and developments taking place in the areas of their expertise, and to include those in the updated versions of their respective chapters. We have been inundated with favourable responses from all the contributors, culminating in the development of a newly updated and contemporary exposé of *Maritime Logistics* that we hereby present to you.

Both editors are extremely grateful to all the contributors and reviewers for their academic professionalism. For the third edition we have been fortunate to have the research assistance of Andreas Kouspos of the Cyprus University of Technology that we gratefully acknowledge. We would also like to thank our associates from Kogan Page, who were always supportive

and knowledgeable of all the issues that one faces in the demanding task of editing and publishing a book of this nature. Thankfully, as we are about to share with the public another authoritative volume of significant contributions in the field of maritime logistics, we feel that the journey has also been particularly rewarding.

We would still be grateful to hear further from you as readers and/or users of this edition, since everyone from their position, be it academic, researcher, industry professional and/or student in this fascinating field, will collectively transform 'maritime logistics' into a significant subject in the discipline of logistics and supply chain management.

Enjoy reading it.

Dong-Wook Song (ds@wmu.se)
Photis M Panayides (photis.panayides@cut.ac.cy)
June 2021

PREFACE TO THE 2ND EDITION

At the end of the preface to the first edition of the book *Maritime Logistics*, we expressed our hope that 'the present volume trains the next generation of maritime logistics specialists and initiates the further progression of this fascinating sub-discipline of logistics and supply chain management over the years to come. The editors would love to hear from you on any area for improvement and inclusion for the future edition.' When writing the preface slightly over three years ago, we had not expected such enthusiastic and tremendous responses from virtually every single part of the world. Students and professionals new to the field sent an appreciative message that they were better guided on the subject with the contents and context of the book. Researchers, especially those in their early stages of research, seemed to have benefited from having read the chapters of the book and subsequently located their positional stance in the field; that is, they were able to see the field as a whole without losing sight of the individual components that make up the entirety of the discipline. Finally, fellow academics, lecturers and teachers conveyed us their welcoming messages and at the same time pointed to a number of areas for further inclusion, improvement and even clarification.

Having really appreciated this encouraging and positive feedback as well as being urged by the publisher Kogan Page to respond to those demanding requests, the editors decided a year ago to take the feedback on board by producing the second edition of the book, which you are now holding. As was the case for the first edition, we first cross-checked which existing chapters were to be updated and revised, and which new chapters were to be developed in line with comments and feedback received and with recent developments and trends. We called on the previous contributors to make the necessary changes and also asked a series of known scholars to contribute chapters on the newly identified areas. Fortunately, we received an equally enthusiastic reaction from new authors and contributors whose work features in this second edition.

Those who read the first edition will find that the second edition has been substantially enlarged in terms of volume and contents but the three parts of the book remain intact. We believe that these enlargements and changes will enrich the knowledge horizon of the field in a more logical manner. In the

pages that follow, you will find the fruits of those individual and collective efforts.

As was the case for the first edition, we are extremely grateful to all the contributors and reviewers for their academic professionalism. Julia Swales from Kogan Page deserves our special thanks for her thorough support from the beginning to the end of this editorial journey; we initially felt 'pushed' by her prodding but her encouragement and patience throughout the journey turned out to be a crucial instrument in this rewarding process.

We would still love to hear more from you as we believe that you are the main figures shaping the academic discipline of maritime logistics over the years to come. Thus, hold the book firmly and read the chapters herein with a critical mind and forward thinking and give us your thoughts and views.

Dong-Wook Song
Photis M Panayides
October 2014

PREFACE TO THE 1ST EDITION

Every book has a reason why it ought to be prepared and published. The book you are holding now is no exception. Both editors have been for over 50 years collectively researching and teaching the subjects of shipping, port and logistics management. Over the years, we have observed an evolution in discipline development with the convergence of two distinct fields of shipping and port management; a convergence that occurred with the use of another field of study, that of logistics and supply chain management. This change has raised concerns as to the effectiveness of teaching the subjects in a traditional sector-oriented approach which does not offer the comprehensive all-round knowledge required for the next generation of students. However, apart from the pedagogic value that this endeavour obviously brings, the book serves as a stimulant to further research in this emerging field of maritime logistics. Judging from the subjects that the contributors to this volume chose to research and analyse, it is evident that there is ample opportunity for empirical investigations that will guide future practice in maritime logistics.

We are grateful to all the contributors and reviewers for their professionalism to ensure the quality of all the chapters has been up to the standard that was set right at the outset. A special thanks goes to Martina O'Sullivan, a commissioning editor for Kogan Page, for her wonderful support and synchronization throughout this arduous but thoroughly rewarding process.

Last but not least we feel obliged to acknowledge the publishing house, Kogan Page. Their decision to publish this volume is testament to the innovativeness that has made them a leading publisher in the transport and logistics field.

It is our hope that the present volume trains the next generation of maritime logistics specialists and initiates the further progression of this fascinating sub-discipline of logistics and supply chain management over the years to come. The editors would love to hear from you on any areas for improvement and inclusion for the future edition.

Dong-Wook Song
Photis M Panayides
August 2011

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Anthony Beresford is a Professor of Logistics and Transport at Cardiff Business School. He has been involved in many international transport-related research and advisory projects; these include authoring the *Handbook on Management and Operation of Dry Ports* for UNCTAD and participating in the Transport Rehabilitation and Trade Facilitation programme for UNDP and the Rwanda Government (1995–1998). Elsewhere he has participated in several European Union projects such as 'Work Organisation in Ports' (WORKPORT). His work for UNESCAP on Cost Structures of Multimodal Transport Corridors has been adopted as a standard methodology for evaluating the effectiveness of international freight supply chains. In the UK, Anthony has contributed to, for example, the public enquiry into the proposed container terminal at Dibden Bay, Southampton (2001–2005) and the Welsh Assembly debate on transport policy options. More recently,

Anthony has acted as an expert witness to the House of Commons Welsh Affairs Committee on the role of Welsh Ports in the UK economy, and has provided input to a range of major transport development projects such as improvements to the UK road network.

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Su-Han Woo is a Professor at the Department of International Logistics, Chung-Ang University, Korea. He has a BA in Economics from Seoul National University in Korea and an MSc and a PhD from Cardiff Business

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PART ONE

Introduction

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01

Introduction to maritime logistics

DONG-WOOK SONG
PHOTIS M PANAYIDES

Background

Globalization and the technological revolution in the transport sector, including containerization, logistics integration, and the consequent expansion of the maritime industry, have redefined the functional role of shipping and ports in global logistics and supply chains and have generated a new pattern of freight distribution. The rapid increase in world trade in the past decade has restructured the global maritime industry, having brought about new developments, deregulation, liberalization and increased competition. There have been dramatic changes in the mode of world trade and cargo transportation, characterized by the prevalence of business-to-business and integrated supply chains. These changes have been embodied by the increasing demand for value-added logistics services and the integration of various transportation modes such as inter- or multi-modal transport systems. As a consequence, the business stability and sustainability of the industry is largely subject to how well it adapts to such a dynamic environment. Therefore, high-quality logistics services and the effective and efficient integration of transport and logistics systems offered by a maritime operator (i.e. a shipping company or port/terminal operator) have become an important issue.

Maritime logistics has been traditionally regarded as the primary means of transporting parts and finished goods (viz. outbound logistics) on a global scale and has recently attracted considerable attention from academics and practitioners alike. However, the term ‘maritime logistics’ is not easy to

define and its precise definition, scope and role within global supply chains are yet to be established (Song and Lee, 2009). The first edition of the present book, *Maritime Logistics* (2012), is considered to be the first formative approach towards the establishment of maritime logistics as an academic discipline by setting up a disciplinary boundary, scope and contents.

Historically, however, the initial attempt to define maritime logistics was made by Panayides (2006), who suggests that, for a better understanding and ultimate definition of the term, the starting point should be to consider the underlying scope and characteristics of the two areas making up the term (i.e. 'maritime transport' and 'logistics and supply chain management'). On the one hand, maritime transport (i.e. shipping and ports) is clearly concerned with the transportation of goods and/or passengers between two seaports by sea; on the other hand, logistics is the function responsible for the flow of materials from suppliers into an organization, through operations within the organization and then out to customers. A supply chain is composed of a series of activities and organizations that materials (e.g. raw materials and information) move through on their journey from initial suppliers to final customers. Supply chain management involves the integration of all key business operations across the supply chain. In general, logistics and supply chain management relate to the coordinated management of the various functions in charge of the flow of materials from suppliers to an organization through a number of operations across and within the organizations, and then reaching out to its consumers (Harrison and van Hoek, 2011).

Based on this clean-cut understanding, Panayides (2006) further elaborates on the issue of convergence of maritime transport and logistics. These two terms are largely attributed to the physical integration of modes of transport facilitated by containerization and the evolving demands of end-users that require the application of logistics concepts and the achievement of logistics goals. At the centre of maritime logistics is, therefore, the concept of integration, be it physical (intermodal or multimodal), economic/strategic (vertical integration, governance structure) or organizational (relational, people and process integration across organizations) as an ongoing attempt to create a greater value for stakeholders (Lee and Song, 2015).

In this process, a number of issues still require further elaboration and explanation. This book brings together the key contributions in the field of 'maritime logistics' from leading academics and researchers from across the globe.

Outline of the book

Part One of this book consists of six chapters introducing the topics of maritime logistics and establishing a foundation upon which the discipline of maritime logistics is developed. In Chapter 2, Veenstra introduces the role of maritime transport and logistics as a trade facilitator having examined a number of issues in a retrospective as well as prospective manner. More specifically, this chapter addresses the relationship between ocean shipping and trade by examining to what extent shipping facilitates trade. In regard to this purpose, the chapter briefly introduces the trade facilitation school of thought in shipping and port management and then describes the mechanism of international trade and the specific role of shipping within this mechanism.

In Chapter 3, Yercan and Yildiz focus on developments in international maritime transport by emphasizing the developments in global trade. They offer a broad idea of logistics and its interaction with international trade, by providing general characteristics of logistics and the interrelation of various business areas. They build a background to the interaction between logistics and the transport industry within the global economy, followed by the more in-depth discussion on developments in the global economy and the maritime transport industry in relation to international trade.

In Chapter 4, Lee, Nam and Song provide a precise understanding of the concept of maritime logistics and a guideline for value creation of maritime logistics systems. The chapter addresses such issues as the importance of maritime transportation in an entire logistics system, the definition of maritime logistics and maritime logistics value, the main activities of maritime logistics, and the process of maritime logistics, as well as the significance and strategic implications for maritime logistics operators.

Bergqvist in Chapter 5 deals with hinterland logistics. Some of the load units arriving at seaports are transhipments for other seaports, while others have inland destinations. The hinterland transportation system enables load units to be transhipped between seaports and inland destinations. The term hinterland is often referred to as the effective market or the geo-economic space in which the seaport sells its services. The logistics related to the hinterland involve many actors and activities, and requires intense collaboration and coordination to work effectively and efficiently. Hence, hinterland logistics and transportation have become a crucial part of ensuring an efficient supply chain.

Finally, Österman and Osvalder in Chapter 6 deal with the human element of maritime operations arguing that mechanization, automation, information and communications technology have made many manual tasks redundant, enabling ship and cargo handling operations with a minimum of manpower. However, there is yet an area of potential to acknowledge and develop in the effort to improve maritime logistics – the role of the human element and the interface between human and technology in the various man-machine systems in the global supply chain. The chapter puts forward a number of ideas to be seriously considered in the industry for the present and future.

Part Two covers topics related to the management of logistics for the shipping sector. Chapter 7 by Hayashi and Nemoto analyses the global intermodal transport that combines maritime and other transport modes, explaining the concept of intermodal transport and its components and characteristics, discussing the function of containers in the development of intermodal freight transport and logistics, introducing typical global intermodal transport services with some examples in North America, Europe and Asia. They discuss the role of intermodal transport facilitators and their services, and review and predict the development factors affecting intermodal transport.

In Chapter 8, Ducruet and Notteboom analyse liner service networks as configured by container shipping lines. They discuss the drivers of and decision variables in liner service design as well as the different liner service types. Next, the chapter provides a global snapshot of the worldwide liner shipping network based on vessel movement data. The changing geographic distribution of main inter-port links is explored in light of recent reconfigurations of liner shipping networks. They move on to the position of seaports in liner shipping networks referring to the concepts of centrality, hierarchy, and selection factors. They conclude by elaborating on the interactions and interdependencies between seaport development and liner shipping network development, notably under current economic changes.

The growth of world container trade during recent decades reflects the coalescent markets in the world. The geographic separation of supply and demand has raised expectations towards transportation services. Keeping up with the growth of global container traffic was considered as one of the biggest challenges. In addition, customers expect fast and reliable services in a wide geographical network. Vessel capacity and utilization provide only one possibility for competitiveness. Vertical and supply chain integration are characterizing the modern transport industry, as transport businesses

are gearing up towards global logistics services based on the principle of the 'one-stop-shop'. In order to accomplish this goal, it is necessary to integrate port, hinterland transportation and logistics management services. It follows that strategic aspects of supply chain integration and diversification are of significant importance in the contemporary shipping industry. In Chapter 9, Panayides, Wiedmer, Andreou and Louca, after having conceptually explained the basic concepts of diversification and supply chain integration, analyse the recent trends, developments and current situation in the maritime shipping industry and carry out an empirical investigation into the relationship between supply chain integration and shipping firm performance.

Chapter 10 by Baird seeks to analyse container shipping line strategy relating to the provision of added-value logistics services. The chapter aims to identify, analyse, and compare/contrast the logistics strategies of container shipping lines. The study entailed the administration of a short questionnaire to survey the top 20 container shipping lines to help investigate these questions. The results of the survey, plus supporting information, are analysed to provide a summary of container line strategy with respect to the provision of logistics services. This analysis includes several brief case studies which seek to review and analyse the specific logistics activities and strategies within several of the top 20 container lines. The case studies offer a more detailed insight into the different approaches adopted by major global container lines with respect to the development and provision of logistics services. The purpose of the overall study is to help develop a wider picture concerning what/how liner shipping competitors are doing with regard to provision of logistics and value-added activities, to assess the extent of these activities in terms of logistics services provided, and to offer an indication as to how this might evolve in future.

Desrosiers in Chapter 11 focuses on the transfer of bulk petroleum at fixed terminal facilities and introduces the reader to the logistics of bulk liquid. Three major components of petroleum movement are introduced (i.e. the petroleum perse, the cargo terminals and the ships), followed by the practical steps involved in transferring this valuable liquid. In addition to the physical movement of petroleum, contractual aspects of petroleum movement and custody transfer are discussed to add context to the need for careful monitoring and proactive efforts by all parties on the scene to prevent both fiscal and cargo loss. It is argued that knowledge of the legal procedures and processes involved in the transfer of bulk petroleum is important to understanding the constraints and problems that can and do arise.

This knowledge will allow the practitioner to not only plan more effective operations, but enable comprehensive action to improve the processes and make more effective and informed decisions.

Finally, Chapter 12 by Comtois and Lacoste covers dry bulk shipping logistics. The globalization of economic activities has led to a profound mutation in the dry bulk trade. The growth in the amount of dry bulk carried by sea and the mutation in the direction of flows are some of the major phenomena. The steady growth in the volume of dry bulk shipments has resulted in intense demand thereby increasing the competitiveness of bulk logistics. Bulk commodities have a low value/weight (or volume) ratio implying that the efficiency of land and marine transport has an impact on value added. The handling conditions of dry bulk materials are influenced by a wide range of factors such as size and weight. Handling equipment is often custom designed for specific dry bulk commodities. There are various types of contractual arrangements used for the shipment of dry bulk commodities. The command centre of dry bulk trade is not always commensurate with dry bulk port location. Ships and consignment size vary enormously. These conditions raise a series of key issues which are fully discussed and analysed in the chapter.

Part Three covers the topic of logistics management for ports and associated sectors. Roso and Rosa in Chapter 13 focus on the concept of dry ports. Dry ports are regarded as a means to increase port throughput, hinterland reach, and transfer parts of port operations to inland terminals by relying on intermodal transport. A dry port is defined as an inland intermodal terminal directly connected by rail to seaport(s) where customers can leave/pick up their units as if directly to a seaport. In addition, the dry port is also a means to rationalize transport in and out of a port by bundling the flows and transferring container transport from road to rail, thus reducing congestion in the proximity of the port – typically relevant for port cities – and bringing about other environmental benefits. They argue that, in order to fully discuss the dry port concept, it is useful to mention intermodal services and review a number of different shapes that an inland freight terminal may take.

In Chapter 14, Valantasis-Kanellos and Song examine an emerging concept applicable to a port/terminal and its hinterland logistics – Port-centric Logistics. The notion that ports are generators of trade and commerce can be traced back to the era of the Phoenicians. Ports have been recently characterized as business networks. Within these networks companies are interdependent. In the context of a holistic system, interfirm relationships

are of high importance. This chapter focuses on ports in a logistics environment; thus a relevant definition must be employed. Under the definition of ports being 'the interface between land and sea providing facilities and services to commercial ships and their cargo, as well as the associated multimodal distribution and logistics activities', this chapter commences a series of discussions associated with the scope of ports in a maritime logistics environment as part of a system, and goes on to examine the latest practices taking place in the field with the concept of port-centric logistics.

Since the hub-and-spoke concept was introduced to the aviation market after the US airline deregulation in the late 1970s, it became a primary distribution model employed by leading international logistics companies. This pattern drives the companies to consolidate shipments on a large scale at major terminals (i.e. hub) and to redistribute the smaller scale of shipments to their respective destinations via radial links (i.e. spoke). In the field of logistics and supply chains, however, the hub concept has been often introduced in various terms in accordance with functionality, such as logistics centre, logistics zone, freight terminal, distribution centre, and warehouse. Such a heterogeneous terminology on the concept of logistics hub seems still in usage by practitioners and academics alike. Having recognized this rather ambiguous concept and definition in the literature, Nam and Song in Chapter 15 attempt to define the logistics hub concept that is applicable to the maritime industry by synthesizing existing studies/perspectives, and examine its possible implications.

Chapter 16 by Parola aims to provide a comprehensive overview of the container port business state of the art and evolution by depicting mainstream trends and common managerial practices. For this purpose, the chapter conceptualizes the nature and typology of the stevedoring services, enlightening the differences between dedicated and multi-user facilities in line with business models of leading market players. Interestingly, the chapter analyses the spatio-temporal dimensions of container port multinational enterprises (MNEs) and their internationalization, illustrating the timing and the geographic scope of overseas expansion in a number of visual illustrations. The chapter goes on to depict firms' most common entry patterns and expands understanding of inter-firm partnerships.

Lam, Parola and Panayides in Chapter 17 examine an ever-more challenging aspect of the maritime logistics business – that is, financing port development and expansion. Developing and operating ports is a highly capital-intensive business. The rapid pace of technology advancement has seen tremendous growth in vessel sizes in various shipping sectors including

container ships, dry bulk carriers, and tankers. In order to handle these vessels, ports have to expand their capacity as well as equip these facilities with a new generation of cargo handling system designed to achieve greater productivity and efficiency from a logistical perspective. Pursuit of greater handling capacity does, however, require enormous financial resources and professional expertise. Ports have been seeking private sector participation through various forms of Public-Private Partnership (PPP) schemes. This chapter adds value to the body of literature in view of the growing trend in port PPPs by performing an exploratory investigation into the impact of PPP on port logistics performance through the discussion of examples from the port industry and the respective countries' situations.

Chapter 18 by Cetin discusses the organizational aspect of port logistics with a conceptual framework established. The changes in the traditional role of ports put responsibility on port authorities as the administrative bodies of port organizations. Their landlord, regulator and operator roles are shifted towards a 'coordinator, facilitator and integrator role in port clusters, international transport, logistics and supply chains'. As the roles and functions are changing, so too are the goals. The changing goals also change the organizational effectiveness criteria. It appears that in today's port business circumstances, commonly used port performance measures such as efficiency, profitability and growth are not enough to assess a port organization's success at all points. With respect to the developments in logistics chains, the chapter covers a wide range of related matters such as port-logistics chain integration, adaptability to changes in the environment, customer orientation and satisfaction, information and communication management, service quality and provision of value added, and intermodal services, innovation and resource acquisition.

Chapter 19 by Woo, Pettit and Beresford aims to investigate the effect of supply chain integration of seaports on port performance by examining the causal relationships among the integration strategies of seaport terminals along the supply chain, and the antecedents and consequences of the integration strategies. The integration strategy is termed 'Port Supply Chain Integration' (PSCI) and the antecedents of PSCI are identified as port supply chain orientation. The logistics performance of ports is considered as a consequence of PSCI because it is suggested that a traditional performance measure such as cargo throughput is not sufficient for a proxy of port performance in the global supply chain era.

Finally, in Chapter 20 of Part Four, Panayides and Song provide an overall conclusion to the book by considering in particular how the topics discussed can drive further research and development for the maritime logistics area.

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02

Maritime transport and logistics as a trade facilitator

ALBERT VEENSTRA

Introduction

In the last decade, international trade agreements and regional trade integration initiatives have reduced the tariff-based barriers to trade significantly. Substantial barriers to trade remain, however, and some new tariff barriers have recently been erected as well, in the 'China-US trade war'. The remaining barriers are often so-called *non-tariff barriers*. In many bilateral and multilateral negotiations, attempts are made to also reduce these barriers, but this turns out to be much more difficult than to reduce import and other tariffs. The reason for this is that a number of these non-tariff barriers are closely related to, or caused by the main conduit of international trade, namely logistics and international transportation, and the non-fiscal government supervision in the international movement of goods.

Ocean transportation has always been related to trade. This relationship goes back hundreds, perhaps thousands of years. During the period of the great explorations of the world, trading and transport always formed one operation. This practice continues, with the large trading houses in the world – Glencore, Cargill, Vitol, Trafigura, ADM, Noble Group, Louis Dreyfus, Bunge and some lesser-known (but not smaller) companies: Koch, Gunvar, Mercuria, Wilmar International, Arcadia, Mabanaft – controlling a large part of the world bulk fleet, mainly through long-term and short-term charter contracts.

In the mid-19th century, however, ocean shipping also became a business activity on its own. The advent of the steam engine brought reliability and predictability far beyond what sailing vessels could offer. This separation of shipping and trade, however, brought a host of new challenges. One that is still debated to this day is the exemption of cartel legislation for liner shipping that originates from the beginning of the 20th century. In the US and Europe, the price-setting exemptions were abolished at the end of the 20th century, but, in the EU, other exemptions are still in place.[1]

Another topic that has been hotly debated among maritime economists is the way in which shipping and ports facilitate trade. Perhaps the biggest supporter of this idea was and is United Nations Conference for Trade and Development (UNCTAD). This United Nations initiative started in 1964 with the ambition to change global trade by providing the poorer countries with an independent role in trade and in transportation (Taylor and Smith, 2007). Its golden years were the 1960s and 1970s when, among others, the Code of Conduct for Liner Conferences saw the light (see for instance Neff, 1980 or Sturmey, 1986). This Code of Conduct was a typical instrument to (re)forge the link between trade and transport: one of the provisions said that transport companies from two trading countries should be allowed to carry equal parts of the trade and leave a limited trade volume to be carried by third parties. This idea later became known as the 40-40-20 rule. The implied result of this rule was that any trading country should thus form its own transport capacity, in order to carry the allotted 40 per cent of its own trade.

Trade facilitation has developed from a narrow idea about the possibility to move goods between countries through ports to a much more extensive concept, encompassing the general trade environment in countries and between countries (Wilson et al, 2005). As a result, it is no longer the simple opportunity of moving goods that defines trade facilitation, but also the ease with which this can be done.

This chapter addresses the relationship between ocean shipping and logistics, and trade, by examining to what extent shipping can be considered a facilitator of or barrier to trade. For this purpose, we first briefly introduce the trade facilitation school of thought in shipping and port management. We then describe in some detail the mechanism of international trade, as well as the specific role of shipping within this mechanism. We aim to connect this to the ongoing work on non-tariff barriers, both theoretical and empirical, that has taken flight in recent years. We then present some empirical evidence for trade facilitation and the role of transportation and logistics quality, using a novel so-called necessary condition analysis technique. We finish with some concluding remarks and an outlook on further research.

Ports and shipping as facilitators of trade

Theoretical considerations on the relationship between trade and shipping in maritime economics go back to Koopmans (1939), who observed that without the analysis of seaborne trade, the analysis of shipping markets cannot succeed. He also introduced the notion that seaborne trade is inelastic to prices in shipping. Tinbergen (1959) proposed the idea that demands for shipping could be measured by the actual tonnage carried by ships. Their perspective was mainly to find sources for cyclicality in shipping. Trade was such a source, although shipping also creates its own cyclicality (see for instance Zannetos (1966) for an early source on this).

In later studies and publications, the relationship between trade and transportation was developed more, and transport costs was introduced as a variable in classic trade models. The classic approach to model global bilateral trade patterns is a gravity model (see Anderson (1979) for a formal derivation of the gravity equations). Such a model normally relates bilateral trade flows to national income, population and distance. Distance is often taken to represent transport costs, although this is certainly not a one-to-one correspondence.[2]

Various authors have tried to estimate more elaborate (maritime) transport cost functions in order to gain a better understanding to what extent high transport costs are a determinant of (i.e. a barrier to) trade. Clark et al (2004) estimate a maritime transport function that includes determinants for distance, product-specific requirements (including value), directional imbalance, total trade volume on a route (to represent increasing returns to scale), technological innovation, anti-competitive practices, and the quality of port and cargo handling infrastructure. They find that seaport efficiency is an important determinant for transport costs. From their analysis, they also conclude that transport costs are potentially a barrier to trade, and need to be considered by policy makers. Arvis et al (2013) also analyse trade costs, which they derive as an implication of the pattern of bilateral international trade.

The point that ports play an important role in facilitating trade has been made for years. See for instance Haralambides and Veenstra (1996) who analyse the interaction between ports and the development of trade. They observe that countries' ambitions to follow an export-led growth strategy have resulted in government retrenchment from ports, and port reform, with both negative and positive consequences. On the one hand, ports have become more efficient, largely due to the involvement of international operators,

while on the other hand, liberalization in many countries has resulted in large redundancy programmes for port workers. The authors argue that the efficiency of port operations is not the only relevant indicator, but the entire economic context of a port should be considered: the competitive environment, access infrastructure by land, and the way in which a government or port authority attempts to recoup some of the port reform costs (among others for the redundancy of port workers) from other parties.

Wilson et al (2003) put port efficiency in a broader framework of four indicators for trade facilitation:

- port efficiency;
- customs environment;
- regulatory environment;
- service sector infrastructure.

Port efficiency is a measure of the quality of transport infrastructure. Customs environment measures direct customs-related costs and also transparency of customs. Regulatory environment measures a country's approach to regulation and the service sector infrastructure measures the level of national business service levels.

Much of this conceptualization of trade facilitation is very location- or country-based. The modelling of trade flows with gravity models is often also rather one-sided in the sense that flows are explained by variables representing exporting and importing countries individually. See Anderson (1979) for a classic source. The only variable that represents relationships between countries is usually transport cost, for which distance or the CIF/FOB price ratio are used as proxy (Carrère, 2002). As a result, the trade facilitation contribution of the link between any pair of export and import countries is not made explicit in much of the trade economics literature.

An exception is the work of Hummels et al (2009) who investigate the trade-diminishing effect of market power of shipping companies. Their work confirms the difference in the way shipping lines treat developing and developed countries in terms of transport prices. In other words, shipping lines present themselves differently in different parts of the world, depending on product value, high import and export tariffs and lack of competition on a trade route. Carrying this line of thinking further, it could be that some of the unfavourable treatment of developing countries by shipping lines carries over to the developed countries. There is a case where this mechanism seems to be at work: the import of fresh fruit from South America to

Europe via the Port of Rotterdam. This is a classic CIF trade, where the exporters book the transport. Shipping lines apparently invest very little in their local liner agents in South America, which results in a lot of physical paperwork. This paperwork is then sent to the receiving parties in Europe, who cannot benefit from the higher level of digitization that shipping lines usually offer in Europe.[3] This leads to the transfer of some of the inefficiencies on one side of a trade lane to the other side of the trade lane.

In the next section, we will explore in some more detail how transportation by means of ships also brings complexities to international trade that could be interpreted as trade barriers.

Practices of international shipping

International trade is made up of commercial transactions between buyers and sellers. These can be complete strangers to each other, or part of the same enterprise. For the commercial transaction this does not make much difference, since, in many cases, even sister companies need to trade with each other as if they are separate companies. This is called arm's length trading, and it has primarily a fiscal background: tax authorities in both import and export countries demand a transaction in which the value of the product is established in a market setting.

The commercial transaction determines the specification of the goods, the price and the number of goods. The transaction usually also contains an arrangement of who takes responsibility for the shipment of the goods. For this purpose, the International Chamber of Commerce has established some standard trade terms that divide the responsibilities of transportation, ownership and insurance among buyer and seller. These trade terms are called Incoterms. Currently there are 11 Incoterms that range from one extreme of the seller takes care of everything (delivery duty paid) to the other extreme of the buyer takes care of everything (ex-works). Important intermediate points where transfers of responsibility can take place are the ocean ports in an international transport chain.

A second important issue in international trade transactions is the relationship between delivery and payment. In an international context, where parties may not know and trust each other, payment and delivery have to take place more or less at the same time. The international transport operator plays an important role in this mechanism. The way this works is that the ocean transport operator can declare that goods were taken onboard the

ship, by signing a so-called Bill of Lading. This is proof that transportation is taking place, and that payment can be transferred. A copy of the Bill of Lading (B/L) is therefore shared with the bank of the seller, who sends it to the bank of the buyer, who then transfers payment on behalf of the buyer. As a result of this mechanism, the B/L is also a document of title that gives the holder rights to the cargo. This greatly facilitates trading of goods that are in transit.

In cases where the buyer and seller are part of the same enterprise, this process can be simplified. In those cases, a simplified version of the B/L is used – the so-called Seaway Bill – which is basically the same as a B/L, except it is not a document of title.

For container shipping, which is the most relevant part of shipping for the purpose of this chapter, some further issues need to be considered. These issues are largely related to the container, not to the ship.

First of all, the container shipping line generally owns the containers in which goods are shipped, and needs to provide these containers to the shippers who want to ship cargo. This mechanism is fraught with problems. The containers need to be made available to the shipper. A shipper does not want to wait too long, and wants a container that is suitable for its needs. There are different types of containers: 20-foot containers, 40-foot containers, 40-foot high cube containers, 45- foot containers, open-top containers, flat beds, foldable containers, refrigerated containers. All these containers conform to the ISO 668 2013 (revised) standard. In addition, commercially, containers may have a five-step scale of cleanliness. The highest level, so-called food-grade containers, is the only level that is acceptable for the transportation of food products.

Second, customs authorities consider containers to be packing material that requires, in many countries, some type of temporary import licence. This licence may restrict the time the empty containers can stay in a country. If the container stays too long, VAT and other levies may become payable.

Third, after delivering a container to a destination country, the shipping line would like to return a container as quickly as possible to a paying customer. For this purpose, the shipping lines all charge fees if the receiver of goods takes too long to pick up the full container, or deliver the empty container back to the shipping line. The first fee is called demurrage (not to be confused with demurrage in bulk shipping), and the second fee is called detention. These two fees range from a few euros per day to as much as €75 per day, chargeable after a so-called free period of several days. Of course, the fees and free days are negotiable, so no shipping line's customer will pay

the same as another customer. How the demurrage and detention fees are established will depend on the party who books transport and their negotiating power.

Because of the need to keep track of containers in countries, formal obligations to report unloaded containers to customs authorities in the destination countries, and the need to only provide the goods in the container to the rightful owner, the shipping line maintains an administrative process in ports in which some fees need to be paid, information for the party who will pick up the container is exchanged, and the empty depot to which the container needs to be returned is recorded. This process is called the *release of the container*. In many ports, this is a cumbersome process that takes time and effort. Only when this process is completed can an inland transport service be booked to pick the container up in the port. Often the release cannot take place or be completed until the container is physically unloaded from the ocean ship. The buyer's agent needs to visit a terminal's website to find the unloading confirmation of the container, and then verify all relevant information, take care of payments, and book transport. The degree to which this process is supported with IT – usually a port community system – differs strongly from port to port and from shipping line to shipping line. RSM (2010) has estimated that in Rotterdam, the cost related to these processes can range from €5–€25 per container. For a customs or freight-forwarding agent, who gets €35–€50 for the administrative handling of a container, this is a substantial cost driver. This is the fourth issue.

A fifth issue is the overall performance of international container lines. Vernimmen et al (2007) have reported on the impact of delays of ocean carriers on logistics variables such as safety stock. Their figures, together with the more recent analysis of Chung and Chiang (2011) result in an average delay for shipping lines of 1.5 days. This delay translates into higher safety stock levels, which are an additional cost for business (Lee and Whang 2005). In addition, there is more working capital tied up in the flow of goods, which also translates into a cost for business (compare the process analysis of Hausmann et al, 2010).[4] Obviously, there are differences between shipping lines and therefore the countries that are served by shipping lines with relatively more delays incur a disadvantage compared to countries that are primarily served by carriers with fewer delays.

A sixth issue is that customs authorities tend to use ship manifest data for their initial risk assessment. There are differences between countries in terms of the time at which they require this information to be submitted. The United States and Europe require this type of data to be submitted before

departure from the origin country, and in Europe the same data needs to be submitted again a few days before arrival in the port of destination. Other countries receive this data shortly before arrival of the ship, or use it to verify imports and exports after loading and unloading has taken place. This formal obligation means that shipping lines and their agents have had to set up a process to gather this data at the right time from their clients or the clients' agents. To indicate that this imposes costs on the logistics chain, shipping lines charge about US $25 per containerized shipment for submitting pre-departure declarations to European Customs authorities in destination countries. Another potential bottleneck is the different ways in which shipping companies facilitate their agents in different countries. In some countries the information exchange between customers' agents and the shipping lines' agents is fully digitized, and in some countries the information exchange is still made with paper documents. The latter is not only a problem for that country, but also for all other the countries the ships are sailing towards to unload cargo. All errors and other problems related to paper-based information exchange are transferred to these destination countries as well.

A final point deals with the pricing structure of container shipping. The complicated tariff structure of container shipping is well documented in the maritime economics literature. It is well known that, apart from a base transport tariff, shipping companies may charge a bunker adjustment factor (BAF), a currency adjustment factor (CAF), port congestion charges, piracy risk charges, terminal handling charges, war risks, security surcharges, winter surcharges, dangerous goods and refrigeration surcharges, and document fees. Cariou and Wolf (2006) looked into the BAFs and the underlying bunker price developments, and found that these charges do not accurately reflect the underlying cost development. In other words, some of these surcharges are used to raise the price for transport. These surcharges can easily raise the total transport bill by 50 per cent or more, and they make the transport cost for ocean shipping complex and difficult to interpret. The chosen Incoterm determines which party books ocean transport. This will also influence the height of certain charges, as well as the basic transport tariff.

In summary, current shipping line operations result in time delay and costs for logistics chains, either due to administrative processes, formalities the shipping line has to carry out, or enforcement measures to increase the circulation of containers. Hummels and Schaur (2012) estimate the impact of time delays on trade, and find that each day of delay reduces the probability of trade by 1–1.5 per cent. Time delay really is a trade barrier, and ocean shipping, which causes structural delays, can be seen as the cause of this.

In addition, other complexities of container shipping may also cause a barrier to trade. This is confirmed by Nordås et al (2006), whose analysis builds on Hummel's work, and includes logistics services. In their analysis, poor logistics services also translate into time delays, which have a negative effect on trade.

Some of the issues mentioned above exhibit a 'transfer effect'. This is the case for the quality of information in the shipping documents and, under specific conditions, for demurrage and detention. For the former, the provision of information by the seller or his agent to the shipping line may be so poor that the buyer will run risks of additional customs inspection, delays and additional costs. For the latter, the condition is that the seller books transport under the chosen Incoterms. This is common practice, for instance, in the trade of fresh fruit originating from the southern hemisphere. In these cases, the seller may choose to limit demurrage and detention free time in the port of destination, as this will save costs. The buyer will then be very limited in its options to transport containers out of the port, or run a high risk of incurring demurrage or detention fees.

To investigate to what extent this type of thinking has been recognized in current efforts to measure non-tariff barriers to trade, in the next section we look in some detail at these measurement efforts.

International trade research and non-tariff barriers

Definition of non-tariff barriers

Through the initiatives of the Global Agreement on Trade and Transport (GATT) and the WTO negotiation rounds, trade tariffs, i.e. the duties paid on imported or exported goods, have generally decreased worldwide. See for more details the historical overview of trade policy measures in the WTO World Trade Report 2013.

As a result, the attention of WTO and other trade policy bodies has shifted to non-tariff barriers. Defined narrowly, these are all trade barriers that are not tariffs (Deardorff and Stern 1997). However, almost always, what is meant is that the non-tariff barriers are actively engineered by policymakers. This means that non-tariff barriers that are studied by academics and trade policy analysts can always be traced back to some policy goal of one or a group of countries.

Carrère and de Melo (2011) provide a useful classification of non-tariff barriers that refers to the UNCTAD 2006 classification effort of non-tariff barriers. We have reproduced their list in Table 2.1 (see also UNCTAD (2013) for a more detailed list).